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Effectiveness of the *Lunch is in the Bag* program on communication between the parent, child and child-care provider around fruits, vegetables and whole grain foods: a group-randomized controlled trial

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Conflict of Interest Statement

The authors declare no conflict of interest for the study.

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Abstract

Objective—To evaluate the effectiveness of the parent- and early care education (ECE) center-based *Lunch is in the Bag* program on communication between parent, child, and their ECE center providers around fruits, vegetables and whole grain foods (FVWG).

Method—A total of n=30 ECE center; 577 parent-child dyads participated in this group-randomized controlled trial conducted from 2011–2013 in Texas (n=15 ECE center, 327 dyads intervention group; n=15 ECE center, 250 dyads comparison group). Parent-child and parent-ECE center provider communication was measured using a parent-reported survey administered at baseline and end of the five-week intervention period. Multilevel linear regression analysis was used to compare the pre-to-post intervention changes in the parent-child and parent-ECE center provider communication scales. Significance was set at $p < 0.05$.

Results—At baseline, parent-child and parent-ECE center provider communication scores were low. There was a significant increase post-intervention in the parent-ECE center provider communication around vegetables (Adjusted $\beta = 0.78$, 95%CI: 0.13, 1.43, $p = 0.002$), and around fruit (Adjusted $\beta = 0.62$, 95%CI: 0.04, 0.20, $p = 0.04$) among the parents in the intervention group as compared to those in the comparison group. There were no significant intervention effects on parent-child communication.

Conclusion—*Lunch is in the Bag* had significant positive effects on improving communication between the parents and ECE center providers around FVWG.

Keywords

preschool; parent-child communication; parent-childcare provider communication; early care education; nutrition; fruits; vegetables; whole grain foods

Introduction

Recent data indicates that children ages 2 to 18 years in the United States (U.S.) fail to meet the recommended intakes of healthy food such as fruits, vegetables and whole grains (FVWG), with 60% not consuming enough fruit and 93% not consuming enough vegetables (Kim et al. 2014). While the intake of FVWG has declined steadily over the last few years, the enrollment of preschool-age children in early care and education (ECE) centers has increased. Approximately 80% of preschoolers in the U.S. attend some form of non-parental childcare (Mamedova & Redford 2013). These preschoolers depend on their parents and the ECE center providers for their dietary needs, highlighting the importance of communication

around child dietary needs and habits between parent-child as well as the parent-ECE center providers.

The literature evaluating the communication between parent-child and parent-ECE center providers around healthy foods such as FVWG is sparse. Studies have shown that the quantity and quality of messages given by parents are correlated (positively or negatively) to nutrition knowledge scores among children of preschool age (Anliker et al. 1990). Other studies have shown that food preferences of young children are affected by the context in which they are presented, indicating that children develop an understanding of food not only through taste, sight and smell, but also conversations with their parents and providers (Birch et al. 1981; McPhie et al. 2011). The 2011 position paper by the *Academy of Nutrition and Dietetics* on *Benchmarks for Nutrition in Child care* recommends that nutrition education for children and families should be a component of ECE center-based programs, and that providers should talk with families about nutrition education and engage them in the process of communicating nutrition information to the children and vice versa (Benjamin Neelon & Briley 2011). In Texas, there is an increasing trend for ECE centers that require parents to provide food from home (Sweitzer et al. 2009). Thus, the interaction between ECE center, parent and the child around the preschooler's nutrition becomes even more important. Studies have shown that lunches packed from home for preschoolers have inadequate calories, often include foods high in fat, sugar and sodium such as sweets and chips (Kelly et al. 2010; Peterson, 2009), and do not meet the Child and Adult Care Food Program (CACFP) recommendations for fruits and vegetables (Sweitzer et al. 2009). Furthermore, Dev et al., reported that Head Start providers had significantly greater nutrition training and mealtime communication with their children as compared to non-Head Start providers (Dev & McBride 2013). Thus, strategies encouraging parent-child and parent-ECE center provider communication around healthy nutrition, especially for non-Head Start ECE centers are needed.

Lunch is in the Bag is a parent and ECE center-based program aimed at increasing dialogue between parent, child and ECE center providers to promote intake of FVWG by educating parents and providers on how to pack healthy lunches for their preschool-age children ages 3 to 5 years (Hoelscher et al. under review). The efficacy trial of the *Lunch is in the Bag* program was conducted across 30 non-Head Start ECE centers in Texas (Briley et al. under review). The purpose of this study is to evaluate the effect of the *Lunch is in the Bag* program on communication between parent and their child, as well as parent and the ECE center providers around FVWG.

Materials and Methods

The primary aim of the *Lunch is in the Bag* study was to determine the efficacy of the program on servings of FVWG packed in the sack lunches and consumed by preschoolers, ages 3 to 5 years, using a group-randomized controlled trial design (n= 30 ECE centers; 577 parent/child dyads). Results of the primary outcomes are presented elsewhere (Briley et al. under review). For this paper, the effectiveness of *Lunch is in the Bag* program strategies on parent-child and parent-ECE center providers communication around FVWG was evaluated, which was an important secondary objective of the parent study.

A convenience sample of 30 ECE centers were recruited in two cohorts (school year 2011–2012 and school year 2012–2013) across three metropolitan statistical areas of central and south Texas with n=15 of the centers randomly assigned to intervention and n=15 to wait-list comparison group (Hoelscher et al. under review). Eligibility criteria for ECE center included: a) serves children ages 3 to 5 years, and b) requires parents to send packed lunches from home. A letter of invitation to participate in the study was sent to parents of children ages 3 to 5 in the participating centers. Informed consent was obtained from all interested parents for themselves as well as their child to participate in the study. While the program was implemented across the ECE center, only those consenting to participate were measured. Teachers received \$15 and parents received up to \$50 worth of gift cards for their time. Primary outcome measures for the parent study were amounts of FVWG, dairy, and snack foods in sack lunches parents provided for their children to eat at the ECE center (Hoelscher et al. under review). The study was approved by the University of Texas Health Science Center, Center for Protection of Human Subjects.

Lunch is in the Bag intervention: Detailed description of the *Lunch is in the Bag* program is available elsewhere (Hoelscher et al. under review). The program was implemented over five weeks in the fall semester of the school year with a one week booster in the spring semester. The program enlists the ECE center, teachers, parents, and children in cueing and reinforcing changes in the home-based food environment to increase parents' packing sack lunches that enable children to achieve healthy eating patterns. A one-hour teacher training was conducted by trained project staff at each ECE center prior to program implementation. Weekly newsletters containing nutrition recommendations using MyPlate guidelines, healthy lunch, snack and beverage ideas, recipes and how to engage children in nutrition learning were sent home to parents. At the ECE center, weekly activity stations were displayed combined with classroom-based activities, and notes from teacher to parent were implemented. Ancillary resources including commercially available story books around healthy eating, MyPlate placemats, 'gold medal lunch' stickers were provided to ECE center teachers. Pilot evaluation of the program has shown positive effects on increasing intake of vegetables and whole grains in previous studies (Sweitzer et al. 2010). This paper evaluates effectiveness of the program in improving parent-child and parent-ECE center provider communication at the end of initial five week intervention period.

Data collection

All measurements were conducted before the intervention (T0), and immediately after the initial five weeks of intervention (T1).

Parent and child demographics—Socio-demographic variables including parent and child age, parent and child gender and race/ethnicity, parent marital status, income level, education level were collected at baseline using parent self-report surveys.

Parent-child and parent-ECE center provider communication (Table 2)—Parent-child and parent-ECE center provider communication was measured using a parent-reported survey administered at baseline and end of the five-week intervention period. Project staff sent the surveys home to the consenting parents. Communication between parent and child

was assessed using four questions for each of the FVWG adapted from previously validated questionnaires (Baranowski et al. 2006). These four questions asked the parents about their child's approval of packing FVWG foods in the sack lunches; how often the child has asked the parent regarding packing FVWG foods in the sack lunches; child reminded parents to buy FVWG foods for his or her sack lunches; and frequency of child talking about FVWG foods for his or her sack lunch.

Communication between parent and ECE center provider was also assessed using four questions for each of the FVWG. These included asking the parents regarding how often someone from ECE center approved FVWG foods in their child's sack lunches; how often ECE center provider has asked the parent regarding packing FVWG foods in their child's sack lunches, reminded parents to buy FVWG foods for their child's sack lunches, and communicated with parents about FVWG. Response options for each question were on a five point Likert-type scale ranging from 'Never' (coded as 0) to 'All the time' (coded as 4). Six summative scales, one each for FVWG, were developed; three scales for the parent-child communication, and three scales for the parent-ECE center provider communication (possible range per scale: 0 to 16 with four questions per scale and 5 response options per question ranging from 0 to 4; Cronbach's alpha = 0.79 to 0.92).

Parent and child anthropometrics—Child height and weight were measured at baseline using stadiometers and digital scales by trained project staff during regular preschool hours. Height and weight was used to compute age and gender specific BMI percentiles using growth charts. This was then classified to determine child weight status as underweight (<5th percentile) normal weight (BMI 5th to <85th percentile), overweight (BMI >=85th to 94th percentile) or obese (BMI >=95th percentile) (Centers for Disease Control and Prevention 2014b).

Parent height and weight was self-reported on the parent survey which was used to compute BMI and weight status. BMI < 18.5 classified as underweight, BMI >=18.5 to <25.0 normal weight, BMI >=25.0 to <30.0 overweight and BMI >=30.0 obese (Centers for Disease Control and Prevention 2014a).

Statistical analysis—STATA version 13.0 statistical software was used for all analysis (STATA Corp, College Station, TX). A total of 633 parent-child dyads were measured at baseline, of which n=577 complete parent-child dyad data (n=15 ECE center, 327 dyads intervention group; n=15 ECE center, 250 dyads comparison group) was available for analysis at the end of the five week period (91% completion rate). Missing data were excluded from the analysis. Sensitivity analysis showed no difference between the completers and non-completers for the outcomes of interest. For descriptive analysis, means, standard deviations and frequencies were computed for the sociodemographic and communication variables that were primary outcomes of interest for this study. Pearson's chi-square test and student's t-test were used to examine the baseline differences between the intervention and control group for sociodemographic characteristics and parent and child BMI.

This study examined whether the *Lunch is in the Bag* intervention improved parent-child and parent-ECE center provider communication. The six outcome variables of interest for this study were a) parent-child communication around fruits; b) parent-child communication around vegetables; c) parent-child communication around whole grains; d) parent-ECE center provider communication around fruits; e) parent-ECE center provider communication around vegetables; and f) parent-ECE center provider communication around whole grains. Multilevel linear regression analysis was used to compare the pre-to-post changes in the outcome variables in the intervention and control groups. This study adjusted for the variation among schools and the variation among individuals nested within ECE centers, thus controlling for cluster effects (Murray 1998). Various known confounders which were considered for inclusion into each of the regression models included parents age, gender, race, marital status, employment, income, education, BMI and child BMI. Collinearity among the variables was assessed. Variance inflation factor for all of the variables was <10. Backward selection technique was used for variables selection. Any variable which resulted in a change of estimate by greater than 10% were included in the final model. Significance level for all analyses was set at 0.05.

Results

A total of 577 parent-child dyad data was available for the analysis of interest. Despite randomization, there were significant differences at baseline between intervention and comparison ECE centers for parent age, race/ethnicity, marital status, education level, and income level. At baseline, a significantly greater proportion of the parents whose children were in the intervention ECE centers were >40 years of age, White, not married, and had a higher education and income level ($p<0.01$). Among the children, overall 25.4% of the children were overweight or obese with a BMI 85th percentile for age and gender with no differences between the intervention and comparison groups. Twenty of the 30 participating ECE programs were affiliated with a church or synagogue, 5 were affiliated with local or nationwide organizations or chains, and 5 were stand-alone organizations. All programs were privately funded (data not shown). Table 1 provides an overview of baseline differences between participants.

Table 2 shows the baseline differences between the intervention and comparison groups around each of the parent-child and parent-ECE center provider communication variables. Overall, at baseline, there were no significant differences between the two groups for either of the two sets of communication variables. Across all variables, more parents replied 'never/rarely' for communication with ECE center (Range: 53% to 87%) around FVWG foods as compared to communication with their child (Range: 26% to 72%). Overall, the internal consistency of the six communication scales was high with Cronbach's alpha between 0.89 to 0.92 for parent-child and 0.79 to 0.83 for parent-ECE center communication.

Effect of Lunch is in the Bag on parent-child communication (Table 3)

Results show that, at baseline, parent-child communication scores were relatively low with the lowest score for vegetables (4.8 +/-4.2) followed by whole grains (6.1 +/-4.5), and

highest for fruits (8.1 $\pm$ 5.1) out of a possible score of 16. There were no significant differences between the intervention and comparison groups in the scores across FVWG at baseline. Results of the multilevel linear regression analysis showed no significant intervention effects on parent-child communication scales.

Effect of Lunch is in the Bag on parent-ECE center provider communication (Table 4)

Overall, communication scores were low at baseline for parent-ECE center provider scales with the average scores for FVWG ranging from 2.8 to 3.1 out of a possible available score of 16 indicating that parents never or rarely communicated with their child's ECE center provider regarding FVWG. Across all FVWG, scores for parent-ECE center provider scales were consistently lower than scores on parent-child scales, in both intervention and comparison groups.

For the parent-ECE center provider communication, there was a significant increase post-intervention in the mean scores for communication around vegetables (Adjusted β = 0.78, 95%CI: 0.13, 1.43, $p=0.002$), and communication around fruit (Adjusted β = 0.62, 95%CI: 0.04, 0.20, $p=0.04$) among the parents in the intervention group as compared to those in the comparison group. There was a trend towards an increase in scores for whole grains post-intervention for the intervention group as compared to the controls; however, multivariate analysis rendered these not statistically significant.

Discussion

Overall, the results of our study shows that the *Lunch is in the Bag* intervention strategies were effective in improving the communication between parents and the ECE center providers especially around fruits and vegetables. Furthermore, communication scores between parent-ECE center providers for whole grains also increased post-intervention, albeit these were not statistically significant. To our knowledge, this study is the first to determine the impact of a preschool-based, parent-centered nutrition education program on communication between parent-child, and parent-ECE center around FVWG. While previous studies (Briley et al. 1999) have indicated the importance of communication between parent and the child and ECE center providers to have sustained effects on dietary habits of children, few have evaluated the effectiveness of interventions on these communication constructs. Communication between ECE center providers and parents around healthy nutrition is important for obesity prevention among preschoolers (Benjamin Neelon & Briley 2011). The current evidence-base on studies evaluating parent-child and parent-ECE center provider communication around nutrition is scarce. Acharya et al. (2011), in a cross-sectional study of 770 caregiver-child dyads across 57 childcare centers in Alabama and Texas, reported a positive correlation between the provider and child BMI suggesting the need for ECE centers to be highly engaged in promoting healthy environment for their staff and children. Johnson et al., in a qualitative study of communication between parents and ECE staff about preschoolers' eating revealed certain barriers to communication including limited time and concerns regarding parent reactions and defensiveness, and a need for ECE staff training around sensitive communication (Johnson et al., 2013). Moreover, studies have shown that parent's key areas of concern for their children are

focused around nutrition and physical activity environments of childcare centers (Benjamin et al. 2008). Thus, programs such as *Lunch is in the Bag* that foster communication between parents and ECE center providers around healthy eating are warranted.

Interestingly, while there was a trend towards an increase in the parent-child communication scores for FVWG post-intervention, these results were not statistically significant. This could likely be due to several reasons. Firstly, at baseline, the scores for the parent-child scales were relatively higher as compared to those for the parent-ECE center scales. Thus, there was a greater room for improvement in the parent-ECE center scales as compared to the parent-child scales.

Secondly, the intervention activities were mainly directed at the ECE center staff and parent, thus resulting in increased communication between parent-ECE center staff more so than between parent-child. Thirdly, the self-report survey measured the parent perception of ECE center and child communication with them around FVWG which was an indirect and subjective form of measurement of the communication constructs. Lastly, the intervention strategies may not have been intensive or long enough, given a five week intervention period, to improve communication between parent and child around FVWG. Nevertheless, given the low scores for parent-child communication at baseline, this study demonstrates a need for strategies to improve parent-child communication around FVWG. Parents remain one of the most significant influences on child behavior as well as home food environment (Silventoinen et al. 2009). Ndiaye et al (2013) evaluated parent-child communication about nutritional decision-making behavior and demonstrated low levels of communication around food choices between parents and children, and low involvement from children in food selection and preparation. Furthermore, studies have shown that parent-packed lunches from home for preschoolers are often high in fat, sugar and sodium (Kelly et al. 2010; Peterson, 2009), and do not meet the CACFP recommendations for fruits and vegetables (Sweitzer et al. 2009). Future studies for obesity prevention in preschoolers should include strategies for bolstering familial discussion around healthy foods.

This study showed that baseline parent-child and parent-ECE center provider communication scales' scores were low across both groups, with parent-ECE center provider scores being lower than those for parent-child. A majority of the parents reported that their child's ECE center rarely approves, asks, reminds or communicates with them across all FVWG foods in their child's lunches. Given that preschoolers are dependent on their parents and providers for their dietary needs, communication between parents and their child's ECE center is critical to establish healthy dietary habits early in life. One of the reasons for this poor communication could be because the providers do not have adequate nutrition knowledge and communication skills. Studies have shown that preschool teachers have low nutrition knowledge (Sharma et al. 2013) and do not receive adequate training in preschooler's nutrition needs, thus inhibiting dialogue with the parents around these issues. Training in elementary school teachers has been shown to increase implementation of behaviorally-based health promotion programs (Hoelscher et al. 2004). These results, along with those of our study, call for implementation of training programs for ECE center providers educating them around nutrition needs of preschoolers. Moreover, strategies to engage parents to foster communication with the ECE center around nutrition are

encouraged. In fact, the *Caring For Our Children* (CFOC) report by the American Academy of Pediatrics recommends that ECE center providers partner with food and nutrition practitioners to provide training for their staff and parents alike (American Academy of Pediatrics et al. 2010).

For parent-child communication, the scores were lowest for communication around vegetables, with a majority of the parents reporting ‘never or rarely’ when asked whether their child approves, asks, reminds or talks to them about vegetables. The scores were slightly higher for whole grain foods and highest for communication around fruits. These results are not unusual since fruit intake in children is consistently higher than intake of vegetables, and since fruits are often packed in preschool lunches (Sweitzer et al. 2010). Recent longitudinal data from the National Health and Nutrition Examination Survey (NHANES) from 2003 to 2010 shows that U.S. children ages 2 to 18 years are consuming fewer vegetables as compared to fruits, with potatoes comprising up to 30% of the vegetables (Kim et al. 2014). Moreover, the vegetable consumption has remained unchanged during this time period. For whole grain foods, studies have shown that a vast majority of the children in the U.S., including those of preschool age fare poorly (Kirkpatrick et al. 2012). Furthermore, studies have also shown that parents can promote excessive weight gain among children by using inappropriate child feeding practices (Clark et al. 2007). These results, along with those of our study, highlight the need to implement strategies such as *Lunch is in the Bag* to increase the communication between parent-child, especially around vegetables and whole grains, and to evaluate if improved communication further influences dietary intake of these healthy foods.

Strengths of the study include a large sample size and adequate power to conduct the multilevel analysis for the study. The analysis was robust and accounted for the variation between and within ECE centers. Finally, the communication scales for both parent-child and parent-ECE center provider showed strong internal consistency with Cronbach’s alpha >0.70 for all scales at baseline, thus validating the constructs that the study was trying to measure.

These strengths notwithstanding, the study has some limitations. The study sample was predominantly higher income and White, thus limiting the generalizability of the findings to lower income, ethnically-diverse communities. Studies have shown that consumption of fruits and vegetables by children is linked to education level of the mother (Vereecken et al. 2004) as well as availability of these foods (O’Connor et al. 2010). It would be interesting to see in future studies if the strategies used in this study would have similar effects in populations with lower intakes of these healthful foods. Outside of construct validity, other psychometric properties of the communication constructs were not evaluated as part of the current study. However the instrument was adapted from previously validated constructs (Baranowski et al, 2006). Another limitation is that there is no clear linkage between parent and ECE center providers’ influence on food consumption behaviors of the preschool children which needs to be examined in future studies (Briley & McAllaster 2011). Also, since parents were the primary target of the intervention, parent perception regarding communication with ECE center providers was evaluated; however the provider perception around these constructs was not measured which needs to be considered in future studies.

The communication variables evaluated in the current study were the secondary outcomes of the group-randomized controlled trial. Hence, by nature the analyses are exploratory. Lastly, there were some baseline differences in sociodemographic variables between the intervention and comparison groups. However, these differences were taken into account in the analysis.

Conclusion

In conclusion, the study showed that the *Lunch is in the Bag* program was effective in improving communication between the parents and ECE center providers. Results of this study have significant implications towards implementing integrated training and educational programs for ECE center providers and parents to improve communication around healthy nutrition for preschoolers.

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References

- Acharya K, Feese M, Franklin F, Kabagambe E. Body mass index and dietary intake among Head Start children and caregivers. *Journal of the American Dietetic Association*. 2011; 111(9):1314–1321. [PubMed: 21872694]
- American Academy of Pediatrics, American Public Health Association & National Resource Center for Health and Safety in Child Care and Early Education. *Caring for our children: national health and safety performance standards; guidelines for early care and education programs*, 3rd edition. Elk Grove Village, IL: American Academy of Pediatrics; Washington, DC: American Public Health Association; 2010.
- Anliker JA, Laus MJ, Samonds KW, Beal VA. Parental messages and the nutrition awareness of preschool children. *Journal of Nutrition Education*. 1990; 22(1):24–29.
- Baranowski T, Missaghian M, Broadfood A, Watson K, Cullen K, Nicklas T, Fisher J, Baranowski JC, O'Connell S. Fruit and vegetable shopping practices and social support scales: A validation. *Journal of Nutrition Education & Behavior*. 2006; 38(6):340–351. [PubMed: 17142190]
- Benjamin Neelon SE, Briley ME. Position of the American Dietetic Association: benchmarks for nutrition in child care. *Journal of the American Dietetic Association*. 2011; 111(4):607–615. [PubMed: 21443997]
- Benjamin SE, Haines J, Ball SC, Ward DS. Improving nutrition and physical activity in child care: what parents recommend. *Journal of the American Dietetic Association*. 2008; 108(11):1907–1911. [PubMed: 18954582]
- Birch LL, Marlin DW, Kramer L, Peyer C. Mother-child interaction patterns and the degree of fatness in children. *Journal of Nutrition Education*. 1981; 13(1):17–21.
- Briley M, Hoelscher DM, Roberts-Gray C, Ranjit N, Byrd-Williams C, Sweitzer S, Sharma SV, Palafox M. Efficacy of the Lunch is in the Bag intervention to increase parents' packing of healthy

sack lunches for young children: a cluster-randomized trial in early care and education centers. under review.

- Briley M, McAllaster M. Nutrition and the child-care setting. *Journal of the American Dietetic Association*. 2011; 111(9):1298–1300. [PubMed: 21872691]
- Briley ME, Jastrow S, Vickers J, Roberts-Gray C. Dietary intake at child-care centers and away are parents and care providers working as partners or at cross-purposes? *Journal of the American Dietetic Association*. 1999; 99(8):950–954. [PubMed: 10450310]
- Centers for Disease Control and Prevention. About BMI for adults. 2014a. viewed 21 August 2014, http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html
- Centers for Disease Control and Prevention. About BMI for children and teens. 2014b. viewed 21 August 2014, http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html
- Clark HR, Goyder E, Bissell P, Blank L, Peters J. How do parents' child-feeding behaviours influence child weight? Implications for childhood obesity policy. *Journal of Public Health*. 2007; 29(2): 132–141. [PubMed: 17442696]
- Dev DA, McBride BA. Academy of Nutrition and Dietetics benchmarks for nutrition in child care 2011: are child-care providers across contexts meeting recommendations? *Journal of the Academy of Nutrition and Dietetics*. 2013; 113(10):1346–1353. [PubMed: 23916973]
- Faith MS, Van Horn L, Appel LJ, Burke LE, Carson JA, Franch HA, Jakicic JM, Kral TV, Odoms-Young A, Wansink B, Wylie-Rosett J. American Heart Association Nutrition and Obesity Committees of the Council on Nutrition, Physical Activity and Metabolism, Council on Clinical Cardiology, Council on Cardiovascular Disease in the Young, Council on Cardiovascular Nursing, Council on Epidemiology and Prevention, & Council on the Kidney in Cardiovascular Disease. Evaluating parents and adult caregivers as "agents of change" for treating obese children: evidence for parent behavior change strategies and research gaps: a scientific statement from the American Heart Association. *Circulation*. 2012; 125(9):1186–1207. [PubMed: 22271754]
- Hoelscher DM, Briley M, Roberts-Gray C, Ranjit N, Byrd-Williams C, Sweitzer S, Sharma SV, Palafox M. The Lunch is in the Bag trial: baseline findings from Early Care and Education (ECE) centers that require parents to send sack lunches. under review.
- Hoelscher DM, Feldman HA, Johnson CC, Lytle LA, Osganian SK, Parcel GS, Kelder SH, Stone EJ, Nader PR. School-based health education programs can be maintained over time: results from the CATCH Institutionalization study. *Preventive Medicine*. 2004; 38(5):594–606. [PubMed: 15066362]
- Johnson SL, Ramsay S, Shultz JA, Brannen LJ, Fletcher JW. Creating potential common ground and communication between early childhood program staff and parents about young children's eating. *Journal of Nutrition Education and Behavior*. 2013; 45:558–570. [PubMed: 23769298]
- Kelly B, Hardy LL, Howlett S, King L, Farrell L, Hattersley L. Opening Australian preschoolers' lunchboxes. *Australian and New Zealand Journal of Public Health*. 2010; 34(3):288–292. [PubMed: 20618271]
- Kim SA, Moore LV, Galuska D, Wright AP, Harris D, Grummer-Strawn LM, Merlo CL, Nihiser AJ, Rhodes DG. Division of Nutrition, Physical Activity, and Obesity, National Center for Chronic Disease Prevention and Health Promotion, CDC. Vital signs: fruit and vegetable intake among children - United States, 2003–2010. *Morbidity and Mortality Weekly Report*. 2014; 63(31):671–676. [PubMed: 25102415]
- Kirkpatrick SI, Dodd KW, Reedy J, Krebs-Smith SM. Income and race/ethnicity are associated with adherence to food-based dietary guidance among US adults and children. *Journal of the Academy of Nutrition and Dietetics*. 2012; 112(5):624–635. [PubMed: 22709767]
- Mamedova, S.; Redford, J. National Center for Education Statistics, Institute of Education Sciences. Washington, DC: U.S. Department of Education; 2013. Early childhood program participation, from the National Household Education Surveys Program of 2012. viewed 21 August 2014, <http://nces.ed.gov/pubs2013/2013029.pdf>
- McPhie S, Skouteris H, McCabe M, Ricciardelli LA, Milgrom J, Baur LA, Aksan N, Dell'Aquila D. Maternal correlates of preschool child eating behaviours and body mass index: a cross-sectional study. *International Journal of Pediatric Obesity*. 2011; 6(5–6):476–480. [PubMed: 21780868]

- Murray, DM. Design and analysis of group-randomized trials. Oxford University Press, USA; 1998.
- Ndiaye K, Silk KJ, Anderson J, Horstman HK, Carpenter A, Hurley A, Proulx J. Using an ecological framework to understand parent-child communication about nutritional decision-making and behavior. *Journal of Applied Communication Research*. 2013; 41(3):253–274.
- O'Connor TM, Hughes SO, Watson KB, Baranowski T, Nicklas TA, Fisher JO, Beltran A, Baranowski JC, Qu H, Shewchuk RM. Parenting practices are associated with fruit and vegetable consumption in pre-school children. *Public Health Nutrition*. 2010; 13(1):91–101. [PubMed: 19490734]
- Peterson, S. The Lunch Box Program—Packing healthy take-along lunches for preschool children. USDA Land-Grant Success Stories in Competency Training. Cooperative State Research, Education and Extension Service. 2009. www.nifa.usda.gov/neal/family/sri/childcare_sri_competencies.html
- Sharma SV, Dortch KS, Byrd-Williams C, Truxillio JB, Rahman GA, Bonsu P, Hoelscher D. Nutrition-related knowledge, attitudes, and dietary behaviors among Head Start teachers in Texas: a cross-sectional study. *Journal of the Academy of Nutrition and Dietetics*. 2013; 113(4):558–562. [PubMed: 23415503]
- Silventoinen K, Rokholm B, Kaprio J, Sørensen TIA. The genetic and environmental influences on childhood obesity: a systematic review of twin and adoption studies. *International Journal of Obesity*. 2009; 34(1):29–40. [PubMed: 19752881]
- Stang J, Loth KA. Parenting style and child feeding practices: potential mitigating factors in the etiology of childhood obesity. *Journal of the American Dietetic Association*. 2011; 111(9):1301–1305. [PubMed: 21872692]
- Sweitzer SJ, Briley ME, Robert-Gray C. Do sack lunches provided by parents meet the nutritional needs of young children who attend child care? *Journal of the American Dietetic Association*. 2009; 109(1):141–144. [PubMed: 19103336]
- Sweitzer SJ, Briley ME, Roberts-Gray C, Hoelscher DM, Harrist RB, Staskel DM, Almansour FD. Lunch is in the bag: increasing fruits, vegetables, and whole grains in sack lunches of preschool-aged children. *Journal of the American Dietetic Association*. 2010; 110(7):1058–1064. [PubMed: 20630163]
- Vereecken CA, Keukelier E, Maes L. Influence of mother's educational level on food parenting practices and food habits of young children. *Appetite*. 2004; 43(1):93–103. [PubMed: 15262022]

Highlights

- Data on parent communication with their preschooler and childcare providers around nutrition is sparse.
- We evaluated intervention effects on parent-child and parent-childcare provider around fruits, vegetables and whole grains.
- Communication between parent-child and parent-childcare provider was low at baseline.
- Results showed significant improvements in parent communication with childcare provider around fruits and vegetables.

Figure 1.
Study Flow using CONSORT diagram

Table 1
Participant characteristics at baseline (577 parent-child dyads), *Lunch is in the Bag* study, Texas, 2011–2013

Variable	Category	Overall		Treatment		p Value [‡]
		%	Total	Intervention (n=327) %	Control (n=250) %	
Parent age	20–29	8.5	568	6.3	11.3	<0.001 [*]
	30–34	25.9		22.2	30.7	
	35–39	39.8		39.4	40.3	
	40+	25.9		32.2	17.7	
Parent gender	Male	9.9	577	10.7	8.8	0.45
	Female	90.1		89.3	91.2	
Parent race	White	71.4	573	78.1	62.7	<0.001 [*]
	Other races	28.6		21.9	37.4	
Parent marital Status	Married	88.5	573	92.0	83.9	0.003 [*]
	Other	11.5		8.0	16.1	
Parent education	Bachelors +	76.6	576	83.8	67.1	<0.001 [*]
	<Bachelors	23.4		16.2	32.9	
Parent employment	Employed	75.9	569	76.2	75.6	0.88
	Others	24.1		23.8	24.4	
Parent income	<\$59,999	17.3	549	10.9	25.9	<0.001 [*]
	\$60,000–\$99,999	25.7		25.9	25.4	
	>\$100,000	57.0		63.3	48.7	
Parent BMI	Underweight	2.8	566	3.1	2.5	0.105
	Healthy weight	60.6		64.6	55.3	
	Overweight	23.0		20.8	25.8	
	Obese	13.6		11.5	16.4	
Child BMI	Underweight	5.7	582	5.2	6.4	0.26
	Healthy weight	68.9		70.0	67.5	
	Overweight	11.3		9.4	13.9	
	Obese	14.1		15.5	12.3	

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* results of chi-square test evaluating baseline differences between intervention and comparison groups
* significant at $p < 0.05$

Baseline differences between intervention and comparison group for parent-child and parent-ECE center provider communication (n=577 parent-child dyads), *Lunch is in the Bag* study, Texas, 2011–2013

Table 2

Parent-child communication variables				
Scale Name Cronbach's alpha	Variable	Category	Baseline Intervention n (%)	Control n (%)
Vegetable scale $\alpha=0.91$	Child approves vegetables packed for lunch	Never/Rarely	109 (33.75)	82 (32.54)
		Sometimes	78 (24.15)	57 (22.62)
		Most/all of the times	136 (42.11)	113 (44.84)
		Total	323	252
				0.45 p=0.79
	Child asks for vegetables	Never/Rarely	190 (58.64)	147 (58.80)
		Sometimes	82 (25.31)	64 (25.60)
		Most/all of the times	52 (16.05)	39 (15.60)
		Total	324	250
				0.02 p=0.99
	Child reminds to buy vegetables	Never/Rarely	234 (72.22)	179 (71.03)
		Sometimes	68 (20.99)	55 (21.83)
		Most/all of the times	22 (6.79)	18 (7.14)
		Total	324	252
				0.10 p=0.95
	Child talks about vegetables	Never/Rarely	180 (55.38)	153 (61.45)
		Sometimes	109 (33.54)	64 (25.70)
		Most/all of the times	36 (11.08)	32 (12.85)
		Total	325	249
				4.14 p=0.13
Fruit scale $\alpha=0.92$	Child approves fruits packed for lunch	Never/Rarely	47 (14.55)	25 (9.92)
		Sometimes	19 (5.88)	18 (7.14)
		Most/all of the times	257 (79.57)	209 (82.94)
		Total	323	252
				2.97 p=0.23
	Child asks for fruit	Never/Rarely	90 (27.78)	66 (26.29)
		Sometimes	63 (19.44)	42 (16.73)
		Most/all of the times	171 (52.78)	143 (56.97)
		Total	323	252
				1.14 p=0.57

Child reminds to buy fruits	Total	324	251		
	Never/Rarely	141 (43.25)	96 (38.4)	2.61 p=0.27	
	Sometimes	88 (26.99)	64 (25.6)		
	Most/all of the times	97 (29.75)	90 (36.0)		
Total	326	250			
Child talks about fruits	Never/Rarely	106 (32.52)	81 (32.53)	0.59 p=0.74	
	Sometimes	120 (36.81)	85 (34.14)		
	Most/all of the times	100 (30.67)	83 (33.33)		
	Total	326	249		
Child approves whole grain packed for lunch	Never/Rarely	60 (18.58)	33 (13.10)	3.25 p=0.19	
	Sometimes	45 (13.93)	40 (15.87)		
	Most/all of the times	218 (67.49)	179 (71.03)		
	Total	323	252		
Child asks for whole grain foods	Never/Rarely	148 (45.68)	106 (42.06)	1.06 p=0.59	
	Sometimes	85 (26.23)	66 (26.19)		
	Most/all of the times	91 (28.09)	80 (31.75)		
	Total	324	252		
Child reminds to buy whole grain foods	Never/Rarely	219 (67.59)	150 (60.00)	3.54 p=0.17	
	Sometimes	64 (19.75)	61 (24.4)		
	Most/all of the times	41 (12.65)	39 (15.60)		
	Total	324	250		
Child talks about whole grain foods	Never/Rarely	174 (53.70)	138 (55.42)	1.04 p=0.59	
	Sometimes	99 (30.56)	67 (26.91)		
	Most/all of the times	51 (15.74)	44 (17.67)		
	Total	324	249		
Parent-ECE center provider communication variables					
Scale Cronbach's alpha	Variable	Category	Baseline Intervention n (%)	Control n (%)	Chi-sq p- Value
Vegetable scale α=0.83	ECE center provider approves vegetables in packed lunches	Never/Rarely	198 (62.07)	147 (61.51)	0.06 p=0.97
		Sometimes	33 (10.34)	24 (10.04)	

Fruit scale $\alpha = 0.79$	ECE center provider asks about packing vegetables			1.14 $p=0.57$	
	Most/all of the times	88 (27.59)	68 (28.45)	319	239
	Total				
	Never/Rarely	251 (77.47)	199 (80.24)		
	Sometimes	31 (9.57)	24 (9.68)		
	Most/all of the times	42 (12.96)	25 (10.08)		
	Total	324	248		
	ECE center provider reminds about packing vegetables			0.59 $p=0.74$	
	Never/Rarely	272 (84.47)	204 (82.26)		
	Sometimes	28 (8.70)	26 (10.48)		
	Most/all of the times	22 (6.83)	18 (7.26)		
	Total	322	248		
	ECE center provider communicates about vegetables			0.45 $p=0.79$	
	Never/Rarely	238 (73.68)	189 (75.9)		
	Sometimes	59 (18.27)	43 (17.27)		
	Most/all of the times	26 (8.05)	17 (6.83)		
	Total	323	249		
	ECE center provider approves fruit in packed lunches			0.02 $p=0.99$	
	Never/Rarely	188 (58.93)	140 (58.33)		
	Sometimes	38 (11.91)	29 (12.08)		
	Most/all of the times	93 (29.15)	71 (29.58)		
	Total	319	240		
	ECE center provider asks about packing fruit			0.92 $p=0.63$	
	Never/Rarely	252 (77.78)	199 (80.24)		
	Sometimes	31 (9.57)	24 (9.68)		
	Most/all of the times	41 (12.65)	25 (10.08)		
	Total	324	248		
	ECE center provider reminds about packing fruit			0.49 $p=0.78$	
	Never/Rarely	272 (84.47)	205 (82.66)		
	Sometimes	27 (8.39)	25 (10.08)		
	Most/all of the times	23 (7.14)	18 (7.26)		
	Total	322	248		
	ECE center provider communicates about fruit			0.99 $p=0.61$	
	Never/Rarely	236 (67.43)	190 (67.38)		
	Sometimes	60 (17.14)	42 (14.89)		
	Most/all of the times	54 (15.43)	50 (17.73)		
	Total	350	282		

Whole grains $\alpha=0.83$	ECE center provider approves whole grain foods in packed lunches	Never/Rarely	206 (64.58)	149 (62.87)	0.45 $p=0.79$
		Sometimes	32 (10.63)	22 (9.3)	
		Most/all of the times	81 (25.39)	66 (27.85)	
	Total		319	237	
	ECE center provider asks about packing whole grain foods	Never/Rarely	263 (81.17)	204 (82.59)	0.29 $p=0.86$
		Sometimes	25 (7.72)	19 (7.69)	
		Most/all of the times	36 (11.11)	24 (9.72)	
	Total		324	247	
	ECE center provider reminds about packing whole grain foods	Never/Rarely	280 (86.69)	207 (83.81)	1.57 $p=0.46$
		Sometimes	21 (6.50)	23 (9.31)	
		Most/all of the times	22 (6.81)	17 (6.88)	
	Total		323	247	
	ECE center provider communicates about whole grain foods	Never/Rarely	248 (77.02)	193 (77.82)	0.37 $p=0.83$
		Sometimes	49 (15.22)	39 (15.73)	
		Most/all of the times	25 (7.76)	16 (6.45)	
	Total		322	248	

Table 3

Effect of *Lunch is in the Bag* intervention on parent-child communication, (n=577 parent-child dyads)

Scale Name (Range)	Baseline (T0)		Post-intervention (T1)		Multivariable mixed effect regression analysis ^{##}
	Intervention Mean (SD)	Control Mean (SD)	Intervention Mean (SD)	Control Mean (SD)	
Vegetable scale (0–16)	4.8 (4.22)	4.69 (4.23)	4.66 (4.65)	4.15 (4.32)	0.22 (−0.68, 1.11) [#] p= 0.63
Fruit scale (0–16)	8.12 (5.12)	8.17 (5.17)	6.93 (5.69)	7.41 (5.66)	−0.92 (−1.95, 0.12) p= 0.08
Whole grains (0–16)	6.06 (4.52)	6.24 (4.50)	5.62 (5.08)	5.71 (4.80)	−0.44 (−1.21, 0.33) p= 0.26

* Multivariate mixed model adjusted for center as a random effect, baseline scores, parent education;

[#] Multivariate mixed model adjusted for center as a random effect, baseline scores, parent age, parent race, marital status, parent education, parent BMI.

Effect of *Lunch is in the Bag* intervention on parent-ECE center provider communication, (n=577 parent-child dyads)

Table 4

Scale Name (Range)	Baseline (T0)		Post-intervention (T1)		Multivariable mixed effect regression analysis ^{§*}
	Intervention Mean (SD)	Control Mean (SD)	Intervention Mean (SD)	Control Mean (SD)	
Vegetable scale (0–16)	3.08 (3.86)	2.77 (3.64)	3.59 (4.13)	2.54 (3.74)	0.78 (0.13, 1.43) p = 0.02 *
Fruit scale (0–16)	2.91 (3.39)	2.71 (3.21)	3.32 (3.68)	2.51 (2.47)	0.62 (0.04, 0.20) p = 0.04 *
Whole grains (0–16)	2.83 (3.74)	2.61 (3.52)	3.43 (4.03)	2.60 (2.84)	0.60 (−0.04, 1.24) p = 0.06

[§] Multivariate mixed model adjusted for center as a random effect, baseline scores, and parent education

* significant at p<0.05