Published in final edited form as:

Acad Pediatr. 2013 ; 13(3): 243–250. doi:10.1016/j.acap.2013.01.003.

Do High-Risk Preschoolers or Overweight Mothers Meet AAP-Recommended Behavioral Goals for Reducing Obesity?

Christy Boling Turer, M.D., M.H.S.¹, Marissa Stroo, B.S.², Rebecca J. Brouwer, M.S.², Katrina M. Krause, M.A.², Cheryl A. Lovelady, Ph.D. R.D.³, Lori A. Bastian, M.D.⁴, Bercedis Peterson, Ph.D.⁵, and Truls Østbye, M.D., Ph.D.²

¹Departments of Pediatrics and Medicine, UT Southwestern and Children's Medical Center, Dallas, TX

²Department of Community and Family Medicine, Duke University Medical Center, Durham, NC

³Department of Nutrition, University of North Carolina at Greensboro, NC

⁴Department of Medicine, Duke University Medical Center, Durham, NC

⁵Department of Biostatistics & Bioinformatics, Duke University Medical Center, Durham, NC

Abstract

Background—The American Academy of Pediatrics (AAP) has issued specific behavioral recommendations to prevent obesity. It is unclear how often high-risk preschoolers and overweight mothers meet recommended behavior-goals, and whether meeting these goals is negatively associated with overweight/obesity.

Objective—Describe the proportion of preschoolers and mothers that meet AAP-recommended behavior-goals, and examine the associations of meeting goals with weight-status, and mothers meeting goals and children meeting corresponding goals.

Methods—Secondary analysis of baseline data (prior to an intervention) from mother-preschooler dyads in a weight-control study. Mothers were overweight or obese. Preschoolers were 2–5 years old. Dietary and feeding practices were assessed using questionnaires. Activity was measured directly using accelerometry. Outcomes included preschooler overweight and maternal obesity.

Results—The respective proportions of children and mothers that met behavior-goals were: 17% and 13% for 5 fruits/vegetables/day, 46% and 33% for zero sugar-sweetened beverages/day, 41% and 13% for fast-food <1x/week, and 46% and 13% for screentime 2 hours/day. Moderate-to-vigorous physical activity did not exceed 60 minutes/day in any participant. 49% ate family meals together 7x/week. For each additional goal met, the adjusted odds for preschooler overweight was 0.9 (95% CI, 0.8–1.1), and for maternal obesity, 0.8 (95% CI, 0.6–0.9). Preschoolers had significantly greater odds of meeting each goal when mothers met the corresponding goal.

© 2013 Academic pediatric Association. Published by Elsevier Inc. All rights reserved.

Corresponding Author: Christy Boling Turer M.D., M.H.S.; Department of Pediatrics, 5323 Harry Hines Blvd., Dallas, TX 75390-9063. Fax (214) 648-3220; Phone (214) 648-4798. Christy.Turer@UTSouthwestern.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

The authors have no financial disclosures or conflicts of interest.

Conclusions—Few high-risk preschoolers or overweight mothers meet AAP-recommended behavior-goals. Meeting a greater number of behavior-goals may be particularly important for maternal weight. Preschoolers have greater odds of meeting behavior-goals when mothers meet behavior-goals.

Keywords

childhood obesity; behavioral modification; obesity prevention; maternal child health

INTRODUCTION

Early obesity prevention and management strategies may forestall the development of obesity, since the proportions of children, adolescents, and adults with obesity increase with age.¹ One in ten preschool-age children are obese, yet the proportion with obesity increases to one in five among adolescents, and to one in three among adults.^{2,3}

Recognizing the importance of early prevention and treatment, the American Academy of Pediatrics (AAP) recommends that clinicians assess and advise parents about specific behavior recommendations for their children.⁴ Recommended behaviors include: limit sugar-sweetened beverages (SSB); eat at least five servings of fruits and vegetables per day; be moderate to vigorously-physically active (MVPA) for at least 60 minutes a day; limit screentime to no more than two hours per day; remove televisions from children's bedrooms; eat breakfast every day; limit eating out, especially fast food; have regular family meals; and limit portion sizes. Parents are encouraged to role model recommended behaviors.

Few data exist regarding the proportion of high-risk preschoolers (considered at higher risk for overweight due to maternal overweight/obesity⁵) and overweight mothers who report meeting each AAP-recommended behavior-goal; and it is unknown whether meeting these goals is associated with overweight/obesity. Parental behaviors and the early home environment influence children's behaviors and adult body weight. Children born to parents who are obese (body mass index [BMI] ≥ 30 kg/m²) are at increased risk for developing obesity.⁵ Household routines such as family meals are associated with obesity in children.⁶ Parents and children share similar activity patterns and food preferences,^{7,8} and there is evidence for associations between mother's and preschooler's dietary and lifestyle habits.^{9,10} Although it may be equally important to recommend that parents adopt these behaviors for themselves to ensure that preschoolers meet AAP-recommended behavior-goals, not enough is known about the proportions of preschoolers and mothers that report meeting these goals, and the relationship of meeting these goals with preschooler and maternal weight status.

The study objectives were to describe the proportions of high-risk preschoolers and overweight mothers who report meeting AAP-recommended behavior-goals; examine whether meeting the goals is associated with child overweight and maternal obesity (vs. maternal overweight); and evaluate the likelihood of a preschooler meeting each behavior-goal, by whether the mother meets the goal.

PATIENTS AND METHODS

This study used cross-sectional baseline data (prior to an intervention) from mothers and 2–5 year-old preschoolers who were enrolled in a behavioral weight-control study (Kids and Adults Now: Defeat Obesity! [KAN-DO]¹¹). The purpose of the study was to evaluate whether an eight-month, low-intensity intervention could improve healthy-weight attainment

(weight maintenance among normal-weight, and relative weight reduction among overweight children) among preschoolers that were considered at higher risk for overweight due to maternal overweight or obesity. Reduction in the mother's BMI was a secondary outcome of the study. Study eligibility criteria for mothers included: 1) had at least one child between 2–5 years old, 2) had recently delivered a baby (within 2–7 months prior to study entry; the postpartum period was reasoned to be a period when mothers would be more open to behavioral change¹²), 3) were overweight pre-/postpartum (measured postpartum BMI ≥ 25 kg/m² and reported BMI ≥ 25 kg/m² prior to pregnancy), 4) were English-language proficient, 5) had an accessible telephone number and mailing address, and 6) had no contraindications to exercise. The study design and rationale have been published.¹¹

Four hundred mother-preschooler dyads were recruited at two sites (Duke University and University of North Carolina Greensboro) using publicly-displayed flyers and postcards sent to mothers over 18 years old who recently had applied for birth certificates in one of 14 counties in central North Carolina, and were known to have applied for another birth certificate 2–5 years prior. A purchased list of publicly-available phone numbers was matched with birth-certificate applications to contact potentially eligible mothers. Eligible, interested mothers were sent a self-administered baseline questionnaire (written at an 8th grade literacy-comprehension level) to be completed prior to an individual baseline-assessment visit. Of 4,445 women who had state birth records, were sent recruitment postcards, and were screened by telephone, 496 eligible women attended the enrollment visit and provided written informed consent; but of these, 80 were not eligible due to a measured BMI <25 kg/m², and 16 did not complete the baseline assessments.

All recruitment and enrollment procedures were approved by the Institutional Review Boards at both study sites, and all procedures were in accordance with the ethical standards for human experimentation established by the Declaration of Helsinki.

Main outcomes

Outcome measures for this study (and the overall KAN-DO study) were preschooler overweight (including obesity, BMI $\geq 85^{\text{th}}$ percentile) and maternal obesity (BMI ≥ 30 kg/m² vs. overweight [BMI 25 – <30 kg/m²]). Height and weight were measured at the baseline-assessment visit. BMI was calculated for all participants using measured height (standardized SECA 214 portable stadiometer) and weight (Tanita BSB-800S digital scale). Preschooler BMI was converted to BMI percentile for age and gender using Center for Disease Control (CDC) reference data.¹³

Outcome measures for the study's second objective (to evaluate the likelihood of a preschooler meeting each behavior-goal by whether the mother meets the goal) were each of the AAP-recommended behavior-goals (described below). These goals were dependent variables for the second study objective and independent variables for the primary study objective.

Independent variables

AAP-recommended behavior-goals included: 1) eat ≥ 5 servings of fruits/vegetables/day, 2) limit screentime to ≤ 2 hours/day, 3) aim for ≥ 1 hour/day of physical activity (PA), 4) eliminate consumption of SSB, 5) limit fast-food consumption and eating out, and 6) regularly eat family meals together.⁴ This study did not assess breakfast consumption, TV in bedrooms, or portion sizes, because they not measured in both mothers and preschoolers.

To determine dietary intake, mothers completed a questionnaire regarding daily intake of food items for themselves and preschoolers. Specific questions, used extensively in North Carolina public health programs¹⁴, were used to assess servings of fruits/vegetables, SSB,

and fast food. To measure fruit/vegetable consumption, mothers were asked how many servings of each were eaten in a typical day. Sample serving sizes were provided.¹⁵ Response categories ranged from 0–3+ servings/day, and were combined into a sum of fruit/vegetable servings/day. Using the AAP behavior-goal, responses were dichotomized at <5 versus ≥5 fruit/vegetable servings/day.

The variable indicating SSB consumption was constructed using responses from questions assessing the frequency and amount of SSB and non-diet sodas consumed in a typical day. For this analysis, which used the AAP behavior-goal, responses were dichotomized at none versus any. Consumption of 100% fruit juice was not examined, because the AAP does not specifically address juice in the behavioral recommendations for all children regardless of weight,⁴ and because maternal juice intake was not assessed in this study. Juice that included anything other than 100% fruit juice was categorized as a SSB.

Fast-food consumption was assessed using the question “How many times a week do you usually eat from a fast-food restaurant like Burger King,® Chick-Fil-A,® Bojangles,® or Pizza Hut® (eat in, take out, or delivery)?” Response categories included, 0–<1x; 1x; 2x; 3x; 4x; or ≥5x/week. The responses were dichotomized at <1x versus ≥1x/week. Although the AAP does not specify a recommended level of fast-food intake, prior research suggests that consuming food prepared away from home more than once per week is associated with higher BMI.¹⁶

The number of family meals eaten together was assessed by asking “During the past seven days, how many times did all, or most of your family living in your house, eat a meal together?” Response categories included 0; 1–2 times; 3–4 times; 5–6 times; and ≥7 times/week. Responses were dichotomized at ≥7 versus <7 times/week based upon prior published research.¹⁷

The amount of “screentime” was calculated from two questions: the number of hours/day sitting and watching TV or videos, and the amount of time spent using a computer or playing computer games. Response categories for each question ranged from 0–4 hours/day, and were combined into total screentime/day, with response categories dichotomized at ≤2 versus >2 hours/day in accordance with the recommended behavior-goal.⁴

PA was measured using multi-axial accelerometry in both mothers and preschoolers.¹⁸ Participants were asked to wear the device on the right hip continuously for seven days. Minutes of moderate-to-vigorous physical activity (MVPA) were defined using published cut-offs (≥1,535 counts/one-minute epoch for mothers¹⁹, and ≥715 counts/15-second epoch for preschoolers²⁰).

Demographic variables were obtained by maternal report. Preschooler characteristics included age (in months) and gender. Maternal characteristics included age, marital status (single/not partnered versus married/partnered), parity (no. of biological children), time since delivery of newborn (in weeks), and employment status (worked full-time, part-time, or did not work for pay). Household characteristics included race/ethnicity (African-American, white/Caucasian, and other), highest household education (less than college degree versus college graduate), and household income (<\$15,000, \$15,000–<\$30,000, \$30,000–<\$60,000 and ≥\$60,000).

Descriptive, bivariate, and multivariable analyses were used to examine associations between meeting behavior-goals and preschooler overweight and maternal obesity. The proportions of mothers and preschoolers meeting each behavior-goal were described. Bivariate analyses were performed using Pearson’s χ^2 -statistic (or Fisher’s exact test for small cell counts, where appropriate), to examine associations between independent

variables and preschooler overweight, maternal obesity. Logistic regression models were constructed in which the dependent variables were preschooler overweight and maternal obesity, and independent variables included the mean total behavior-goals met and demographic characteristics. To determine independent associations between each behavior and maternal/preschooler weight-status, models were run in which the independent variables were the dichotomized behavior-goal variables (indicating whether each behavior-goal was met). PA was not included in the models because no mothers or preschoolers met the goal of 60 minutes/day. All five behavior variables and demographic characteristics were forced into the models, and backwards stepwise elimination (with an alpha-to-enter of 0.5) was used to select variables to keep in the models. Harrell recommends using this large alpha level to ensure that the model is not over-fitted to the data.²¹ The resulting behavior-goal variables remaining in the model were considered potential predictors of weight-status.

Bivariate and multivariable analyses were used to explore associations between mothers meeting behavior-goals and preschoolers meeting the corresponding behavior-goals.

RESULTS

Among preschoolers in the study sample, 44% were female, 24% were overweight (including 9% who were obese), and the mean age was 42 months (Table 1). The mean age for mothers was 33 years, and 22% were African-American. Most mothers were obese and married/partnered, and half worked full- or part-time. The mean time since delivery of their newborn was approximately five months. Three-quarters of mothers were from households in which the highest educational degree was a college degree or higher, and 57% reported an annual household income \$60,000.

In bivariate analyses of characteristics associated with preschooler overweight and maternal obesity (data not shown), socio-demographic characteristics that were significantly associated with preschooler overweight included maternal obesity ($p<.01$) and older preschooler age ($p=.03$). Characteristics that were significantly associated with maternal obesity included: being married/partnered, African-American, not having received a college degree, and having a lower annual household income (all, $p<.01$).

Few preschoolers and mothers met each recommended behavior-goal (Table 2). Only one out of six preschoolers and one out of eight mothers consumed 5 servings/day of fruits/vegetables; and, whereas almost half of preschoolers met the recommended level of daily screentime, only one out of eight mothers reported spending 2 hours/day in front of a screen. Mean duration of moderate-to-vigorous activity for preschoolers was 15 minutes/day, and for mothers, 8 minutes/day; no one met the recommended one-hour of MVPA per day. Less than half of preschoolers and one-third of mothers reported not consuming any SSB. A minority of both preschoolers and mothers ate fast food less than once/week. Almost half of mother-preschooler dyads ate seven or more family meals together per week. More than half of mothers and one-third of preschoolers reported meeting a total of zero or one recommended behavior-goals.

In analyses of the association of behavior-goals with preschooler overweight and maternal obesity, prior to adjustment, for each additional behavior-goal met (data not shown), the unadjusted odds ratio for preschooler overweight was 0.8 (95% CI, 0.7–0.99), and for maternal obesity, 0.8 (95% CI, 0.7–0.9). In the multivariable analysis, for each additional behavior-goal met, the adjusted odds ratio for preschooler overweight was 0.9 (95% CI, 0.8–1.1), and for maternal obesity, 0.8 (95% CI, 0.6–0.9). In a model that did not adjust for maternal weight status (considering that inclusion of maternal weight status over-adjusted

the model), each additional behavior-goal met was associated with significantly lower adjusted odds of preschooler overweight (OR, 0.8, 95% CI, 0.7–0.99).

Specific behavior-goals that were significantly associated with maternal obesity in unadjusted analyses included SSB <0 ounces/day and fast-food consumption <1x/week (Table 3). For preschoolers, only family meals eaten together 7 times/week was associated with lower unadjusted odds of preschooler overweight. In a multivariable model with all behavior-goals entered together (Table 3), only fast-food consumption less than once/week was associated with significantly lower adjusted odds of maternal obesity. For preschooler overweight, only family meals eaten together 7 times/week was associated with significantly lower adjusted odds of preschooler overweight. Not including maternal weight status from the preschooler model did not alter these findings.

In the analysis of the association between mother meeting a behavior-goal and preschooler meeting the corresponding goal, for every behavior-goal, when the mother met the behavior-goal, the child had significantly greater adjusted odds of meeting the corresponding goal (Table 4). The adjusted odds of a preschooler meeting a specific behavior-goal when their mother met the goal were four times higher for viewing 2 hours/day of TV/computers, six times higher for not drinking any SSB, almost seven times higher for eating five or more servings of fruits and vegetables/day, and almost 67-times higher adjusted odds of eating fast food less than weekly.

DISCUSSION

This is the first study to describe the frequency and concordance of AAP-recommended behaviors (released in 2010) followed by high-risk preschoolers and their overweight mothers. Few preschool-age children or their overweight/obese mothers were found to meet behavior-goals recommended by the AAP to prevent and reverse childhood obesity. For overweight mothers, the results suggest that meeting additional goals reduces the odds of obesity, and that limiting fast-food consumption to less than weekly may be particularly important for promoting a healthier weight. For preschoolers, regular family meals appear to be important. The strong association between maternal and preschooler behaviors suggests that parental role modeling of healthy habits may be critical for cultivating healthy behaviors in young children. Given the concordance between both maternal-preschooler overweight and behaviors, it is likely that a child will become progressively more overweight with continued exposure to the behavioral patterns of the parent. Thus, issuing and disseminating specific recommendations for maternal behavior-goals hold potential to influence the habits and future weight of preschool-age children.

In this study of overweight and obese mothers, meeting more behavior-goals was associated with lower adjusted odds of maternal obesity, but not preschooler overweight/obesity. The reason for this difference may be because mothers met fewer behavior-goals than preschoolers. The mean number of behavior-goals met by mothers was less than that of preschoolers (1.5 versus 1.9 behaviors), and fewer mothers than preschoolers met four or more behavior-goals (4% of mothers versus 16% of preschoolers). Alternatively, preschooler weight-status may have been influenced by other factors more than the goal behaviors; this was supported by the finding in bivariate analysis that, prior to adjustment, meeting more behavior-goals was associated with preschooler weight-status.

This study also identified specific behavior-goals that appear to be important for weight-status among overweight mothers and preschoolers. For mothers, infrequent fast-food consumption was associated with lower odds of maternal obesity. Fast-food intake has been associated with lower dietary quality and higher daily caloric intake, and more frequent

consumption of fast food in cross-sectional and longitudinal studies has been associated with higher body mass and greater weight gain in adults.^{22,23} This study extends these findings to a sample of overweight mothers.

In this high-risk population of preschool-age children with overweight mothers, eating meals together as a family was associated with lower odds of preschooler overweight. The reason for this finding may be that meals eaten at home have been associated with lower caloric intake and better dietary quality, compared to meals eaten outside the home (at fast-food establishments).^{24,25} The study findings are consistent with prior research in which an increased frequency of family meals was associated with lower risk of obesity in young children,⁸ and overweight in older children^{16,26}; a lower number of family meals also predicts persistence of overweight over time.²⁷ These findings suggest that increasing the frequency of family meals might lower the likelihood of preschooler overweight, and that family meals are an important goal behavior to recommend.

Notably, other behavior-goals recommended by the AAP were not independently associated with maternal obesity or preschooler overweight in this study. The lack of associations between behavior-goals other than fast-food intake and maternal obesity might be due to limitations inherent in using self-reported dietary and activity data or restriction of the sample to mothers who were overweight or obese. Including normal-weight mothers would likely have led to more variability in the frequency of reported behaviors, and potentially allowed for detection of significant associations. Similarly, in the preschoolers, the lack of independent associations between behaviors other than family meals and preschooler overweight could reflect limitations due to parentally-reported diet and activity data, too short a period of exposure, too small a sample to detect a small difference, or true lack of an association. In older children, adolescents, and adults, each recommended behavior has been associated with lower risk of overweight.^{28,29,30,31}

Finally, the study data indicate that there are clear associations between maternal and preschooler behaviors. Clinically, this is important. If preschoolers' behaviors are highly correlated with those of the mother, then pediatricians might consider communicating with mothers about the importance of role-modeling goal behaviors, a point increasingly supported by family-based interventions for pediatric obesity.^{29,32} These findings also suggest that unhealthy behaviors in the child, while corresponding to those of the mother, do not yet appear to be associated with preschooler overweight/obesity. Thus, increased emphasis on obesity prevention in preschoolers and young children is critical.

Certain study limitations should be acknowledged. The study sample was predominantly Caucasian with few Latinos. Participants also were relatively highly educated, which may have been related to the proximity of the recruitment sites (UNC Greensboro and Duke) to undergraduate and graduate schools. The selection of only overweight and obese mothers limits the generalizability of the findings. Including healthy-weight mothers as the reference group might have strengthened the association between maternal behaviors and risk of maternal obesity. For now, the results suggest that meeting fewer maternal behavior-goals is associated with obesity among overweight mothers. Several of the behavioral variables relied on mother's self-report and not direct observation. Studies using direct measures of time spent watching TV and 3-day TV diaries have associated duration of TV-watching with weight-status among preschoolers.³³ The cross-sectional study design can only suggest association; the possibility exists that findings were due to reverse causation (e.g. low preschooler BMI prompting more family meals at home). Further research is needed assessing the longitudinal association between meeting behavior-goals and weight-status.

The study also has several strengths. The dyadic sample of overweight mothers and their preschool-age children is unique. The study sample appeared to reflect the demographic composition of the population from which it was drawn. For example, the sample had a similar proportion of African-American participants as the proportion reported in census data for central North Carolina (21.5%).³⁴ Also, several key parameters were measured directly, including physical activity using accelerometry in both mothers and preschoolers, and weights and heights in all participants.

CONCLUSION

Few high-risk preschoolers or overweight/obese mothers meet AAP-recommended behavior-goals to prevent and reduce obesity. Meeting a greater number of these goals may be important for maternal weight-status, and maternal behaviors appear to be an important influence on the behaviors of the child. Prospective studies are needed to determine whether meeting AAP-recommended behavior-goals, by mother, child, or both, leads to weight-status improvement among overweight mothers and preschool-age children.

This study suggests that for pediatricians to positively shape behaviors in preschoolers, they should consider discussing the mother's own behaviors. In so doing, the behavior changes in the mother may not only benefit her own weight-status, but also the future weight of her child.

Acknowledgments

We are grateful to all our colleagues in the KAN-DO Study Research Group, and, in particular, thank Nancy Zucker (Department of Psychology and Neuroscience, Duke University Medical Center, Durham, NC) and Anne Bowman (former graduate student, Department of Nutrition, University of North Carolina at Greensboro, NC) for their assistance in the conduct of this study.

Support for the KAN-DO study was provided by the National Institutes of Diabetes and Digestive and Kidney Diseases (NIDDK; R01-DK-075439).

References

- Centers for Disease Control. [Accessed May 1, 2012] Overweight and Obesity. Available at: www.cdc.gov/obesity/data/trends.html.
- Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999–2010. *JAMA*. 2012; 307:483–490. [PubMed: 22253364]
- Flegal KM, Carroll MD, Kit BK, Ogden CL. Prevalence of obesity and trends in body mass index among US adults, 1999–2010. *JAMA*. 2012; 307:491–497. [PubMed: 22253363]
- American Academy of Pediatrics. [Accessed December 13, 2012] Expert Committee Recommendations on the Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity. Step 1—Obesity Prevention at Well Care Visits. Action Steps [Column 1], “Assess behaviors and attitudes,” and “Give consistent evidence-based messages for all children regardless of weight”. Available at: <http://www2.aap.org/obesity/pdf/COANImplementationGuide62607FINAL.pdf>.
- Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med*. 1997; 337:869–873. [PubMed: 9302300]
- Anderson SE, Whitaker RC. Household routines and obesity in US preschool-aged children. *Pediatrics*. 2010; 125:420–428. [PubMed: 20142280]
- Moore LL, Lombardi DA, White MJ, Campbell JL, Oliveria SA, Ellison RC. Influence of parents' physical activity levels on activity levels of young children. *J Pediatr*. 1991; 118:215–219. [PubMed: 1993947]
- Borah-Giddens J, Falciglia GA. A meta-analysis of the relationship in food preferences between parents and children. *J Nutr Educ*. 1993; 25:102–107.

9. Greengerg RS, Ariza AJ, Binns HJ. Activity and dietary habits of mothers and children: close ties. *Clin Pediatr*. 2010; 49:1026–1032.
10. Sonnevile KR, Rifas-Shiman SL, Kleinman KP, Gortmaker SL, Gillman MW, Taveras EM. Associations of obesogenic behaviors in mothers and obese children participating in a randomized trial. *Obesity*. 2012; 20:1449–1454. [PubMed: 22349735]
11. Østbye T, Zucker N, Krause KM, et al. Kids and Adults Now! Defeat Obesity (KAN-DO): rationale, design and baseline characteristics. *Contemp Clin Trials*. 2011; 32:461–469. [PubMed: 21300177]
12. McBride CM, Emmons KM, Lipkus IM. Understanding the potential of teachable moments: the case of smoking cessation. *Health Educ Res*. 2003; 18:156–170. [PubMed: 12729175]
13. Centers for Disease Control. [Accessed Oct 31, 2012] Growth charts. Available at: http://www.cdc.gov/growthcharts/percentile_data_files.htm.
14. Food and Nutrition Services. [Accessed Oct 31, 2012] Women, Infants, and Children. Available at: <http://www.fns.usda.gov/wic/>.
15. USDA. [Accessed Oct 31, 2012] Choose my plate.gov. Available at: <http://www.choosemyplate.gov/food-groups/>. (MyPyramid used for the trial, which was conducted prior to changing to MyPlate.)
16. Fulkerson JA, Farbaksh K, Lytle L, et al. Away-from-home family dinner sources and associations with weight-status, body composition, and related biomarkers of chronic disease among adolescents and their parents. *J Am Diet Assoc*. 2011; 111:1892–1897. [PubMed: 22117665]
17. Kontogianni MD, Farmaki A, Vidra N, et al. Associations between lifestyle patterns and body mass index in a sample of Greek children and adolescents. *J Am Diet Assoc*. 2010:215–221. [PubMed: 20102848]
18. Mini Mitter. [Accessed Oct 31, 2012] Products. Available at: <http://www.minimitter.com>.
19. Colley RC, Tremblay MS. Moderate and vigorous physical activity intensity cut-points for the Actical accelerometer. *J Sports Sci*. 2011; 29:783–789. [PubMed: 21424979]
20. Pfeiffer KA, McIver KL, Dowda M, Almeida MJCA, Pate RR. Validation and calibration of the actical accelerometer in preschool children. *Med Sci Sports Exerc*. 2006; 38:152–157. [PubMed: 16394968]
21. Harrell, FE. Regression Modeling Strategies with Applications to Linear Models, Logistic Regression, and Survival Analysis. New York, NY: Springer New York; 2001.
22. Fowles ER, Timmerman GM, Bryant M, Kim S. Eating at fast-food restaurants and dietary quality in low-income pregnant women. *West J Nurs Res*. 2011; 33:630–651. [PubMed: 21131508]
23. Bowman SA, Vinyard BT. Fast food consumption of US adults: impact on energy and nutrient intakes and overweight status. *J Am Coll Nutr*. 2004; 23:163–168. [PubMed: 15047683]
24. Poti JM, Popkin BM. Trends in energy intake among US children by eating location and food source, 1977–2006. *J Am Diet Assoc*. 2011; 111:1156–1164. [PubMed: 21802561]
25. Bowman SA, Gortmaker SL, Ebbeling CB, Pereira MA, Ludwig DS. Effects of fast-food consumption on energy intake and diet quality among children in a national household survey. *Pediatrics*. 2004; 113:112–117. [PubMed: 14702458]
26. Fulkerson J, Neumark-Sztainer D, Hannan P, Story M. Family meal frequency and weight status among adolescents: cross-sectional and 5-year longitudinal associations. *Obesity (Silver Spring)*. 2008; 16:2529–2534. [PubMed: 18719674]
27. Gable S, Chang Y, Krull J. Television watching and frequency of family meals are predictive of overweight onset and persistence in a national sample of school-aged children. *J Am Diet Assoc*. 2007; 107:53–61. [PubMed: 17197271]
28. Ledoux TA, Hingle MD, Baranowski T. Relationship of fruit and vegetable intake with adiposity: a systematic review. *Obes Rev*. 2010; 12:e143–e150. [PubMed: 20633234]
29. Dubois L, Farmer A, Girard M, Peterson K. Regular sugar-sweetened beverage consumption between meals increases risk of overweight among preschool-aged children. *JADA*. 2007; 107:924–934.

30. de Ruyter JC, Olthof MR, Seidell JC, Katan MB. A trial of sugar-free or sugar-sweetened beverages and body weight in children. *N Engl J Med*. 2012; 367:1397–1406. [PubMed: 22998340]
31. Dennison BA, Erb TA, Jenkins PL. Television viewing and television in bedroom associated with overweight risk among low-income preschool children. *Pediatrics*. 2002; 109:1028–1035. [PubMed: 12042539]
32. Klohe-Lehman DM, Freeland-Graves J, Clarke KK, et al. Low-income, overweight and obese mothers as agents of change to improve food choices, fat habits, and physical activity in their 1-to-3-year-old children. *J Am Col Nutr*. 2007; 26:196–208.
33. Cox R, Skouteris H, Rutherford L, Fuller-Tyszkiewicz M, Dell'Aquila D, Hardy LL. Television viewing, television content, food intake, physical activity, and body mass index: a cross-sectional study of preschool children aged 2–6 years old. *Health Promot J Austr*. 2012; 23:58–62. [PubMed: 22730942]
34. U.S. Census Bureau state and county quick facts. [Accessed Oct 28, 2012] Available at: <http://quickfacts.census.gov/qfd/states/37000.html>.

WHAT'S NEW

Study findings indicate that few preschool-age children or overweight mothers meet AAP-recommended behavior-goals to prevent obesity. Meeting more behavior-goals appears to be particularly important for maternal weight. Preschoolers have greater odds of meeting behavior-goals when mothers meet recommended behavior-goals.

Table 1

Characteristics of Preschoolers and Mothers in the Study Sample

No. of Participants = 400		
n (%) or mean (SD)		
<i>Child characteristics</i>		
Weight-status	BMI <85 th percentile	304 (76%)
	BMI 85 th -<95 th percentile ^a	96 (24%)
Female gender		177 (44%)
Preschooler age, months		42 (13)
<i>Maternal characteristics</i>		
Weight-status	Overweight, BMI 25–29.9 kg/m ²	149 (37%)
	Obese, BMI ≥ 30 kg/m ²	251 (63%)
Age, years		33 (5)
Marital status	Single (not partnered)	39 (10%)
	Married (partnered)	361 (90%)
Employment status	Full-time	119 (30%)
	Part-time	76 (19%)
	Do not work for pay	205 (51%)
Weeks postpartum		23 (5)
Parity, no. biological children		3 (1)
<i>Household characteristics</i>		
Race/ethnicity	African-American	87 (22%)
	Non-Latino white	301 (75%)
	Other	12 (3%)
Characteristic		
<i>n (%) or mean (SD)</i>		
Highest parental educational level	High-school degree or less	35 (8.8%)
	Some post high-school training	60 (15%)
	College graduate	155 (39%)
	Post-graduate degree	150 (38%)
Household income	\$15,000	40 (10%)
	>\$15,000 - \$30,000	35 (9%)
	>\$30,000 - \$60,000	36 (9%)
	> \$60,000	223 (57%)

^aThe proportion of children who were obese (BMI ≥ 95th percentile) was 9%.

Table 2

Proportions of Preschoolers and Mothers Meeting AAP-Recommended Behavior-Goals

Behavior	Frequency	Mothers	Preschoolers
		<i>n</i> (%)	<i>n</i> (%)
Fruit and vegetable servings, per day	<i>Goal: 5 or more</i>	69 (17%)	52 (13%)
	3–4	202 (51%)	191 (48%)
	1–2	119 (30%)	150 (38%)
	None to less than 1	8 (2%)	7 (2%)
Screentime, hours per day	<i>Goal: less than 2</i>	183 (46%)	52 (13%)
	None	13 (3%)	3 (1%)
	Less than 2	169 (43%)	49 (12%)
	2 or more	208 (53%)	348 (87%)
Moderate-to-vigorous physical activity, minutes/day ^a	<i>Goal: 60 minutes</i>	0 (0%)	0 (0%)
	> 45 – < 60 minutes	6 (2%)	2 (1%)
	> 30 – 45 minutes	14 (4%)	6 (2%)
	> 15 – 30 minutes	115 (34%)	49 (13%)
	0 – 15 minutes	202 (60%)	329 (85%)
	Missing	63 (16%)	14 (4%)
Sugar sweetened beverages, ounces/day	<i>Goal: none</i>	184 (46%)	131 (33%)
	3–6	128 (32%)	56 (14%)
	9–12	39 (10%)	63 (16%)
	15–21	28 (7%)	31 (8%)
	24 or more	19 (5%)	115 (29%)
Fast food meals, per week	<i>Goal: none or < once</i>	162 (41%)	139 (35%)
	None	34 (9%)	30 (8%)
	Less than once	128 (32%)	109 (27%)
	Once	113 (28%)	94 (24%)
	Twice	77 (19%)	78 (20%)
	Three or more times	48 (12%)	89 (22%)
Family meals eaten together, per week	<i>Goal: 7 or more</i>	193 (49%)	
	5 – 6	95 (24%)	
	3 – 4	66 (17%)	
	1 – 2	37 (9%)	
	None	7 (2%)	
Total number of behaviors	6	0 (0%)	0 (0%)

Behavior	Frequency	Mothers	Preschoolers
		<i>n</i> (%)	<i>n</i> (%)
	5	57 (3%)	3 (1%)
	4	36 (9%)	13 (3%)
	3	96 (24%)	53 (13%)
	2	105 (26%)	102 (26%)
	1	93 (23%)	135 (34%)
	0	57 (14%)	92 (23%)

^aMinutes of moderate-to-vigorous physical activity, defined as 715 counts/15 second epochs children, (mean 15 minutes, SD 9.55) and 1535 counts/1 minute epoch for mothers (mean 8 minutes, SD 7.76). 18,19

Table 3

Bivariate and multivariable analyses of the associations of meeting behavior-goals and maternal obesity, child overweight.

Goal behavior ^a	Odds ratio (95% confidence interval) for			
	Maternal obesity if mother meeting goal		Child overweight/obesity if child meeting goal	
	Unadjusted	Adjusted ^b	Unadjusted	Adjusted ^b
Fruit and vegetables, five or more servings/day	0.8 (0.4, 1.4)	— ^c	0.6 (0.3, 1.2)	0.6 (0.3, 1.2)
Screentime, two or less hours/day	0.7 (0.4, 1.3)	— ^c	1.0 (0.6, 1.6)	1.2 (0.7, 1.9)
Sugar sweet beverages, zero ounces/day	0.6 (0.4, 0.9)	0.8 (0.5, 1.3)	0.8 (0.5, 1.3)	— ^c
Fast food meals, less than once/week	0.6 (0.4, 0.9)	0.6 (0.4, 0.97)	0.7 (0.4, 1.1)	0.8 (0.5, 1.3)
Family meals together, seven or more/week	0.99 (0.7, 1.5)	1.3 (0.9, 2.1)	0.6 (0.4, 0.9)	0.6 (0.4, 0.97)

^aBehavior-goals included five or more fruit/vegetable servings/day, zero sugar-sweetened beverages, fast-food meal less than once/week, screentime two or less hours/day, family meals together seven or more times/week, and moderate-to-vigorous physical activity 60 min/day.

^bModels adjusted for characteristics that were significantly associated with maternal obesity and preschooler overweight in bivariate analyses. The model for maternal obesity adjusted for maternal age, race/ethnicity, marital status, income, education, and parity. The preschooler model adjusted for preschooler age (in months), gender, race/ethnicity, and maternal weight status.

^cBehavior-goal eliminated from the model, $p > .5$.

Table 4

Bivariate and Multivariable Analysis of the Association of Child Meeting Behavior-Goal and Mother Meeting Behavior-Goal

Behavior-goal ^a	Proportion children meeting behavior-goal when:		Adjusted ^b Odds Ratio (95% CI) for
	mother meets goal	mother does not meet goal	child meeting behavior-goal when mother meets behavior-goal
Fruits and vegetables, 5 servings/day	48%	13%	6.8 (3.5, 13.5)
Screentime, 2 hours/day	78%	45%	4.3 (2.4, 7.5)
Sugar-sweet beverages, zero oz/day	79%	29%	6.0 (3.4, 10.6)
Fast food meals, less than once/week	89%	14%	66.8 (31.4, 142.0)

^aPhysical activity was not included in analyses because no participants met the goal of 60 minutes/day. The variable family meals eaten together/week was not included in analyses because the question was asked once for the household, and not separately for mother and child.

^bSeparate multivariable logistic regression models, constructed for each behavior-goal, were adjusted for child age (in months), gender, maternal BMI (postpartum), working outside the home, race/ethnicity, and highest household educational level.