Healthy Habits, Happy Homes
Randomized Trial to Improve Household Routines for Obesity Prevention Among Preschool-Aged Children

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IMPORTANCE Racial/ethnic and socioeconomic disparities exist across risk factors for childhood obesity.

OBJECTIVE To examine the effectiveness of a home-based intervention to improve household routines known to be associated with childhood obesity among a sample of low-income, racial/ethnic minority families with young children.

DESIGN Randomized trial.

SETTING The intervention was delivered in the families' homes.

PARTICIPANTS The study involved 121 families with children aged 2 to 5 years who had a television (TV) in the room where he or she slept; 111 (92%) had 6-month outcome data (55 intervention and 56 control). The mean (SD) age of the children was 4.0 (1.1) years; 45% were overweight/obese. Fifty-two percent of the children were Hispanic, 34% were black, and 14% were white/other. Nearly 60% of the families had household incomes of $20 000 or less.

INTERVENTIONS The 6-month intervention promoted 4 household routines, family meals, adequate sleep, limiting TV time, and removing the TV from the child's bedroom, using (1) motivational coaching at home and by phone, (2) mailed educational materials, and (3) text messages. Control subjects were mailed materials focused on child development.

MAIN OUTCOMES AND MEASURES Change in parent report of frequency of family meals (times/wk), child sleep duration (hours/d), child weekday and weekend day TV viewing (hours/d), and the presence of a TV in the room where the child slept from baseline to 6 months. A secondary outcome was change in age- and sex-adjusted body mass index (calculated as weight in kilograms divided by height in meters squared).

RESULTS Compared with control subjects, intervention participants had increased sleep duration (0.75 hours/d; 95% CI, 0.06 to 1.44; P = .03), greater decreases in TV viewing on weekend days (−1.06 hours/d; 95% CI, −1.97 to −0.15; P = .02), and decreased body mass index (−0.40; 95% CI, −0.79 to 0.00; P = .05). No significant intervention effect was found for the presence of a TV in the room where the child slept or family meal frequency.

CONCLUSIONS AND RELEVANCE Our results suggest that promoting household routines, particularly increasing sleep duration and reducing TV viewing, may be an effective approach to reduce body mass index among low-income, racial/ethnic minority children. Longer-term studies are needed to determine maintenance of behavior change.

TRIAL REGISTRATION clinicaltrials.gov Identifier: NCT01565161
The prevalence of overweight and obesity among young children in the United States is high. Racial/ethnic minority children and those living in low-income households bear a disproportionate share of the burden of overweight status, making development of effective intervention strategies for these high-risk populations particularly urgent. Racial/ethnic and socioeconomic disparities also exist across many known risk factors for childhood overweight and obesity. Interventions that are able to address the disparities in obesity-related risk factors may help curb the increase in overweight and obesity among racial/ethnic minority children and those living in low-income households.

Among a national sample of preschool-aged children, Anderson and Whitaker found that children who were exposed to 3 household routines (ie, regularly eating dinner as a family, adequate nighttime sleep, and limiting screen time) had substantially lower obesity rates than children who were not exposed to those routines. The findings were similar across racial/ethnic groups and across socioeconomic status. Anderson and Whitaker’s findings suggest that promotion of these household routines may be an effective way to prevent childhood obesity among racial/ethnic minority and low-income families. While a number of home-based obesity prevention interventions have been implemented in very early infancy, to our knowledge, few obesity interventions for older children have been delivered in the home where household routines occur. No home-based interventions have addressed all of these household routines.

The purpose of this study was to assess the extent to which a home-based intervention, compared with a mailed control condition focused on healthful development, resulted in improvements in household routines that may be preventive of childhood overweight and obesity among racial/ethnic minority and low-income families with children aged 2 to 5 years. We also examined the impact of the intervention on change in child body mass index (BMI, calculated as weight in kilograms divided by height in meters squared).

Methods

Study Design and Participants

Healthy Habits, Happy Homes is a randomized trial. In Supplement, eFigure 1 provides a schematic of the study design. Between June 1, 2011, and February 1, 2012, we recruited families from 4 community health centers that serve primarily low-income and racial/ethnic minority families in the greater Boston area. Participants were families with children aged 2 to 5 years who had a television (TV) in the room where the child slept (verified by staff at home visit). We excluded (1) parents who were unable to respond to interviews in English or Spanish; (2) families who planned to move from the area; (3) parents who were younger than 18 years of age; and (4) children who had a chronic health condition such as severe cerebral palsy.

Using patient records from individual health centers, we identified 1467 potentially eligible families. We mailed a letter to each parent introducing the study and inviting them to participate and included an opt-out telephone number should the family choose not to participate. We telephoned families who did not refuse additional contact beginning 7 days after mailing the letter. Of the 1467 potentially eligible families, research assistants attempted telephone contact with 1148, during which time they described the study, screened for eligibility, collected contact information, and scheduled a home visit to collect baseline data and obtain written consent. Families were enrolled once we obtained their baseline data and written consent. Of the 500 parents who could be contacted and were eligible for the study, 121 enrolled in the study (response rate = 24%).

For simplicity, we determined our required sample size using one of our targeted routines—TV viewing. To detect a 1.2-hour reduction in TV viewing per day with a 2-sided 5% significance level and a power of 80%, we determined that a sample size of 60 participants per condition was necessary, based on an anticipated dropout rate of 10%.

To assign enrolled families to the intervention or control condition, we used a stratified block randomization scheme. Stratum was recruitment site blocked by child sex; condition was assigned by blocks of 4 in each strata. Our statistical programmer used a computerized routine to randomly assign the stratified blocks to the intervention and control condition. Assignments were implemented through sealed sequentially numbered individual envelopes that the research assistant opened following the completion of baseline assessments.

All baseline and 6-month follow-up data were obtained during a home visit. Participants received $40 for completing the baseline visit and $50 for completing the 6-month follow-up visit. All study activities were approved by the Harvard Pilgrim Health Care human subjects committee.

Treatment Groups

Families randomized to the control condition received 4 monthly mailed packages that included educational materials on reaching developmental milestones during early childhood and low-cost incentives (eg, coloring books). The educational materials were adapted from the Centers for Disease Control and Prevention’s “Developmental milestones” (http://www.cdc.gov/ncbddd/actearly/milestones/index.html). Materials focused on milestones for each age group organized by developmental domain (social/emotional, language, cognitive, and motor).

Intervention

The Healthy Habits, Happy Homes intervention is a home-based intervention that uses individually tailored counseling by health educators to encourage behavior change. The intervention was informed by findings from focus groups with 74 racial/ethnic minority parents of young children. Major components of the intervention included (1) motivational coaching by a health educator during 4 home visits and 4 health coaching telephone calls, (2) mailed educational materials (eFigure 2 in Supplement) and incentives, and (3) weekly text messages on adoption of household routines.

We trained 4 bilingual health educators to use motivational interviewing during the home visits and coaching...
To measure TV viewing time, we asked parents to report the number of days at least 1 h of TV was watched in the past month. We defined TV presence as an average of 2 h more than those without a TV in the bedroom. Although the intervention was designed to reduce the amount of TV watched, we found that 83% of intervention parents and 70% of control parents reported TV presence. To reduce TV presence, we taught parents to remove the TV from the child’s bedroom and to use the TV only for daily check-ins. As a result, 94% of intervention parents were able to remove the TV from the child’s bedroom, whereas 77% of control parents did so (p = 0.03).

Outcome Measures
Our main outcomes were change, from baseline to follow-up, in 4 behaviors: eating meals together as a family, child’s sleep duration, child’s TV viewing time, and presence of a TV in the room where the child slept. Using surveys at baseline and follow-up, we asked parents to report the number of days at least some of the family ate a meal together in the past 7 days.24 To measure sleep duration, we asked parents to quantify the average amount of daily sleep their child obtained including naps, and separately asked about bedtime and wake time in the past month.25-27 To measure TV viewing time, we asked parents to report separately the number of hours their child watched TV on an average weekday and weekend day in the past month.28 We also asked whether the child had a TV in the room where he or she slept.29

As a secondary outcome, we assessed change in child BMI. Trained research assistants measured child height using a Schorr board and child weight using a calibrated electronic scale. We then calculated child BMI and age-specific and sex-specific percentiles using the Centers for Disease Control and Prevention references.30 We chose BMI itself as the anthropometric outcome rather than BMI z score because published studies have indicated that while the BMI z score is optimal for assessing adiposity on a single occasion, BMI is preferable for measuring change in adiposity.31

We kept detailed records of completed home visits and calls. To assess parents’ satisfaction with the intervention, we asked parents in the intervention group during the follow-up survey to rate how satisfied they were with the program components and how helpful each component was in guiding their approach to their child’s behaviors. We also asked parents whether they would recommend the program to their family and friends.

Statistical Methods
We first performed univariate analyses of variables of interest to examine baseline distributions of characteristics by intervention status and to examine distributional assumptions. In intent-to-treat complete case analyses, we used regression models to examine differences from baseline to follow-up. In regression models, we used linear regression, whether they would recommend the program to their family and friends.
completed the 6-month follow-up assessments. Table 2 shows baseline characteristics of our study sample overall and by intervention assignment. The mean (SD) age of the children was 4.0 (1.1) years; 45% were overweight or obese at baseline. Nearly 60% of the study sample had annual household incomes at or below $20 000. Children in the study were predominantly Hispanic (52%) or black (34%), and 80% co-slept with their parents. There were no substantive group differences at baseline in health behaviors or BMI.

Table 3 shows baseline and 6-month follow-up levels of our behavioral and BMI outcomes by intervention arm. Frequency of eating family dinners remained relatively unchanged in both the intervention and control families with no intervention effect. We observed an intervention effect for child sleep duration; at 6 months, child sleep duration increased by 0.56 hours/d in the intervention group and decreased by 0.19 hours/d in the control group, yielding a difference of 0.75 hours/d (95% CI, 0.06 to 1.44; P = .03). We observed larger decreases in weekend TV viewing among children in the intervention group compared with the control group (−1.06 hours/d; 95% CI, −1.97 to −0.15; P = .02). Weekday TV viewing also decreased more among children in the intervention, but this difference was not statistically significant. Families in both the intervention (20%) and control (12%) conditions reported removing the TV from the room where their child slept, with no significant intervention effect (P = .29).

At 6 months, child BMI had decreased by a mean of 0.18 in the intervention group and increased by 0.21 in the control group, yielding a difference of −0.39 (95% CI, −0.79 to 0.00; P = .05).

We aimed for participants to complete 4 home visits and 4 phone calls with a health educator by 6 months. Among the 62 families randomized to intervention, 48 (77%) completed all 4 home visits. Fewer families completed the phone calls; 23 (37%) completed all 4 phone calls. Among the 55 intervention families who completed the process survey at follow-up, 89% reported being “satisfied” or “very satisfied” with the program as a whole; 98% were “satisfied” or “very satisfied” with the counseling received during home visits; and 98% were “satisfied” or “very satisfied” with the counseling received during coaching calls. Nearly all parents (98%) reported they would recommend the program to friends and family.

Discussion

In this 6-month follow-up of a home-based randomized trial, we found that a multicomponent intervention that uses individually tailored counseling focused on improving household routines increased children’s sleep duration and reduced children’s TV viewing on weekends. We found that, compared with control subjects, children who participated in the intervention decreased their BMI.

To our knowledge, the Healthy Habits, Happy Homes study is the first home-based randomized trial to address key household routines related to obesity risk among young children. Recent reviews of obesity prevention interventions among young children have identified the paucity of home-based interventions and have called for interventions that are appropriately tailored for families.32,33 Our use of motivational interviewing by trained health educators allowed families to identify and work on the challenges and barriers of key relevance to them. We also designed our intervention based on findings from our formative research with racially/ethnically diverse, low-income parents of young children to ensure our intervention was contextually appropriate for these high-risk populations. Our use of mobile technology to encourage behavior change is also novel; to our knowledge, few studies have examined the use of mobile technology to encourage the adoption of healthful weight-related behaviors.34,35 Our results suggest such an approach is feasible among ethnically/racially diverse, low-income families. Future studies should be designed to specifically examine the effectiveness of text messages in supporting healthful weight-related behavior change among families with young children.
We found that our intervention had a significant effect on child sleep duration. Despite strong evidence that sleep duration and quality are associated with obesity risk in young children,25,27 few published intervention studies have focused on increasing preschool-aged children’s sleep.36,37 Our results suggest that a home-based intervention that uses motivational interviewing to elicit change in household routines can be used to increase child sleep duration. Empirical evidence of the inverse association between TV viewing and sleep38,39 suggests that household routines related to both sleep and TV viewing may be needed to achieve a change in child sleep duration.

In our intervention, the mean difference (intervention vs control) in TV viewing on weekend days was −1.06 hours at 6 months. This magnitude of effect is higher than 2 of the 3 intervention studies that have successfully decreased TV viewing/screen time among preschool-aged children40,41; the third intervention measured total screen time only, making a direct comparison of the effect for TV viewing difficult.42 We did find a smaller, nonsignificant difference (−0.31) in TV viewing on weekdays. It is possible that parents have more free time on the weekends and therefore are better able to implement limits on children’s TV viewing. Further investigation into how barriers to limiting TV viewing may differ on weekends and weekdays is warranted.

Our intervention did not have a significant intervention effect on the presence of a TV in the room where the child slept. There are 2 factors that could have contributed to these non-significant findings. First, it is possible that our intervention, which focused on household routines, was not intensive or specific enough to change this behavior. It is possible that a more intensive and targeted approach, such as financial incentives, may be needed to motivate families to give up a TV. Second, in our sample, most parents (80%) reported that their children sleep with them. It is possible that parents are not willing to remove the TV from their own room. Future research should...
explore strategies to motivate parents to remove the TV from a room where they sleep with their child. Our intervention had no effect on the frequency of family meals. The frequency of family meals was fairly high among our sample, approximately 6 times per week, which may have resulted in our participants having little “room to move” with regards to this behavior. The wording of our question, which defined family meals as “at least some of the family ate together” may have contributed to this ceiling effect. Because our intervention had an effect on child BMI despite not changing family meal frequency, our results suggest that changing the frequency of family meals may not be a necessary strategy for reducing obesity risk among low-income, racially/ethnically diverse families. Rollins et al explored the association between family meal frequency and obesity levels among a national sample of children aged 6 to 11 years and found that the influence of family meals on weight status may differ by race/ethnicity and income; they found no association between the frequency of family meals and obesity prevalence among Hispanic and black girls and found a positive association between the frequency of family meals and obesity rates among Hispanic boys from low-education households. Similar results have been found among adolescents. Further research on how the association between obesity risk and family meal frequency and quality may differ by race/ethnicity and/or income is needed.

At 6 months, the mean difference in BMI for the intervention vs control groups was −0.40. This magnitude of effect was similar to a recent community-based obesity prevention intervention for Latino American families with preschool-aged children (Salud Con La Familia) in which the adjusted mean difference was −0.59 (95% CI, −0.94 to −0.25) at 3 months. Like our intervention, the Salud Con La Familia intervention was culturally tailored and addressed family meals and TV viewing. It is unclear as to the intervention effect of Salud Con La Familia on these household routines as these data were not provided. Our findings suggest that a home-based intervention that uses motivational interviewing to elicit change in household routines, in particular around TV viewing and sleep duration, is effective in reducing child’s BMI.

When interpreting our results, several limitations should be considered. First, our intervention targeted low-income and racial/ethnic minority parents. Thus, our intervention may not generalize to more socioeconomically advantaged populations. Second, of the 500 families we contacted, only 121 (24%) enrolled in the study. Thus, it is unclear how these results would generalize to those who did not take up the intervention. Third, although, where possible, we used validated measures to assess our behavioral outcomes, we used parental report rather than objective measures. Thus, it is possible that parents could exaggerate improvements in behaviors. However, our effect on

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Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); TV, television.

a Odds ratio (95% CI).
b Adjusted for child age and sex.
BMI, an objective measure, and the fact that parents in the intervention arm did not report an increase in family meals, a key intervention target, argues against exaggerated reports of behavior change. Fourth, the follow-up period was only 6 months, therefore, it is unknown whether these changes in behavior and BMI were sustained.

In summary, after 6 months, we found that the Healthy Habits, Happy Homes intervention improved sleep duration and TV viewing behaviors, as well as decreased BMI among racially/ethnically diverse children from low-income households. Future studies with a longer follow-up are needed to determine maintenance of these behavior changes.

**REFERENCES**


