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An In-Home Intervention to Improve Nutrition, Physical Activity and Knowledge among Low-Income Teen Mothers and Their Children: Results from a Pilot Study

Ann M. Davis, PhD, MPH ABPP^{1,2}, Katherine Gallagher, PhD³, Melissa Taylor, MPH⁴, Kimberly Canter, MA^{2,5}, Meredith Dreyer Gillette, PhD^{2,6}, Karen Wambach, PhD⁷, and Evelyn Nelson, PhD⁸

¹Department of Pediatrics, University of Kansas Medical Center, Kansas City, Kansas

²Center for Children's Healthy Lifestyles & Nutrition, Kansas City, Missouri

³Department of Psychiatry, Boston Children's Hospital, Harvard Medical School, Boston, Massachusetts

⁴Department of Nutrition, Kansas State University, Manhattan, Kansas

⁵Clinical Child Psychology Program, University of Kansas, Lawrence, Kansas

⁶Department of Behavioral Sciences, Children's Mercy Hospitals and Clinics

⁷School of Nursing, University of Kansas Medical Center, Kansas City, Kansas

⁸Department of Telemedicine, University of Kansas Medical Center, Kansas City, Kansas

Although rates of teenage pregnancy have declined in recent years, teenage pregnancy rates in the United States remain higher than rates in other industrialized nations (1,2). Furthermore, teenage pregnancy continues to occur at disproportionately high rates within populations of ethnic minority youth. Recent reports indicate that the rate of teenage pregnancy (i.e., pregnancies occurring between ages 15 – 19) for African American adolescents nearly doubles that of Caucasian adolescents, and the rate of teenage pregnancy for Hispanic adolescents nearly triples that of Caucasian adolescents (3).

Among other risk factors and stressors that impact adolescent mothers, research indicates that adolescent mothers are more likely to gain an excessive amount of weight (i.e., over 40 pounds) during pregnancy when compared to pregnant women who are at least twenty years old (4). Furthermore, research indicates that teenage mothers may continue to gain weight after delivery regardless of any intention to lose weight (5,6). Although typically developing teenagers are expected to gain some amount of weight during adolescence, this post-partum weight gain puts adolescent mothers at high risk for becoming overweight or obese. In addition to the personal health risks associated with overweight and obese status, children of overweight and obese adolescent mothers may be at increased risk for pediatric overweight and obesity, as well as a myriad of other negative outcomes (6,7). Further, previous research with low-income, African American teenage mothers indicates that the patterns of food consumption are similar for mothers and their toddlers. If adolescent mothers are not consuming healthy food, their toddlers are not likely to be consuming healthy food (8), potentially putting them at additional risk for negative health consequences (e.g., pediatric obesity).

Despite the need for intervention work targeting the health behaviors of pregnant teenage mothers, research in this area is very limited. Literature does indicate that nutrition education programs can have an impact with regard to weight loss among low-income adult mothers. For example, Klohe-Lehman and colleagues (2006; 9) found that participation in a weight loss program with a focus on improving nutritional knowledge (e.g., information about recommended dietary guidelines) was associated with increased weight loss in a sample of ethnically diverse, low – income adult mothers. Research also suggests that weight loss interventions may help reduce perceived barriers to healthy eating for low-income adult mothers, therefore increasing the likelihood that positive dietary changes occur (10). Research indicates similarly positive effects for children whose mothers participate in weight loss programs with an educative component. Specifically, Klohe-Lehman and colleagues (2007; 11) found that overweight and obese mothers (aged 18 – 45) who made positive changes to their eating habits (e.g., ate more fruits and vegetables) made similar changes to their child’s diet post-intervention. Additionally, a brief intervention with low-income adolescent mothers was successful in delaying suboptimal feeding practices among adolescent mothers (12), suggesting that brief, in-home interventions may result in the development of positive and health-promoting parenting practices.

Due to the unique developmental status of teenage mothers, as well as their risk for adverse health outcomes following pregnancy, health interventions targeting this group are of utmost importance. The current pilot study seeks to contribute to the literature by examining the impact of a health intervention for low-income adolescent mothers by partnering with an existing community based program. Using a one-group pre-post design, the pilot seeks to evaluate the impact of a brief in-home intervention for teenage mothers targeting health knowledge and behavior.

METHODS

Participants

Eligible participants were teen mothers receiving services from a comprehensive child development and family support program affiliated with a large, Midwestern, academic health center. The community-based program which was funded by several large federal grants (including Head Start and Early Head Start) provided low-income families with in-home direct services and supplemental services through partnerships with other local service agencies. In-home staff invited all current and expecting teen mothers over a one year period to participate in the current intervention study. Given the fact that this pilot study was conducted in the “real world” in partnership with community organizations that provide direct service to low-income, at-risk populations, recruitment and participation were open to pregnant adolescents and mothers who had already delivered.

Study Procedures

All study procedures were approved by the institutional review board of the university through which the intervention was run. Consent from the legally emancipated teen mothers was obtained by trained staff in the home. Following consent, a baseline assessment was conducted to obtain height and weight of the teen mother and her child (if born). Pre-pregnancy weight was obtained via self-report for those who were expecting at the start of the study. The knowledge assessment and the health behavior survey were also obtained at this initial visit. Over the next two to three months, participants received six in-home intervention sessions focused on physical activity and nutrition. Specifically, three intervention sessions focused on the mother and three focused on the child. Interventions such as these, which target diet and physical activity following childbirth, have proven to be successful in terms of helping postpartum women lose weight (13). Each session was

delivered by in-home staff who worked for the community agency; these staff had a bachelor's degree in a field related to child development, but had no specific obesity or nutrition training. Each in-home staff was provided with a six session manual and given a two-hour training by the research team on the delivery of the sessions prior to the start of the intervention. Topics covered during the sessions included health information related to food (e.g., reading nutrition labels, preparing healthy and inexpensive meals) and exercise (e.g., engaging in family-oriented exercise activities, exercising around the house), as well as behavioral topics (e.g., goal setting, tracking, social support; see Table 1 for a list of topics by session). Fidelity to the manual was measured by topic checklists completed by trainers after each in-home session which were reviewed by the trainer on a regular basis. Sixty adolescent mothers were initially considered for inclusion in the current study. Of these 60 mothers, three candidates were excluded for failure to report pre-pregnancy weight, and nine were excluded for failure to complete pre-intervention or post-intervention health outcome measures.

Measures

Health Knowledge—Knowledge was assessed using questionnaires covering the central topics of the teaching sessions. One 10-item questionnaire was developed to cover the three teaching sessions focused on maternal health, and one 10-item questionnaire was developed to cover the three teaching sessions focused on child health. Mothers completed questionnaires pre-intervention and post-intervention. See Table 2 for sample questions from the Health Knowledge Questionnaire.

Health Behaviors—Maternal health behaviors were assessed using a modified version of the California Health Interview Survey (CHIS) 2005 Adolescent Questionnaire, version 5.2 (14). The CHIS is a widely used assessment of health knowledge and behaviors. Twelve items were selected from the CHIS 2005 that focused on the consumption of fruits, vegetable, fried foods, pop, sugary foods, eating breakfast and eating as a family. Child health behaviors were assessed using 12 items adapted from the same measure. See Table 4 for the Health Behavior Questionnaire.

Height and weight—Height was measured using a Seca 214 Portable Stadiometer/Height Rod (Seca, Hanover, MD). Length was taken in a recumbent position for children less than 2 years old and in a standing position for those over 2 years old. Weight was taken on a Befour, Inc. Model ps 6600 digital electronic scale (Befour, Inc. Saukville, WI) at pre- and post-intervention. Scales were calibrated as necessary throughout the one year study. The primary health indicator used for the current study was percent overweight (15) specific to each participant. Due to the variety of participant delivery dates, gestational progress, and age, specific calculations were required to determine percent overweight for adolescent mothers.

For mothers who had delivered prior to the start of the intervention, BMI was computed at pre- and post-assessment using measured height and weight (16). Baseline pre-pregnancy BMI for expecting teen mothers was self-reported at the start of the study. For mothers who delivered over the course of the intervention or were pregnant during the entire intervention period, a more detailed calculation was necessary to take expected maternal weight gain/loss into account before determining percent overweight. First, average gestational weight gain specific to each woman's BMI (17) was added to self-reported pre-pregnancy weight. Next, weekly expected weight gain (specific to BMI and trimester) was deducted from this number. Percent overweight was then calculated by the following formula: $100 \times (\text{actual weight} - \text{fiftieth percentile weight}) / \text{fiftieth percentile weight}$ (15,16). For women who delivered within 6 months prior to the start of the program, it was also necessary to adjust

for expected weight loss. To do this, expected weight retention/loss was calculated based upon a previous study¹ and adjusted based upon time since delivery. For example, if a pregnant mother reported a pre-pregnancy weight of 170 pounds, and her baseline gestation was 22 weeks, the expected weight gain for a woman at 22 weeks gestation who was obese at the start of the study is 15.5 pounds. Therefore, in this example the mother was 12.41% overweight at baseline.

Weight for length or BMI was calculated for each child, depending upon their age. Each measure took into account the child's measured height and weight, as well as their age and gender (15). These calculations were made at pre- and post-intervention.

Data Analysis

All analyses were performed using SPSS for Windows (Version 18.0; SPSS, Chicago, IL). A significance level of $p < .05$ was used unless otherwise indicated. Data presented include descriptive statistics for the sample (e.g., participant ethnicity) and health outcome variables (e.g., health knowledge and behavior, BMI). Paired t-tests for normally-distributed data were used to compare all pre-intervention and post-intervention data.

RESULTS

Participants Characteristics

Forty-six subjects participated in the current study. Teen mother participants ranged in age from 14 to 20 years ($M = 16.97$, $SD = 1.14$). Their children ranged in age from 0 to 53 months ($M = 15.69$, $SD = 13.38$). The majority of teen mother study participants were African American ($N = 33$; 73.3%), followed by Caucasian ($N = 7$; 15.6%), Native American ($N = 3$; 6.7%), or other ($N = 2$; 4%), with one teen mother subject not reporting race. Regarding ethnicity, 13% reported Hispanic/Spanish/or Latino background. Prior to participating in the intervention, 8.7% of mothers had completed 8th grade, 23.9% had completed 9th grade, 13.0% had completed 10th grade, 30.4% had completed 11th grade, and 23.9% had completed 12th grade. Of the participants, 93.3% were unmarried. Approximately 84% of the teen mothers were on free/reduced school lunches. When asked the annual income of the "head of the household", almost two-thirds of teen mothers reported earning less than \$20,000 annually, with a mean yearly income of \$26,505. As for the children, they were 60.78% male. Every teen mother subject received 100% of the intervention sessions.

Health Outcomes

Health Knowledge—Teenage mothers demonstrated significant increases in knowledge about healthy nutrition and physical activity practices for themselves and their children. At pre-intervention, mothers had an average percent correct of 40.67 ($SD = 13.4$) on a questionnaire measuring health knowledge related to themselves. This average knowledge score increased to 67.55 ($SD = 18.36$) at post-test, indicating a statistically significant improvement ($t = -8.98$, $p < .01$). At pre-intervention, mothers had an average percent correct of 39.11 ($SD = 16.35$) on the questionnaire measuring health knowledge specific to their children. At post-intervention, this average score increased to 80.00 ($SD = 13.81$), representing a statistically significant improvement ($t = -13.97$, $p < .01$). Refer to Table 4 for complete information regarding health outcomes.

Health Behaviors—Over the course of the intervention, mothers reported a statistically significant increase in the amount of exercise that they had engaged in over the past seven days (pre-intervention $M = 2.2$ days, $SD = 3.93$; post-intervention $M = 4.06$ days, $SD = 3.21$, $t = -2.40$, $p = .02$). Mothers also reported a statistically significant increase in their own amount of screen time following the intervention (pre-intervention $M = 3.04$ hours per day,

$SD = 3.22$; post-intervention $M = 6.54$ hours, $SD = 5.04$, $t = 2.7$, $p = .011$), which is in the opposite direction of what was expected.

With regard to their children, mothers reported a statistically significant increase in physical activity engaged in over the past seven days (pre-intervention $M = 1.33$ days, $SD = 6.17$; post-intervention $M = 4.32$ days, $SD = 5.54$, $t = -2.46$, $p = .018$) and physical activity engaged in during a typical week (pre-intervention $M = 1.47$ days, $SD = 6.47$; post-intervention $M = 4.10$ days, $SD = 5.68$, $t = -2.9$, $p = .006$). Mothers also reported a trend with regard to their child's consumption of fruit and vegetables from pre-intervention ($M = 2.64$ servings, $SD = 2.37$) to post-intervention ($M = 3.45$ servings, $SD = 2.11$; $t = -1.78$, $p = .09$). Refer to Table 4 for complete information regarding health outcomes.

Body Mass Index—Throughout the intervention the maternal BMI changed from 27.36 ($SD = 6.6$) to 26.98 ($SD = 6.3$; $t = 0.831$, $p = .41$). However, given that mothers were at differing pre-/post-gestational time points, a percent overweight was calculated for each woman taking these factors into account (see methods section). On average, adolescent mothers were 25.4% overweight at pre-assessment and 21.44 % overweight at post-assessment measurements, showing a trend for significant weight loss ($t = -1.78$, $p = .08$).

Regarding changes in child body mass, thirty four children had the necessary measures to calculate either weight for length or BMI percentile. Of these, the mean percentile was 64.82 ($SD = 28.98$) at pre, and 61.19 ($SD = 29.68$) at post. This change was not statistically significant ($t = 1.005$, $p = .322$). For the children who were above a healthy weight at the start of the intervention (with a percentile at or above the 85th, $n = 11$), there was a decrease in mean body mass percentile, from 95.91 ($SD = 3.59$) to 86.95 ($SD = 19.77$) which was not statistically significant ($t = 1.746$, $p = .111$).

DISCUSSION

The current pilot study contributes to the limited body of research regarding health interventions for teenage mothers by providing support for a brief, in-home, education-focused intervention. Minority, low-income teen mothers are at increased risk for adverse health outcomes such as gaining excessive amounts of weight (4). Despite this fact, relatively little intervention outcome data exists specific to this population. Findings from this pilot study suggest low-cost, in-home education-based interventions may be effective for improving nutrition and physical activity knowledge and behaviors among minority, low-income mothers and their children.

Adolescent mothers experienced several changes over the course of the current intervention. Mothers reported an improvement in health knowledge about themselves and their children from pre-intervention to post-intervention. This is particularly encouraging in light of evidence indicating that knowledge-based interventions are associated with weight loss (13), especially since teenage mothers have a difficult time losing weight after pregnancy (5,6). Improved nutritional knowledge may be important in this regard. Interestingly, mothers in the current study reported an increased amount of screen time following the intervention. There are many potential environmental reasons for the increase, such as seasonal changes or the fact that caring for an infant may encourage more sedentary behavior. Additionally, having an infant may make it difficult for teenage mothers to engage in developmentally typical leisure activities (e.g., socializing with friends, participating in after-school activities). Regardless, future research will want to further explore screen time habits of teenage mothers. Future intervention work may benefit from including targeted information regarding activities for new adolescent mothers to do with their infants.

Adolescent mothers also reported a post-intervention increase in their child's physical activity. While this may be due to developmental maturation (e.g., learning how to crawl or walk), this may also suggest that mothers applied knowledge gained throughout the course of the intervention. Furthermore, mothers reported a trend with regard to increased fruit and vegetable intake. Again, this could be related to typical developmental feeding practices, such as adding fruits and vegetables to the child's diet at a certain age. Future research will want to specifically test this relationship in a more controlled fashion, in order to better determine whether participation in an educative intervention causes behavioral change.

Although the current pilot study contributes important information to the sparse existent literature regarding health behavior among pregnant teenagers, several limitations exist. One limitation was lack of a control group and randomization. For example, the addition of a control group would allow researchers to determine whether outcomes such as screen time increased less for the intervention group than for teenage mothers who did not participate in the intervention. However, the intervention was incorporated into an existing program for teenage mothers and did not require additional or different staff to deliver the intervention. This is important from the perspective of translational research and quickly moving research into practice. Our sample size was relatively small, and relied heavily on self-report information. Future researchers should consider using alternative outcome measurements, such as 24-hour diet recalls to monitor food consumption or actigraphs to measure activity, in order to minimize social desirability bias. For example, Behrens et al. (2012;18) recently reported a pilot utilizing pedometers to measure activity with postpartum mothers. Furthermore, our study was not restricted to women who were at a certain point in their pregnancy, therefore requiring complex calculations to account for BMI and percent weight loss. While this design allowed our intervention to have maximum impact on an at-risk population, future research might consider restricting participation in order to better assess weight loss variables. Studies with larger samples may further inform whether maternal age (e.g., early adolescence versus later adolescence) or other factors influence intervention effect for subgroups of teenage mothers and their children. Future research will want to evaluate the feasibility and effectiveness of home-based interventions in larger populations and different geographic locations, as well as with different subgroups of teenage mothers (e.g., there may be important developmental differences between a 14-year-old, a 17-year-old, and a 20-year-old new mother).

Future research may also consider the potential role of technology in intervention delivery with this population. For example, real-time videoconferencing has been utilized to deliver similar knowledge-focused interventions with teen mothers at schools (19) and text messaging and other technologies offer unique advantages with teens (20) and show promise across health interventions (21,22). In addition, future research might also include extended family members and potential other caregivers who may be living with the teenage mother and providing meals. Previous research indicates that adolescent mothers who are responsible for purchasing groceries have higher levels of fruit and vegetable consumption than adolescents who are not responsible for household food selection; similarly, adolescent mothers responsible for food selection have reported greater diet variety for their toddlers (8). Thus, it may be important to include the primary grocery shopper in future interventions with the population. Additionally, future intervention work might specifically target grocery shopping and food selection.

The current pilot study describes an innovative educative intervention for pregnant adolescent women and new mothers. The pilot study supports the feasibility of successfully implementing an in-home intervention for low-income, at-risk teenage mothers, and provides preliminary support for successful post-intervention outcomes.

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Table 1

Topics covered at each intervention session.

		Session Number		
Focus of session	1	2	3	
Mother	What is BMI? Let's Plot Yours Goal Setting Fruits & Vegetables Importance of Breakfast Decreasing Sedentary Behavior Tracking & Goal Setting	Goal Review Avoiding High Calorie Beverages Portion Size Incidental & Planned Exercise Goal Setting	Eating Away from Home Exercising as a Social Activity Goal Setting	
Child	What is BMI Percentile? Let's plot your child's Increasing Fruit & Vegetable Intake Cleaning Out the Cabinets Decreasing Sedentary Behavior Tracking & Goal Setting	Decreasing Snacking Eating as a Family Physical Activity as a Family	Healthy Beverages Eating Away from Home Physical Activity Around the House Goal Setting	

Table 2

Sample questions from the mother and from the child Health Knowledge Questionnaire.

Target	Question
Mother	<p>To plot your BMI, you need to know 4 things. These are:</p> <p>A. Age, Gender, Weight, Diet</p> <p>B. Height, Weight, Gender, Age</p> <p>C. Age, Height, Exercise, Gender</p>
	<p>How many servings of fruits and vegetables are you supposed to eat each day?</p> <p>A. One</p> <p>B. Two</p> <p>C. Three</p> <p>D. Four</p> <p>E. Five</p>
	<p>According to doctor, you are not supposed to spend more than ___ hours watching TV or doing other sedentary activity.</p> <p>A. One</p> <p>B. Two</p> <p>C. Three</p> <p>D. Four</p> <p>E. Five</p>
	<p>One bottle of pop is always one serving, and one bag of chips is always one serving.</p> <p>A. True</p> <p>B. False</p>
	<p>According to doctor, you are supposed to get ___ minutes of exercise every day.</p> <p>A. Thirty</p> <p>B. Forty five</p> <p>C. Sixty</p>
Child	<p>It is important for children to eat lots of fresh fruits and vegetables. When we talk about fresh fruits and vegetables, most of them should be the actual fruit and vegetable and not just juice. How much juice should children drink per day?</p> <p>A. 0-6 oz</p> <p>B. 7-12 oz</p> <p>C. 13-18 oz</p> <p>D. 19-24 oz</p>
	<p>What are the two appropriate drinks for a child under the age of 2? Choose two:</p> <p>A. Juice</p> <p>B. Water</p> <p>C. breastmilk/formula/milk</p> <p>D. pop</p>
	<p>Children under the age of two should watch ___ hours of TV per day, and children between the ages of two and five should watch no more than __ hours of TV per day.</p>

Target	Question
	A. 1, 3
	B. 1, 4
	C. 0, 2
	D. 0, 4

Table 3

Sample Health Behavior Questions from the CHIS survey.

1.	Yesterday, how many servings of fruit (such as an apple or a banana) did you eat? Do not count fruit juices.
2.	Yesterday, how many servings of vegetables, like corn, green beans, green salad, or other vegetables did you eat?
3.	Yesterday, how many servings of French fries, home fries, or hash browns did you eat? Do not include potato chips.
4.	Yesterday, how many serving of other white potatoes did you eat? Do not include yams or sweet potatoes. Include red, yellow, purple or brown-skinned potatoes.
5.	Yesterday, how many glasses or cans of soda, such as Coke, or other sweetened drinks, such as fruit punch or Sunny Delight did you drink? Do not count diet drinks.
6.	Yesterday, how many glasses of 100% fruit juice such as orange or apple juice did you drink?
7.	Yesterday, how many servings of high sugar foods, such as cookies, candy, doughnuts, pastries, cake or popsicles did you have?
8.	In the past 7 days, on how many days did you eat breakfast?
9.	Yesterday, how many times did you eat fast food? Include fast food meals eaten at school, at home or at fast-food restaurants, carryout or drive thru.
10.	In the past 7 days, on how many days did you eat lunch?
11.	In the past 7 days, on how many days did you eat dinner at home with at least one of your parents {guardians}?
12.	Not including school PE in the past 7 days, on how many days were you physically active for at least 60 minutes total per day?
13.	Over a typical week, on how many days are you physically active for at least 60 minutes total per day?

Table 4

Health Knowledge, Behaviors, and BMI of Teen Mothers and their Children

	Outcome	Pre-intervention	Post-intervention	P-value
Mothers	Health knowledge ¹	40.67 (±13.4)	67.55(±18.36)	.00 ****
	Fruit/vegetable intake ²	2.21 (±1.62)	2.7(±2.17)	.15
	Physical activity, past seven days ³	2.2 (±3.93)	4.06(±3.21)	.02
	Physical activity, typical week ³	2.2 (±3.93)	4.08(±3.19)	.12
	Screen time ⁴	3.04 (± 3.22)	6.54(±5.04)	.01
	BMI, not pregnant ⁵	28.4 (±6.98)	27.7 (±6.97)	.24
	BMI, expecting mothers (pre-pregnancy) ⁶	22.65(±4.04)	-----	-----
	Percent Overweight ⁷	25.4 (±32.95)	21.44 (± 33.46)	.082
Children	Health knowledge ¹	39.11(±16.35)	80.00(±13.81)	.00 ****
	Fruit/vegetable intake ²	2.64(±2.37)	3.45(±2.11)	.09
	Physical activity, past seven days ³	1.33(±6.17)	4.32(±5.54)	.02 *
	Physical activity, typical week ³	1.47(±6.47)	4.10(±5.68)	.01 *
	Screen time ⁴	2.82(±4.99)	1.76(±2.87)	.10
	Body Mass percentile	64.82 (±28.98)	61.19 (±29.68)	.322

¹ Mean percent correct answers by mothers,

² Mean number of fruits and vegetables consumed during previous day,

³ Mean number of days on which participants exercised for at least 60 minutes,

⁴ Mean number of daily hours spent (Monday through Sunday) watching television or engaging in recreational computer use,

⁵ Mean BMI score of non-pregnant teen mothers,

⁶ Mean BMI/Weight for Length percentiles of children,

⁷ Percent overweight of each mother based upon her expected gestational weight gain/loss

* Significant at p<0.05,

** Significant at p<0.01,

*** Significant at p<0.001,

**** Significant at p<0.0001.