A PARENT-FOCUSED INTERVENTION TO INCREASE PARENT HEALTH LITERACY AND HEALTHY LIFESTYLE CHOICES FOR YOUNG CHILDREN AND FAMILIES

A Dissertation

by

Sasha A. Fleary

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2012

Major Subject: Psychology

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Approved by:

Co-Chairs of Committee,	Robert W. Heffer
	E. Lisako J. McKyer
Committee Members,	William Rae
	Aaron Taylor
Head of Department,	Ludy Benjamin

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ABSTRACT

A Parent-Focused Intervention to Increase Parent Health Literacy and Healthy Lifestyle Choices for Young Children and Families. (May 2012)

Sasha A. Fleary, B.A., The City University of New York – City College of New York;
M.S., Texas A&M University

Co-Chairs of Advisory Committee: Dr. Robert W. Heffer;
Dr. E. Lisako J. McKyer

Health literacy affects caregivers' ability to engage in preventive health care behaviors for themselves and their children. Studies suggest that health literacy among low income families needs improvement, and this possibly contributes to disparities in preventive health care rates. Additionally, parents and caregivers may not be able to provide or seek preventive health care for their children because of lack of knowledge and skills to do so effectively.

This study designed and piloted an intervention that delivered to parents of young children, 1) health literacy information in an experiential manner, and 2) practical skills to engage their families in healthy lifestyle choices, with the decisions for healthy lifestyle choices being based on the health knowledge provided in the intervention. Specifically, the intervention focused on diet/nutrition, physical activity, sleep hygiene, parenting skills, and mental wellness.

The intervention was successful at improving diet/nutrition knowledge at least one month post-intervention and more immediate changes were found for participants'

overall beliefs about diet/nutrition, children's vegetable consumption, and parents' fruits and vegetable consumption. Immediate improvements were also found for factual knowledge about physical activity, sleep, and the relationship between mental health and stress. Additionally, the intervention was successful at improving general knowledge and beliefs about sleep, knowledge about the relationship between sleep and health, and knowledge about common childhood sleep problems at least one month post-intervention. The intervention also reduced participants' bedtime interactions with children that are indicative of sleep problems at least one month post-intervention. Future research should conceptualize the intervention as a multiple health behavior intervention and reflect this in the evaluation.

DEDICATION

To my father, Edward

Your support and confidence in me gave me the strength to keep striving for greatness even when I doubted myself. I wish you could be here in flesh to see me walk across the stage on graduation day but I know you will be there in spirit because you are my guardian angel. Thank you for celebrating every small and large accomplishment I had through this process although at times you did not understand what you were celebrating. I will always cherish those moments and I am so grateful that we had them.

To my mother, Vallarie

Your hard work was not in vain. As a child, you celebrated my moments of triumph and wiped my tears when I was defeated. You gave up a lot to make sure that we had what we needed. My passion for working with families who are struggling is fueled by knowing that no matter the struggle, once you have the support of others, you can be successful. Thank you for teaching me to be resilient and helping me figure out that that is what I wanted to do for children.

To my siblings, Pieter, Afiba, Jenelle, Kerron, Kereem, Rochelle, and Anaya

Thank you for supporting me through these years. You have all been there to share in my successes and provided support when I needed it. You are always a source of laughter and entertainment for me and I cherish the moments we share.

To my niece and nephews, Kadisha, Kerwyn, Jasani, Khaleel, and Zaheim

You are markers of what happy children should be. I am thankful that you are healthy and have parents, aunts, uncles, and grandparents who love you and will do anything to ensure your happiness. Seeing you run around and laughing freely gives me hope for our next generation and encourages me to keep working to help other children have moments like those.

To my family

I dedicate this dissertation and this degree to you. I love you and can't thank you enough for your support and love through this process.

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I would like to thank my committee co-chairs, Dr. Heffer and Dr. McKyer, and my committee members, Dr. Taylor and Dr. Rae, for their guidance and support throughout the course of this project and all other projects they have worked on with me throughout my graduate school career.

Thank you to the College Station Head Start and Early Head Start administrators and the Aggieland Pregnancy Outreach Board of Directors for entrusting me with the families they serve and trusting that I had their best interest at heart. I hope I was able to help and teach the families as much as they have helped me and I have learned from them. I also want to extend my gratitude to the families who participated in this project for welcoming me and making me feel like I was a part of the community. I am ever grateful for their openness and receptiveness to sharing their struggles and successes with myself and each other and working together to help each other.

Additionally, I would like to thank my research assistants for their dedication to the project and hard work. Thanks to all my friends who helped with the project even when they were swamped with their own projects, your friendship is greatly appreciated (Nichelle, Reynolette, Jamyia, Vanessa, Keisha, Dwayne, Ana, Janet, and Rudo).

Thanks to my colleagues and the department faculty and staff for making my time at Texas A&M University a rewarding and fun experience. Finally, this project would not have happened without the funding I received from the College of Liberal Arts and The Institute for Obesity Research and Program Development. I would like to thank these funders for their generosity and for believing in my project.

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INTRODUCTION

According to the National Assessment of Adult Literacy (NAAL; National Center for Education Statistics, 2006) almost 45% of adults in the U.S. have basic or below basic literacy skills and over one third of adults have inadequate health literacy skills (Kutner, Greenberg, & Paulsen, 2006). The United States Department of Health and Human Services (USDHHS; 2000) described health literacy as *the extent to which individuals are able to acquire, process, and comprehend simple health information and use that information to make good health decisions*. Health literacy is influenced by both individual (e.g., literacy, culture, communication skills) and environmental factors (e.g., professionals' communication skills, demands of health care systems), which impact an individual's ability to navigate through the health care system and to engage in self care and disease management (USDHHS, 2000). In the case of parents of young children, low health literacy may compromise their ability to seek or engage in preventive care for their children.

Studies have shown that high health literacy among adults has been associated with adherence to preventive care, increased medical adherence, increased knowledge of health options and reduced rates of hospitalizations (Baker et al., 2002; Kalichman et al., 2009; Miller, Brownlee, McCoy, & Pignone, 2007; Scott, Gazmararian, Williams, &

This dissertation follows the style of the Journal of Pediatric Psychology.

Baker, 2002). Low health literacy among adults has been associated with reduced interest in decision-making regarding their health care, less satisfaction with disease status, increased use of treatment services, higher use of emergency services, and embarrassment due to low health literacy (Baker et al., 2002; Baker et al., 1996; Mancuso & Rincon, 2006). Although a plethora of research exists on the effects of health literacy on adult health, relatively less research has been conducted to address the impact of parental health literacy on the health and well-being of children. Children, especially preschool-aged children, are vulnerable to their environment and rely heavily on their parents to ensure their health and well-being. Based on the adult studies, therefore, parents' health literacy is postulated to influence the preventive health measures parents pursue for their children.

According to the Institute of Medicine (IOM; 2004), older adults, racial and ethnic minorities, individuals with less than a 12th grade education, GED certificate recipients, non-native English speakers, and individuals with low incomes are all more likely to have low health literacy. Head Start was established to serve low income families, and of the families they serve during the 2003–2005 period, approximately 47% were ethnic minorities (excluding "Unspecified"), 32% of parents had less than 12th grade education, and for 29% of families English was not the primary language spoken in the home (Administration for Children and Families, 2005). The demographic characteristics of teenage mothers are likely to include them being ethnic minorities, high school dropouts, and low income status (Singh, Darroch, & Frost, 2001; Ventura, Mathews, Hamilton, Sutton, & Abma, 2011). Given the demographic characteristics of

Head Start and teenage parents, there is reason to believe that health literacy among these populations needs improvement and that children in these families will benefit from a parent-focused intervention targeting health literacy.

This intervention addressed parents' health literacy through health knowledge dissemination and by improving parents' ability to engage in preventive care and health management for their children. Specifically, I developed a 2-tiered experiential intervention. Firstly, I hoped to deliver clearly described health knowledge so that literacy, years of education, and income would not be barriers to understanding the information. This would be accomplished by teaching health information and practical skills in a group setting. For example, I would help parents learn to choose nutritious foods by showing foods with labels so that they will know what to look for when they go food shopping. The second tier of this intervention was developed to give parents practical skills to implement healthy lifestyle choices in their households. To make this part of the intervention experiential, parents would have opportunities to role play and practice coping with challenges in a group setting, for example, effective ways to implement healthy sleep habits for their children. Based on meetings, focus groups, and needs assessments with local Head Start administrators and facilitators (College Station, Texas) and Head Start parents, I have targeted the following preventive care behavior modules: diet/nutrition, physical activity, sleep hygiene, mental wellness (e.g., issues of parenting style, parent and child stress reduction, and mental illness), and parenting skills (developing prosocial child behavior patterns infused through-out the other four modules).

Childhood Obesity

A child is identified as overweight if their body mass index is above the 85th percentile and below the 95th percentile, if a child's body mass index is at or above the 95th percentile, they are identified as obese (Barlow & The Expert Committee, 2007). As of 2004, approximately 17% of children and adolescents in the U.S. are reported to be overweight, and this percentage represents a significant increase over a 6-year period (Ogden et al., 2006). Among children 2 to 5 years old who participated in the National Health and Nutrition Examination Survey (NHANES) in 2003-2004, the prevalence of obesity was 13.9%, with 26.2% being at risk for becoming overweight. Additionally, the prevalence of obesity was highest for Mexican-American children (19.2%), followed by African-American children (13%) and lowest for Caucasian children (11.5%). Head Start programs reported treating approximately 25% of enrolled children for obesity, out of those needing medical treatment during the 2003 – 2005 period (Administration for Children and Families, 2005).

Overweight and obesity places children at increased risk for many diseases including type-2 diabetes, heart failure, hypertension, hyperlipdemia, and cardiovascular disease (Freedman, Dietz, Srinivasan, & Berenson, 1990; Hudson, Cherry, Ratcliffe, & McClellan, 2008). It also impacts overall quality of life, with obese children and adolescents reporting similar health related quality of life (HRQoL) as children and adolescents with cancer (Schwimmer, Burwinkle, & Varni, 2003). Further, children who are obese tend to be absent from school more often, and have more missed academic opportunities (Hudson et al., 2008).

Parents' Perceptions. Although some genetic variables may account for obesity in children, obesity is seen as one of the most preventable diseases. Health literacy and preventive care are fundamental in preventing obesity. Insufficient health literacy poses many barriers to preventing obesity among preschool children. For example, Hudson et al. (2008) conducted a study among Head Start parents and children and found that almost all the children ate less than the recommended serving of fruits and vegetables per day and that higher snack consumption was related to less active play per week. They also found that parents perceived their children to be at a healthier weight than was factual. Although a third of children were obese or at risk for obesity, only 13.5% of parents reported that their children met these criterion. Similarly, Baughcum, Chamberlin, Deeks, Powers, and Whittaker (2000) found that obese mothers were able to identify themselves as being overweight, however, 79% of mothers were not able to identify their overweight children as being overweight, and this was most pronounced in mothers with less education. Parents' lack of perception of their children's weight can be seen as a barrier to them making lifestyle changes to improve their children's health, and may be due to low health literacy. Educating parents on how to distinguish healthy from unhealthy weight is one strategy that can be used to improve health literacy and inform parents' decision to engage in healthier lifestyle choices.

Diet and Nutrition. Another targetable variable in improving parents' health literacy and promoting preventive behavior is parental knowledge of diet and nutrition. Variyam (2001) reiterated that parental nutrition knowledge is essential in obesity prevention, since parents need that knowledge to identify calorie-dense foods, monitor

their children's eating habits, and provide a balanced diet to their children. Dennison, Erb, and Jenkins (2001) presented a good example of the impact of lack of parental knowledge on children's diet when they found that parents who believed whole milk had more nutritious value and was healthier for their children than reduced fat milk were more likely to serve their children whole milk. Additionally, Variyam (2001) found that higher parental knowledge of diet and nutrition and use of nutritional labeling was significantly related to lower prevalence of overweight children. Neuhouser, Kristal, and Patterson (1999) conducted a study on use of nutrition labels and fat intake and found that adults with an education level beyond high school were significantly more likely to read nutrition labels while there was no significant relationship between label use and income. They also found that the strongest predictor of label use was an individual's understanding of the need for a low-fat diet, such that these individuals were 10 times more likely to use the labels than those who did not think it was important to have a low fat diet. Birkett, Johnson, Thompson, and Oberg (2004) found barriers to healthy diet/nutrition behaviors for women in the Supplemental Nutrition Program for Women, Infants and Children (WIC) included lack of knowledge, training, and experience in preparing, buying, and introducing healthier foods to children. Birkett et al. (2004) also found that mothers attributed lack of knowledge about diet/nutrition to inadequate support from family members and spouses.

Based on these findings, I believe that targeting parents' knowledge of diet/nutrition and the importance of diet/nutrition as a health literacy focus in the intervention is essential. The intervention addressed this by providing to *and practicing*

with parents the skills necessary to accurately identify healthy foods based on nutritional labels and healthy menus based on standard dietary recommendations.

In targeting diet and nutrition for intervention, it is also imperative that I address parents' *attitudes* toward diet and nutrition and toward their children's eating habits, in addition to parents' eating habits. Variyam (2001) found that parents' attitudes were predictive of childhood overweight, such that, among parents who agreed that some people were born to be overweight and there was nothing that could be done to change that, 33% of their children were overweight; Oof those who disagreed, only 22% of their children were overweight. Similarly there was a large difference in the percentage of overweight children in parents who agreed (31.1%) and disagreed (17.5%) with the idea that there were too many conflicting recommendations on dietary advice. Parents' attitudes and behaviors toward specific foods also affect the type of foods their children consume, that is, children tend to eat the foods they are served most often and that are readily available in the home (Patrick & Niklas, 2005). Therefore, if parents have a negative or neutral attitude toward low-fat diet, then the foods available in the home will tend to not be of that category and children will build preferences for more high-fat foods.

Patrick and Niklas (2005) stressed the importance of modeling in determining children's eating patterns and diet quality. They argued that parents who modeled healthful eating habits were more likely to have children with similar eating habits. Cooke et al. (2003) found parents' consumption and early introduction of children to fruits and vegetables to be a significant predictor of preschool-aged children's fruits and

vegetables consumption. They suggested that interventions geared at increasing fruits and vegetables consumption in young children should target *parents'* behavior. Jahnke and Warschburger (2008) conducted a study examining the effects of types of eating behaviors on obesity in mother - child dyads. They found that preschool overweight children had significantly higher food responsiveness, external eating behavior, and speed of eating behavior than their healthy weight counterparts. Additionally, maternal "emotional eating" predicted their sons' emotional eating and mediated the relationship between their sons' body mass index (BMI) and emotional eating. Helping parents recognize and target the motives behind their own and their children's eating behaviors was an area of intervention in this study in the physical activity, diet/nutrition and mental health component.

Physical Activity. In addition to diet/nutrition, physical activity has also been identified as a behavior that could be modified and regulated in the prevention of obesity and the promotion of cardiovascular health among children (Donnelly, 1996; French, Story, & Jeffery, 2001; Saris et al., 2003). Studies have shown that higher levels of physical activity in childhood resulted in lower body fat in adolescence (Moore et al., 2003). Pate, Pfeiffer, Trost, Ziegler, and Dowda (2004) studied physical activity levels of children from different preschools and concluded that physical activity varied across schools. Further, Trost, Sirard, Dowda, Pfeiffer, and Pate (2003b) found that overweight boys were significantly less active than their healthy weight peers during the preschool day, putting them at increased risk for further weight gain. Parental understanding of this is important, since some parents and even researchers, as argued in Brown et al. (2009),

are of the impression that preschool children are very active in their preschools, hence there may be less emphasis on the importance of physical activity in the home.

Similar to diet/nutrition, children's level of physical activity is highly correlated with their parents' level of physical activity. Fogelholm, Nuutinen, Pasanen, Myohanen, and Sateela (1999) found parents' inactivity to be a strong positive predictor of children's inactivity; however parent activity was a weaker predictor of children's total activity and vigorous activity. Dennison, Erb, & Jenkins (2002) and Lumeng, Rahnama, Appugliese, Kaciroti, & Bradley (2006) both found that television-watching put preschool children at increased risk for obesity. Further, studies have shown that children who spend a lot of time viewing television, make more requests for parents to purchase foods, and have increased dietary intake, in addition to a decreased opportunity for physical activity (Baranowski, Thompson, DuRant, Baranowski, & Puhl, 1993; Taras, Sallis, Patterson, Nader, & Nelson, 1989). Lindsay, Sussner, Greaney, & Peterson (2009), among other studies, have shown that parents of low income families identify finances as a barrier to physical activity in the home.

Given the findings described above, I propose to address the need for parents to reduce their own and their children's sedentary activity and create home environments that promote physical activities and deter sedentary activities. Additionally, to address income-related barriers, I propose to use the guidelines put forward by Gunner, Atkinson, Nichols, & Eissa (2005) since these are inexpensive lifestyle strategies that promote both physical activity and child development. I propose to refine my interventions to address income and education barriers by imparting information on

physical activity and diet/nutrition in a hands-on manner, such that years of education completed and income will be *minor* barriers to promoting healthy diet/nutrition and increased physical activity in their children.

Parenting Style. Studies have shown that parenting styles regarding physical activity and diet/nutrition affects children's physical activity and healthful eating habits. Positive reinforcement, monitoring, and authoritative parenting were associated with healthful eating habits and increased physical activity, while controlling, permissive and authoritarian parenting styles were associated with reduced physical activity, increased unhealthy eating, increased BMI scores, and weight status (Arredondo et al., 2006; Patrick & Niklas, 2005; Powers,Chamberlin, van Schaick, Sherman, & Whittaker, 2006; Rhee, Lumeng, Appugliese, Kaciroti, & Bradley, 2006). This was one of the contributing reasons for having a module dedicated to teaching parents skills to promote prosocial child behavior patterns.

Sleep Hygiene

As mentioned previously, the purpose of Head Start is to augment the social and cognitive development of children to promote school readiness. In addition to tangible health concerns, other child behaviors may pose a threat to preschool children's health and social and cognitive development. One such concern is sleep. Preschoolers' sleep—or lack thereof—is a growing concern among child psychologists and child health care providers (Cohen, 1999; Harkness & Super, 2006; Owens, 2005). Additionally, it was identified by the College Station Head Start Program Director and facilitators as a concern among parents they serve. Sleep hygiene problems are not limited to having

trouble falling asleep, but also includes night tremors, nightmares, night wakings, and early risings, among other behaviors.

Sadeh (2007), in his review of consequences of sleep loss or sleep disruption among children, highlighted some key areas in which sleep problems may negatively affect cognitive functioning and behavior. He argued that sleep loss had significant effects on children's neurobehavioral functioning such that even moderate sleep loss may have significant effects on children's cognitive and executive functioning including their reaction time, working memory, and attention regulation. Sadeh (2007) further argued for the link between sleep and academic performance, stating that both were positively related. Afek, Lam, Suraiya, Ravid, & Pillar (2004) found that kindergartners who failed to progress to first grade had more sleep problems, including inconsistent sleep-wake schedules, difficulty falling asleep, and night waking, than age-matched controls. Beyond academic performance, duration of sleep was also related to school adjustment in preschool children, such that those with fewer hours of sleep had higher levels of adjustment problems after accounting for family management practices and family stress (Bates, Viken, Alexander, Beyers, & Stockton, 2002).

Touchette et al. (2007) studied the relationship between sleep duration and children's behavioral and cognitive functioning upon school entry and found that shorter sleep durations resulted in increased hyperactivity-impulsivity and lower cognitive functioning on neurodevelopmental tests. They recommend that young children be allowed to sleep at least 10 hours per night to decrease the chances of them having behavioral and cognitive difficulties due to sleep. Similar to Touchette et al. (2007),

Sadeh (2007) reiterated that children's sleep problems may result in symptoms and behavioral problems that resemble Attention Deficit- Hyperactivity Disorder. Shang, Gau, and Soong (2006) examined the relationship between child sleep problems and child behavioral problems and found that children with sleep problems had higher mean *T*-scores on the eight emotional and behavioral syndromes on the Child Behavior Checklist (CBCL; Achenbach, 1991). Therefore, I believe that a health literacy intervention for parents on the effects of sleep problems and deprivation on children may increase their commitment to ensuring their children get sufficient sleep in addition to increasing their awareness and observation on how sleep deprivation may affect their children's cognitive and behavioral functioning beyond daytime sleepiness.

In addition to children's behavioral and cognitive functioning, sleep also affects *parents*' functioning. Martin et al. (2007) examined the effects of preschool children's sleep problems and parent health and found children's sleep problems were associated with serious psychological distress for mothers and poor general health for both parents. Polimeni, Richdale, and Francis (2007) argued that child sleep problems can also result in higher levels of parental stress and parental sleep deprivation. By helping parents understand and recognize how their children's sleep problems contribute to their own health as part of my health literacy intervention, I propose to increase their motivation for good sleep practices for their children.

Insufficient sleeping hours are also related to childhood obesity, another target for prevention in the intervention. Spiegel, Leproult, and L'Hermite-Baleriaux (2004) and Taheri (2006) found a relationship between short sleep duration decreased leptin

levels, increased ghrelin levels, and increased hunger and appetite, suggesting that reduced sleep causes changes in the two appetite regulatory hormones, which result in food intake changes over time that could further lead to overweight or obesity. Taheri (2006) concluded that sleep should be incorporated into obesity interventions. Chaput, Brunet, and Tremblay (2006) found that after adjusting for age, gender, parental obesity, and other potential risk factors, duration of sleep was predictive of childhood obesity, such that children who slept for 8 to10 hours per night were 3.45 times more likely to be obese than those who slept for 12 to13 hours per night. Additionally, for boys in the study, as the number of hours of sleep decreased, BMI, body weight, and waist circumference increased. Sleep duration, therefore, may be considered as a modifiable risk factor for obesity and parents should be further informed about the benefits of their children getting 12 to13 hours of sleep beyond the obvious positive behavioral consequences.

Besides childhood obesity, sleep problems may pose another threat to the development of cardiovascular disease and other health concerns in preschool aged children. Sampei, Dakeishi, Wood, and Murata (2006) examined the impact of sleep duration on blood pressure in preschool children and concluded that since systolic blood pressure was highly correlated with total duration of sleep, it is possible that children may develop sub-clinical health problems if they engage in extremely short or long sleep. This provides further need for home-based interventions to regulate healthy sleep duration and reduce sleep problems in children.

Awareness of the negative consequences of sleep deprivation and sleep problems in preschool children may not be sufficient to bring about change, therefore, I propose to equip parents with practical skills that will ensure their children get sufficient sleep and reduce the number of sleep problems they experience.

Johnson and McMahon (2008) examined preschoolers sleep behavior and parent variables and found parental hardiness, parental problematic sleep-related cognitions, and number of parent interactions with child at bedtime to be predictive of preschoolers sleep problems. Similar to the findings for physical activity and diet/nutrition, Johnson and McMahon (2008) concluded that effective authoritative parenting may be necessary in interventions focused on reducing sleep problems in children, providing further evidence for including parenting skills to help parents change their behavior and their children's behavior.

Further, Mindell, Kuhn, Lewin, Meltzer, and Sadeh (2006) reviewed the efficacy of behavioral treatments of sleep problems, specifically bedtime problems and night wakings, and reported that 94% of the 52 treatment studies examined were efficacious, and 80% of children in all studies had a clinically significant improvement up to 3 to 6 months after treatment. They also found that preventive parent education was a strong predictor of treatment efficacy in studies with controlled groups. This provides evidence for the need to incorporate a parent education and parent behavioral skills component when trying to reduce sleep problems and improve the health of preschool children.

Sleep problems and deprivation are not restricted to child and parent behavior at bedtime, some of these problems stem from parent lifestyle choices. Gregory, Eley,

O'Connor, Rijsdijk, and Plomin (2005) examined family influences on the association between sleep problems and anxiety and found family disorganization to be highly correlated with sleep problems (including early waking, nightmares, and trouble getting to sleep) in children. My intervention addresses these issues by incorporating the need for organization and scheduling in the intervention with parents and providing opportunities for practicing during intervention sessions the skills needed to keep households organized and on schedule.

Mental Wellness

In developing a parent-focused prevention intervention to increase healthy lifestyle choices for young children and families, it is imperative that mental wellness is addressed. Many researchers have found mental health problems in parents to be related to reduced prevention health care service seeking and behaviors for preschool children.

Kavanaugh et al. (2006) studied maternal depressive symptoms and preventive health practices and parenting behaviors for preschool children and found that depressive symptoms were most prevalent among mothers with low income, living in single parent households and with fewer years of education. They found that mothers with depressive symptoms reported poorer oral health behavior practices for their children, inconsistent discipline, and lower parenting confidence. Minkovitz et al. (2005) studied children's receipt of health care in the first three years of their lives and its relationship with maternal depression. Similar to Kavanaugh et al. (2006), they found that mothers with depressive symptoms tended to have fewer years of education, lower incomes, single-parent households, and to be ethnic minorities. Minkovitz et al. (2005) confirmed that

children whose mothers reported having depressive symptoms 2 to 4 months after their birth were less likely to receive preventive health care visits and vaccinations, and were more likely to have emergency department visits in the first 3 years of their lives than their counterparts whose mothers did not have depressive symptoms. Maternal depression not only affected mothers' ability to seek preventive care for their children, it was also related to sleep problems in children (Gregory et al., 2005; Shang et al., 2006).

As previously mentioned, Head Start and teenage parents tend to have lower incomes and approximately one third had less than a high school education. Therefore, they may be at increased risk for depressive symptoms that could result in reduced preventive care for their children, more emergency room visits, and ineffective parenting. As proposed, I plan to provide parents with health information and practical skills that would improve their children's health and their parenting behaviors; however, doing so may not be sufficient to bring about the desired change in lifestyle I aim to achieve due to parent and child stress. I propose to conceptualize and address mental health concerns as barriers to healthy lifestyle choices in families and design my intervention to reflect this. Specifically, I propose to: (a) incorporate parent self-care to prevent symptoms of depression and stress, (b) promote mental wellness by providing parents with the skills to engage in and recognize when self-care is most needed, (c) provide parents with information about the benefits of self-care, and (d) provide parents with skills they can use to soothe themselves and their children during routine, and emergency health care visits.

Stigma. Beyond the impact of parent mental health on young children's health, parents also need to be able to acknowledge and make decisions regarding their children's mental health. According to the Office of Head Start 2005 Biennial Report to Congress, of the children referred for mental health services outside the Head Start Program, 27% did not receive services. Many variables could contribute to these children not receiving services; however, some researchers have argued that the stigma of mental illness coupled with demographic variables such as age, ethnicity, and income may put individuals at increased risk for not seeking services and by extension parents not seeking services for their children (Corrigan, 2004; Gary, 2005; Leaf, Bruce, Tischler, & Holzer, 1987).

Corrigan (2004) argued that many people fail to seek mental health services because of the stigma associated with it, usually due to cues, stereotypes, prejudices, and discriminations. Cues, such as physical appearance and psychiatric symptoms, elicit stereotypes on what constitutes someone with mental health problems and these stereotypes may lead to negative emotional reactions or prejudices and eventually discrimination in the form of avoidance. Corrigan (2004) distinguished between public stigma and self-stigma. Public stigma is what the public does to stigmatize people with mental illness, for example, hindering job opportunities and housing, and criminalizing mental illness. He argued that people may try to avoid public stigmatization (what others might think of them) through denial of mental illness therein impeding care seeking, although perception of treatment success reduced this relationship. Self-stigma is the reactions of people in a group to themselves due to the internalization of public stigma.

Corrigan (2004) argued that individuals with mental illnesses who internalize the public stigmas associated with mental illness tend to have lower self-esteem, lower self-efficacy, and experience shame, all of which may affect the individuals' quality of life and life goals. Further, the experience of shame (both self and family) is also related to treatment avoidance.

In an attempt to improve the mental health literacy of parents, I propose to address the stigmas and stereotypes associated with mental illness through open discussions on the trajectory of responsibilities of mental health professionals and educate them on how they use psychology and child development information in their daily lives. I also propose to provide them with basic information that will help them recognize when their children may require professional help regarding mental health. For example, how to recognize that their children's mental health may be contributing to their eating patterns that may pose a risk for obesity, and how to recognize how their children's mental health may be affecting their sleep problems.

Parenting

Authoritative Parenting Style. Baumrind (1971) defined authoritative parents as having high levels of control and responsiveness; they tend to provide emotional support to their children, have open communication, allow for reasoning, set firm limits, and adopt an overall positive attitude in their interactions with their children. The effects of adopting an authoritative parenting style are controversial, especially when considering low income families, ethnic minority families and other disadvantaged families. Some researchers have argued that the effects of parenting styles across children are not

consistent because of family contexts. Baldwin, Baldwin, and Cole (1990) argued that variables such as socioeconomic status made some parenting styles more relevant than others in families. They argued that it was beneficiary for parents in poor families and who lived in high-risk neighborhoods to adopt more controlling parenting styles than those in wealthy neighborhoods to protect their children. Additionally, Baldwin et al. (1990) found that economically disadvantaged minority children in single parent homes had higher school achievement when their parents were controlling and restrictive, that is, *authoritarian*. Researchers have also argued that the efficacy of parenting styles are different based on the race and ethnicity of the families, such that ethnic minority children are less likely to benefit from authoritative parenting styles (Dornbusch, Ritter, Liederman, & Roberts, 1987; Steinberg, Mounts, Dornbusch, 1991; Steinberg, Lamborn, Dornbusch, & Darling, 1992).

Conversely, some studies show that no such difference exists regarding the effects of parenting style on children. Researchers have found authoritative parenting styles to be related to positive outcomes, including less depressive symptoms, higher academic achievement, high self-esteem, and low rates of drug use, across children of varying ethnicities (Bradley & Corwyn, 2000; Pilgrim, Luo, Urberg, & Fang, 1999; Radziszewska, Richardson, Dent, & Flay, 1996). Querido, Wamer, and Eyberg (2002) found that authoritative parenting style was most predictive of fewer behavior problems in preschool children. Researchers have also shown that more controlling parenting styles had similar negative outcomes across children of varying ethnicities (McLoyd & Smith, 2002).

Parenting Style and Healthy Choices. As reiterated throughout this review, parenting style plays a major role in children's adherence to healthy lifestyle choices parents try to implement for them. The effect of parenting style on young children's preventive care was most pronounced for diet/nutrition and sleep patterns, such that healthier habits were associated with authoritative parenting style, while permissive and authoritarian parenting styles were associated with deterioration in preventive health behaviors in younger children. In spite of studies showing mixed results on the efficacy of authoritative parenting in individuals with similar demographics as my targeted population, I maintain the need to incorporate authoritative parenting to facilitate the implementation of healthy lifestyle choices in the homes. In addition to having a module dedicated to parenting by developing prosocial behaviors in children, I have incorporated the promotion of prosocial behavior and authoritative parenting in the diet/nutrition, physical activity, and sleep modules.

The Bioecological Framework for Understanding Preventive Care for Young Children

As stated before, young children are strongly influenced by their environment and are reliant on their parents to provide them with preventive care. The Bioecological Model, as shown in Figure 1, previously known as the Socioecological Model, was first introduced by Bronfenbrenner (1979) to highlight the importance of the ecological context in the development of the individual. Researchers have continued to emphasize the importance of social ecology in child health and well being, hence providing the premise for using Bronfenbrenner (1979) and Bronfenbrenner and Morris' (2006)

Bioecological Model as a framework for studying and implementing change in young children's preventive health care.

As shown in Figure 1, the Bioecological Model identifies the child at the heart of a progression of concentric circles, which represent systems that influence a given child. It is at this point interpersonal and biological characteristics are examined, however researchers have argued that when trying to conceptualize influences on young children, young children's interpersonal characteristics have very little influence on their behavior because they are so reliant on their environment (Wilson & Evans, 2003). The first system surrounding the child in the Bioecological Model is the Microsystem. The Microsystem is best defined as the most proximal influences on the child. Kazak, Rourke, and Crump (2003) identified the family and its subsystems, that is, parents, siblings, marital relationships, as being most representative of the Microsystem. As demonstrated in this review, a substantial amount of research examining preventive health behaviors have found family environment, parenting styles and other parent characteristics, such as stress and mental health status, to be influential on the preventive care of young children. The second system surrounding the child is the Mesosystem. Researchers define the Mesosystem as the interaction of two or more Microsystems; however, diagrams of the Bioecological Model identify variables that are considered more distal than those in the Microsystem as comprising the Mesosystem (e.g. Kazak et al., 2003, p. 161; Spirito & Kazak, 2006, p. 38). For this study, the Mesosystem will be defined as variables more distal than the Microsystem, and the interaction of these variables with Microsystem variables. Therefore, Head Start programs and Aggieland

Pregnancy Outreach would be considered Mesosystem variables and the interaction of family variables with these agencies will also be considered as part of the Mesosystem. The most distal system in the Bioecological Model is the Exosystem. The Exosystem is all environmental contexts that contribute to culture, subculture and general belief patterns of the child and includes socioeconomic status, religion, policies, law and cultures (Kazak et al., 2003). For this study, the Exosystem will be framed as policies, parent's socioeconomic status, and culture. According to Bronfenbrenner (1993), these

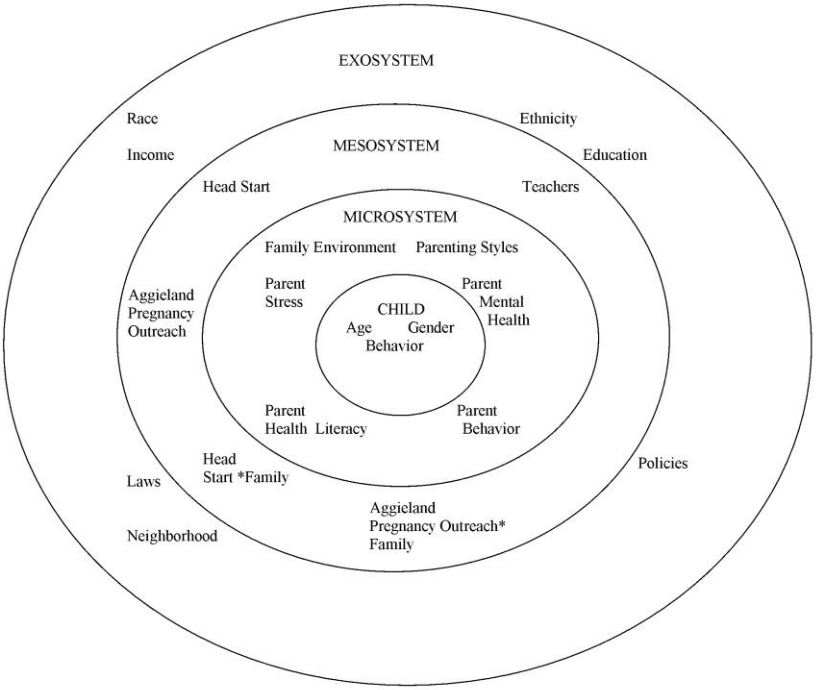

Figure 1. The Proposed Bioecological Model

environmental contexts should lead to indirect influences on the immediate setting in which the person resides.

I conceptualize that to influence preventive health care of young children, family characteristics and agency programs will be most modifiable. However, I chose to focus on modifying *family* characteristics. It is my expectation that in so doing, children's own behavior will be modified to the extent that when they become active decision-makers in their preventive health, they will make healthy lifestyle choices due to modeling from parents and exposure in the home. The intervention is innovative because of its experiential nature; I hope to influence the Exosystem, specifically Head Start and Aggieland Pregnancy Outreach policies and practices by proving that an experiential intervention can lead to improved preventive health in families facing several barriers. Finally, by focusing on a low income, diverse population, I hope to make the intervention specific to individuals in these Exosystem categories.

The Prevention Intervention Research Model

The IOM committee released a report outlining an initiative for the development of prevention science with guidelines for prevention science research (Mrazek & Haggerty, 1994). The report was specific to mental health disorders, but can also be applied to preventable physical diseases such as obesity and oral health, since studies on the prevention of physical illnesses were also included to inform their recommendations for mental health prevention. Mzarek and Haggerty (1994) concluded that although they lacked evidence that prevention interventions reduce the incidence of mental disorders, evidence did indicate that it can reduce the risk factors associated with the onset of

disorders. Therefore there is need to adopt a risk-reduction strategy. Similarly, studies in health prevention have shown that reducing risk factors for preventable diseases has resulted in decreased incidence and prevalence of diseases (Center for Disease Control, 1999; Gortmaker et al., 1999).

The IOM committee argued for the need to distinguish prevention interventions into three distinct categories: universal, selective, and indicative. Universal prevention interventions target the public or whole population without consideration of level of risk. The selective prevention interventions target subpopulations who demonstrate high risk due to biological, psychological, or social risk factors. The indicative preventive interventions target individuals having minimal, detectable signs or symptoms of disease. This proposed prevention intervention will be selective since it will be conducted with parents who have social factors that make them more susceptible to having lower health literacy and fewer healthy lifestyle choices.

The National Institute of Mental Health (NIMH) and IOM proposed a prevention intervention research cycle (Figure 2) to facilitate the risk-reduction strategy they proposed. Heller (1996) criticized the research cycle for not including working with community groups at earlier stages of the development and testing of prevention interventions. I propose to use IOM's model with a few modifications to address Heller's (1996) criticism. In the first section of this proposal, I identified the problem and reviewed information to determine the extent to which it was a problem for the targeted population, and also identified risk and protective factors, therein fulfilling the requirements of Step 1 of the model. To address Heller's criticism, I introduced

community involvement at Step 2. I conducted focus groups with community professionals and parents to identify risk factors and protective factors not in the literature and used this information in addition to the information from the literature in intervention development. In so doing, I was able to integrate research to practice models (begins with researcher and research) and community-centered models (begin with the community and focus on what the community wants) to create the final version of my intervention (Wandersman et al., 2008). Integration of Steps 3 and 4 in my study design will be addressed in the methods and future directions section of this paper respectively.

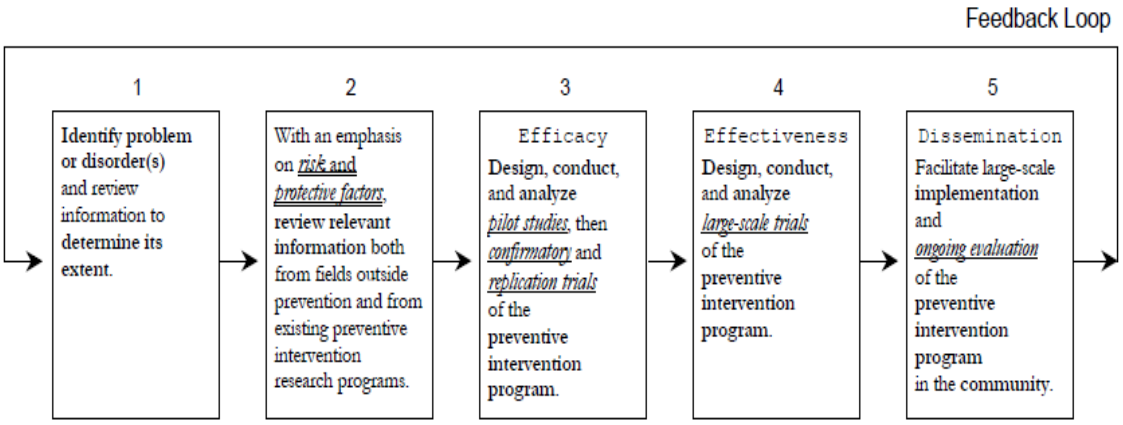

Figure 2. Prevention Science Model Proposed by the IOM Committee

Objectives Of The Current Project

The following are the objectives of this project:

- To design an experiential intervention to provide more hands-on information on health literacy topics/modules, specifically diet/nutrition, physical activity, sleep hygiene, and mental wellness, with parenting skills infused through-out the other four modules;
- To design an intervention where educational background is not a barrier to health literacy;
- To provide parents with practical skills to implement healthy lifestyle choices in their homes;
- To provide an environment where parents have the opportunity to clarify health concerns and seek advice from their peers and others who may be more health literate; and
- To reduce the barrier of health literacy to preventive health care in preschool children.

Strengths

Knowledge is empowering, and this study will seek to disseminate health knowledge in a manner that will be resilient to the barriers low income parents face. The main strength of this study is its utilization of an experiential intervention. Imparting information and showing individuals how to use their knowledge to implement healthy lifestyle choices in the home goes beyond the interventions already in place to promote healthy lifestyle choices. In addition, the parenting and problem-solving skills that will be reiterated and practiced throughout the intervention may help parents build better relationships with their children, hence an indirect benefit of the study. Parents may also

be able to use these skills to promote other healthy changes in their homes that are not the target of my intervention. Another strength of this study is its community involvement in the development and dissemination of the intervention, this is a critical tenet of community-based participatory research. Many interventions to promote preventive health have used the literature to inform the development of the intervention, and because of this they may not meet all of the needs of the community, or use individuals' protective factors to strengthen their intervention. By incorporating the literature with community input on risk and protective factors in the intervention development, this intervention will utilize the community strengths to further promote healthy lifestyle choices.

Hypotheses

Hypothesis 1. Parent's health behavior for themselves and their children predict their initial health literacy.

a. For diet /nutrition, I expected higher education and income, WIC enrollment, higher Family Influence (FI) on fruits and vegetables, FI on low fat foods, and Diet/ Nutrition Physical Activity (DNPA) lifestyle, and positive grocery shopping behavior to predict higher food knowledge and higher health literacy for disease, diet beliefs, general diet, general food beliefs, and child diet beliefs for participants. I also expected higher education and income, WIC enrollment, higher FI on fruits and vegetables, FI on low fat foods, and DNPA lifestyle, and positive grocery shopping behavior to be related to

higher parents' and their children's reported fruits and vegetables consumption.

b. For physical activity, I expected higher education and income, higher FI on physical activity, FI on sedentary activity, and DNPA lifestyle to positively predict participants' physical activity beliefs, physical activity overall knowledge, general physical activity knowledge, physical activity/disease knowledge, and child physical activity knowledge. I also expected higher education and income, higher FI on physical activity, FI on sedentary activity, and DNPA lifestyle to positively predict participants' and their children's reported physical and sedentary activity.

c. For sleep, I expected higher education and income, low Tayside Child Sleep Questionnaire (TCSQ) subscale scores, and low Parental Interactive Bedtime Behaviour Scale (PIBBS) subscale scores to predict participants' sleep beliefs, sleep knowledge, sleep/disease knowledge, child sleep knowledge, and child sleep problems knowledge.

d. For behavioral functioning and stress, I expected higher education and income, lower perceived stress, level of depression, and children's behavioral problems, and higher coping strategies, and children's emotional, social and physical HRQoL to be related to higher participants' health literacy for child behavioral functioning, stress, habits, parent-child relationships, temperament, handling child behavior, and disease. I also expected higher education and income, lower perceived stress, level of depression, and

children's behavioral problems, and higher coping strategies, and children's emotional, social and physical HRQoL to be related to higher participants' doctors' visit behaviors and all but children's behavioral problems, to be related to lower children's behavioral problems.

Hypothesis 2. I expected changes in health literacy from pretest to posttest would be significantly related to changes in healthy lifestyle choices and behaviors from pretest to posttest.

a. For diet/nutrition I expected that differences from pretest to posttest for health literacy for diet/nutrition (Food Knowledge, Disease, Diet Beliefs, General Diet, General Food and Child Diet) would be positively correlated with differences from pretest to posttest for diet/nutrition behaviors (Child Fruits, Child Vegetables, Parent Fruits, Parent Vegetables, FI on Fruits and Vegetables, FI on Low Fat [foods], DNPA Lifestyle, Grocery Shopping).
b. For physical activity, I expected that differences from pretest to posttest for health literacy for physical activity (Physical Activity Beliefs, Sedentary Activity Beliefs, Physical Activity Knowledge, General Physical Activity, Physical Activity Disease, Child Physical Activity) would be positively correlated with differences from pretest to posttest for physical activity behaviors (FI Physical Activity, FI Sedentary Activity, DNPA Lifestyle, Child Physical Activity Minutes, Parent Physical Activity Minutes, Parent with Child Physical Activity) and negatively correlated with differences from pretest to posttest for sedentary activity behaviors (Child Sedentary

Activity Minutes, Parent Sedentary Activity Minutes, Parent with Child Sedentary Activity).

c. For sleep, I expected that differences from pretest to posttest for health literacy for sleep (Beliefs, Knowledge, Disease, Child Sleep, Child Sleep Problems) would be positively correlated with the PIBBS-B score and negatively correlated to the TCSQ Total, TCSQ Core Sleep Problems, TCSQ Parent Intervention, PIBBS-A, PIBBS-C, PIBBS-D, PIBBS-E, and PIBBS-Total scores.

d. For behavioral functioning and stress, I expected that differences from pretest to posttest for health literacy for behavioral functioning and stress (Child Behavior, Stress, Habits, Relationship, Temperament, Handling Child, Disease) would be positively correlated with children's HRQoL, doctors' visit behaviors, and coping strategies but negatively correlated with depression, perceived stress, and child behavioral problems.

Hypothesis 3. I expected participants' health literacy to be significantly higher at posttest than at pretest. Further, I expected this difference in health literacy would be maintained for at least 1 month after the intervention because of the experiential nature of the intervention. As a result, I also predicted that follow-up would be significantly different from pretest.

a. For diet/nutrition, I expected that participants' health literacy for diet/nutrition (Food Knowledge, Disease, Diet Beliefs, General Diet, General Food and Child Diet) would improve from pretest to posttest and this

improvement would be maintained at follow-up. I also expected that follow-up scores would be significantly higher than pretest scores.

b. For physical activity, I expected that participants' health literacy for physical activity (Physical Activity Beliefs, Sedentary Activity Beliefs, Physical Activity Knowledge, General Physical Activity, Physical Activity Disease, Child Physical Activity) would improve from pretest to posttest and this improvement would be maintained at follow-up. I also expected that follow-up scores would be significantly higher than pretest scores.

c. For sleep, I expected that participants' health literacy for sleep (Beliefs, Knowledge, Disease, Child Sleep, Child Sleep Problems) would improve from pretest to posttest and this improvement would be maintained at follow-up. I also expected that follow-up scores would be significantly higher than pretest scores.

d. For behavioral functioning and stress, I expected participants' health literacy for behavioral functioning and stress (Child Behavior, Stress, Habits, Relationship, Temperament, Handling Child, Disease) would improve from pretest to posttest and this improvement would be maintained at follow-up. I also expected that follow-up scores would be significantly higher than pretest scores.

Hypothesis 4. I expected participants would adopt significantly healthier lifestyle choices in their homes at posttest than at pretest. Further, I expected this difference in

behavior would be maintained for at least 1 month after the intervention because of the experiential nature of the intervention. As a result, I also predicted that follow-up would be significantly different from pretest.

a. For diet/nutrition, I expected that participants' and their children's diet/nutrition behaviors (Child Fruits, Child Vegetables, Parent Fruits, Parent Vegetables, scores for FI on Fruits and Vegetables, FI on Low Fat [foods], DNPA Lifestyle, Grocery Shopping) would improve from pretest to posttest and this improvement would be maintained at follow-up. I also expected that follow-up scores would be significantly higher than pretest scores.

b. For physical activity, I expected that participants' and their children's physical activity behaviors (scores for FI Physical Activity, FI Sedentary Activity, DNPA Lifestyle, Child Physical Activity Minutes, Parent Physical Activity Minutes, Parent with Child Physical Activity) would improve from pretest to posttest and this improvement would be maintained at follow-up. I also expected that follow-up scores would be significantly higher than pretest scores. On the other hand, I expected that participants' and their children's sedentary activity behaviors (Child Sedentary Activity Minutes, Parent Sedentary Activity Minutes, Parent with Child Sedentary Activity) would decrease from pretest to posttest and this decrease would be maintained at follow-up. I also expected that follow-up scores would be significantly lower than pretest scores.

c. For sleep, I expected that participant and children's problematic sleep behaviors (scores for TCSQ Total, TCSQ Core Sleep Problems, TCSQ Parent Interventions, PIBBS-A, PIBBS-C, PIBBS-D, PIBBS-E, and PIBBS-Total) would decrease from pretest to posttest and this decrease would be maintained at follow-up. I also expected that follow-up scores would be significantly lower than pretest scores. Conversely, I expected that PIBBS-B score would improve from pretest to posttest and this improvement would be maintained at follow-up. I also expected that the PIBBS-B follow-up scores would be significantly higher than pretest scores.

d. For behavioral functioning and stress, I expected participants' coping strategies, doctors' visit behaviors, and children HRQoL scores would improve from pretest to posttest and this improvement would be maintained at follow-up. I also expected that follow-up scores would be significantly higher than pretest scores. I also expected participants' level of stress and depression and children's behavioral problems would decrease from pretest to posttest and this decrease would be maintained at follow-up. I also expected that follow-up scores would be significantly lower than pretest scores.

METHOD

Participants

Thirty mothers (M_{age} = 23.14, *SD* = 5.45) of young children were recruited from College Station Head Start and Early Head Start and Aggieland Pregnancy Outreach via flyers distributed by the agencies' staff and word of mouth for participation in the intervention. Twenty-one (70%; M_{age} = 23.14, *SD* = 5.45) participants attended the first session of the intervention, 13 (62%) completed the intervention, and 9 (69%) completed measures at 1-month follow-up. The overall retention rate from first session to follow-up was 43%. Participants' who did not complete the intervention or did not complete follow-up measures were not significantly different on ethnicity (χ^2 = 6.54, *p* = 0.37), income (χ^2 = 14.78, *p* = 0.39) and education (χ^2 = 6.91, *p* = 0.55) from those who completed the intervention. Participants were of varied ethnicities (~29% Caucasian, ~29% African-American, ~10% Asian, and ~33% Hispanic), and each ethnicity was fairly distributed across the sample (χ^2 = 2.81, *p* = 0.42). Participants' education ranged from some high school to completed graduated school, with 71% having at least a high school education. Participants did not vary significantly in their education (χ^2 = 4.48, *p* = 0.35). Regarding income, participants' income ranged from $0 to over $35 000 per year, with 90% making $20 000 or less per year. Participants did not vary significantly on their income (χ^2 = 9.09, *p* = 0.25). Sixty-two percent of participants reported currently being enrolled in WIC. Seventy-six percent of participants identified English as the primary language spoken in the home. Fifty-two percent of participants reported being unemployed.

Measures

Demographic Questionnaire. The demographic questionnaire included socio-economic and socio-cultural information about the family, including the caregiver's age, gender, educational attainment, ethnicity, primary language spoken, employment status, and household income. Questions about WIC status were included since this might be a confounding variable for nutrition behaviors.

Health Literacy. Both the IOM (2004) and the Agency for Healthcare Research and Quality (AHRQ; 2004) have concluded that the two widely used tests for studying health literacy, the Rapid Estimate of Adult Literacy in Medicine (REALM) and the Test of Functional Health Literacy in Adults (TOFHLA; Parker et al., 1995) measure reading ability and are poor measures of health literacy. For this reason, I developed my own measure of health literacy that includes some general questions, as well as questions specific to the target behaviors in the intervention. These measures are described more specifically under each target behavior subheading.

Diet/Nutrition. To measure diet/nutrition health literacy, a measure was created that assessed *Food Knowledge* (7 items), *Disease* (5 items), *Diet Beliefs* (26 items), *General Diet* (4 items), *General Food* (14 items), and *Child Diet* (8 items). All subscales, except for *Food Knowledge*, were rated on a 4-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree), responses were reverse-coded where necessary (higher scores = more knowledge) and average scores were calculated. For *Food Knowledge*, participants' responses were scored as correct (1 point) or incorrect (0 points) and a total score was calculated. *Food Knowledge* tested

participants' knowledge about the food groups, serving sizes, and good and bad fats. *Disease* assessed participant's knowledge about the origins of diseases, including obesity, diabetes, and heart disease, as it is related to diet/nutrition. *Diet Beliefs* is a total score derived from items in the *General Diet*, *General Food*, and *Child Diet* subscales. *General Diet* assessed participants' knowledge about general statements about diet and nutrition (e.g., Diet is special foods people eat to lose weight). *General Food* assessed participants' knowledge and beliefs about foods and eating (e.g., You should eat foods high in potassium). *Child Diet* assessed participants' knowledge and beliefs about the influence of diet/nutrition on their children's wellbeing (e.g., The type of foods children eat have no effect on their mood). Means and standard deviations of the health literacy for diet/nutrition at pretest, posttest, and follow-up are presented in Table 1.

To measure participants' and their children's food intake, household rules for and family influence on diet/nutrition, and participants' grocery shopping behaviors, an instrument was created. Most of the items on this instrument was adapted from Sallis' *Active Where? Parent Child Survey* and *Amherst Health and Activity Study Survey*. Both measures have demonstrated adequate internal consistency, test-retest reliability, and construct and discriminant validity (Forman et al, 2008; Grow et al. 2008; Taylor et al., 2002; Trost et al., 2003a). Variables such as *Child Fruits*, *Child Vegetables*, *Parent Fruits*, and *Parent Vegetables* are participant-reported consumption of fruits and vegetables for them and their child the previous day. *FI of Fruits and Vegetables* (4 items) examined participants' influence on their children's fruits and vegetables by providing them with and encouraging them to eat fruits and vegetables (e.g., [You]

Table 1. Descriptive statistics of diet/nutrition variables

Variable		Pretest (*N*=21)		Posttest (*N*=13)		Follow-up (*N*=9)	
	α	M	SD	M	SD	M	SD
HL Food Knowledge	0.49	3.52	1.50	3.92	1.19	3.13	1.55
HL Disease	0.40	3.35	0.38	3.11	0.59	3.25	0.55
HL Diet Beliefs	0.81	2.90	0.35	3.23	0.37	3.28	0.43
HL General Diet	0.54	2.61	0.59	2.99	0.58	3.31	0.57
HL General Food	0.30	2.82	0.24	3.32	0.23	3.07	0.39
HL Child Diet	0.89	3.16	0.63	2.60	0.59	3.67	0.53
Child Fruits	-	1.76	1.09	1.90	1.07	2.29	1.38
Child Vegetables	-	1.35	1.41	3.00	1.37	2.57	1.39
Parent Fruits	-	1.85	1.42	2.50	1.35	2.25	1.75
Parent Vegetables	-	1.50	1.28	2.50	1.83	2.13	1.46
FI Fruits & Vegetables	0.85	2.56	1.06	2.73	0.89	2.50	0.50
FI Low Fat	0.86	1.90	1.19	2.13	1.00	2.47	0.74
DNPA Lifestyle	0.90	2.95	0.70	2.90	0.61	3.05	0.59
Grocery Shopping	0.78	2.50	0.54	2.34	0.30	2.50	0.30

Note. HL = health literacy; FI = family influence, DNPA = diet/nutrition physical activity.

provided fruits and vegetables to your child as part of a meal). *FI on Low Fat* foods (4 items) examined participants' influence on their children's low fat foods consumption by providing them with and encouraging them to eat low fat foods (e.g., [You] eaten low fat foods with your child). *FI on Fruits and Vegetables* and *FI on Low Fat* foods questions both asked that participants report how much they engaged in the behavior in the last week on a 5-point interval (0 = Never, 1 = 1-2 days, 2 = 3-4 days, 3 = 5-6 days, 4 = 7 days). *DNPA Lifestyle* (10 items) examined participants' diet/nutrition and physical

lifestyle choices for the home (e.g., Do you limit the amount of soda your child is allowed to drink?). *Grocery Shopping Behavior* (11 items) examined participants' grocery shopping behavior (e.g., How often do you look at the nutrition facts label on food packets when grocery shopping?). *DNPA Lifestyle* and *Grocery Shopping Behavior* items were rated on a 4-point Likert scale (1 = Never, 2 = Sometimes, 3 = Usually, 4 = Always). Means and standard deviations of diet/nutrition behavior at pretest, posttest, and follow-up are presented in Table 1.

Physical Activity. To measure physical activity health literacy, a measure was created that assessed *Knowledge* (5 items), *Physical Activity Beliefs* (20 items), *General Physical Activity* (8 items), *Physical Activity Disease* (3 items), and *Child Physical Activity* (7 items). All subscales, except *Knowledge,* were rated on a 4-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree), responses were reverse-coded where necessary (higher scores = more knowledge) and average scores were calculated. For *Knowledge*, participants' responses were scored as correct (1 point) or incorrect (0 points) and a total score was calculated. *Knowledge* tested participants' knowledge about amount of time adults and children should spend engaging in physical and sedentary activity, and bone and muscle strengthening exercises. *Physical Activity Beliefs* is a total score derived from items in the *General Physical Activity*, *Physical Activity Disease*, and *Child Physical Activity* subscales. *General Physical Activity* assessed participants' knowledge and beliefs about engaging in physical activity (e.g., Physical activity is only sports and exercise). *Physical Activity Disease* assessed participants' knowledge about the relationship between diseases and physical activity

(e.g., People who are physically active have lower risk of having breast cancer than those who are inactive). *Child Physical Activity* assessed participant's knowledge and beliefs about the relationship between physical activity and children's well-being (e.g., Physical activity can help my children sleep better). Means and standard deviations of the health literacy for physical activity at pretest, posttest, and follow-up are presented in Table 2.

Table 2. Descriptive statistics for physical activity variables

		Pretest (*N*=21)		Posttest (*N* = 13)		Follow-up (*N* = 9)	
Variable	α	M	SD	M	SD	M	SD
HL PA Beliefs	0.77	3.06	0.32	3.1.	0.32	3.30	0.40
HL Knowledge	-	1.42	0.93	2.08	0.95	1.78	1.09
HL General PA	0.66	3.03	0.35	3.12	0.30	3.24	0.35
HL PA Disease	0.30	3.08	0.44	3.18	0.57	3.33	0.53
HL Child PA	0.55	3.17	0.45	3.23	0.42	3.38	0.59
FI PA	0.92	2.25	1.18	2.10	1.03	1.78	0.82
FI SA	0.71	1.79	0.96	2.17	0.72	1.98	0.48
DNPA Lifestyle	0.90	2.95	0.70	2.90	0.61	3.05	0.59
Child PA Min.	-	206.76	223.22	147.00	147.95	87.86	60.95
Child SA Min.	-	101.47	83.44	136.00	142.92	120.00	163.40
Parent PA Min.	-	217.62	276.48	163.33	237.61	102.22	103.53
Parent SA Min.	-	145.00	118.74	143.33	88.22	194.00	172.88
Parent/ Child PA	-	152.10	154.01	83.18	75.71	101.11	100.93
Parent/ Child SA	-	78.95	78.45	100.45	95.67	70.22	54.04

Note. HL = health literacy; PA= physical activity; SA = sedentary activity; FI = family influence; DNPA = diet/nutrition physical activity; Min. = minutes

To measure participants' and their children's physical and sedentary activity, and household rules for and FI on physical and sedentary activity, an instrument was created. Similar to diet/nutrition, most of the items on this instrument was adapted from Sallis' *Active Where? Parent Child Survey* and *Amherst Health and Activity Study Survey*. Variables such as *Child Physical Activity Minutes*, *Child Sedentary Activity Minutes*, *Parent Physical Activity Minutes*, *Parent Sedentary Activity Minutes*, *Parent with Child Physical Activity*, and *Parent with Child Sedentary Activity* are participant reported time spent engaging in physical and sedentary activities for them and their children for the previous day. *FI on Physical Activity* examined participants' influence on their children's physical activity by providing them with opportunities and encouraging them to participate in physical activity (e.g., [You] encouraged your child to do physical activities or play sport). On the other hand, *FI on Sedentary Activity* examined participants' influence on their children's sedentary activity by reducing opportunities and discouraging them from participating in sedentary activity (e.g., [You] helped your child think of ways to reduce the time he or she spends being inactive or sitting around). *FI on Physical Activity* and *FI on Sedentary Activity* questions asked that participants report how much they engaged in the behavior in the last week on a 5-point interval (0 = Never, 1 = 1-2 days, 2 = 3-4 days, 3 = 5-6 days, 4 = 7 days). Means and standard deviations of physical activity behaviors at pretest, posttest, and follow-up are presented in Table 2.

Sleep Hygiene. To measure sleep health literacy, a measure was created that assessed *Beliefs* (17 items), *Disease* (4 items), *Child Sleep* (6 items), and *Child Sleep*

Problems (6 items). All subscales were rated on a 4-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree), responses were reverse-coded where necessary (higher scores = more knowledge) and average scores were calculated. For *Knowledge*, participants' responses were scored as correct (1) or incorrect (0) and a total score was calculated. Sleep knowledge tested participants' knowledge on how much sleep children and adults should get per night. *Beliefs* is a total score derived from *Disease*, *Child Sleep*, and *Child Sleep Problems*. *Disease* assessed participants' knowledge and beliefs about the relationship between sleep and health (e.g., Lack of sleep is related to obesity). *Child Sleep* assessed knowledge and beliefs about the influence of sleep on children's well-being (e.g., Sleep has no effect on your child's mood). *Child Sleep Problems* assessed knowledge and beliefs about common sleep problems in children (e.g., It is normal for preschoolers to wake up during the night). Means and standard deviations of health literacy for sleep at pretest, posttest, and follow-up are presented in Table 3.

The Tayside Children's Sleep Questionnaire (TCSQ; McGreavey, Donnan, Pagliari, & Sullivan, 2005) is a 10-item questionnaire that was originally designed to detect children who have sleep problems or disorders of initiating and maintaining sleep (DIMS). Parents are asked to rate their children's early morning arousal, nighttime disruption, and initial falling asleep problems on a 5-point scale ranging from *The Sleep Behavior Never Occurs* to *The Sleep Problems Happen Every Night* for items 2-10. For item 1, a different 5-point intensity scale is used to coincide with the content of the item.

Table 3. Descriptive statistics for sleep variables

Variable		Pretest (*N*=21)		Posttest (*N*=13)		Follow-up (*N*=9)	
	α	M	SD	M	SD	M	SD
HL Beliefs	0.80	2.86	0.36	3.18	0.41	3.21	0.51
HL Knowledge	-	0.48	0.51	1.08	0.64	0.50	0.53
HL Disease	0.54	2.70	0.53	3.27	0.55	3.17	0.56
HL Child Sleep	0.81	3.16	0.48	3.27	0.48	3.31	0.55
HL Child Sleep Problems	0.57	2.61	0.44	3.13	0.37	3.15	0.55
TCSQ Total	0.69	14.14	6.55	10.33	9.33	11.50	8.73
PIBBS-A	0.78	41.44	26.18	34.85	19.83	14.81	21.15
PIBBS-B	0.21	44.17	21.30	54.17	25.00	16.67	23.94
PIBBS-C	0.31	34.38	27.77	46.88	34.18	8.33	17.68
PIBBS-D	0.10	40.00	27.08	29.17	24.62	18.06	19.87
PIBBS-E	0.85	60.00	28.85	61.46	32.07	29.17	32.33
PIBBS-Total	-	44.77	15.92	41.67	13.92	30.74	9.78
TCSQ Core Sleep Problems	0.54	5.35	3.35	4.54	4.18	6.00	4.86
TCSQ Parent Interventions		3.17	2.09	3.00	2.65	3.17	2.99

Note. HL = health literacy; TCSQ = Tayside Child Sleep Questionnaire; PIBBS = Parent Interactive Bedtime Behavior Scale.

The TCSQ yields two factor scores in addition to the *Total Problem Score*: *Core Sleeping Problems* and *Parental Interventions*. This measure had good internal consistency (reliability alpha = 0.85), and discriminant validity.

The Parental Interaction Bedtime Behavior Scale (PIBBS; Morrell & Cortina-Borja, 2002) is a 17-item measure intended to depict the techniques used by parents at their children's bedtime. Parents rate their behavior on a 5-point scale ranging from *Never* to *Very Often*. The measure yields five scales and a total score. *Active Physical*

Comforting (PIBBS-A) is a measure of parents' strategy of actively putting their child to sleep (e.g., Stroke part of child or pat). *Encourage Autonomy (PIBBS-B)* is a measure of parents' strategy of having the child put himself to sleep (e.g., Leave to cry). *Settle by Movement (PIBBS-C)* is a measure of parents' strategy of using movement to settle the child (e.g., Car rides). *Passive Physical Comforting (PIBBS-D)* is a measure of parents' strategy of being physically present for the child to go to sleep without engaging in active comforting (e.g., Lie with child next to their bed). *Social Comforting (PIBBS-E)* is a measure of parents' strategy of using verbal and/or social interaction to put the child to sleep (e.g., Talking softly to the child). The *PIBBS-Total score* is the sum of all subscales except for *PIBBS-B*, which is subtracted from the score. The scale has reasonable reliability (reliability alpha = 0.712) and discriminant and construct validity (Morrell & Cortina-Borja, 2002). Morrell and & Cortina-Borja also suggested that the scale could be effectively used in longitudinal research evaluating change and the role of parental behavior. In order to make the measure more suitable for children not in infancy, minor alterations were made in the measure (e.g., replace cot with bed).

Means and standard deviations of the sleep behaviors at pretest, posttest, and follow-up are presented in Table 3.

Behavioral Functioning and Stress. To measure health literacy for children's behavioral functioning and stress, a measure was created that assessed *Behavior* (15 items), *Stress* (5 items), *Habits* (3 items), *Parent-Child Relationship* (3 items), *Temperament* (4 items), *Handling Child* (5 items), and *Disease* (4 items). All subscales were rated on a 4-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 =

Strongly Agree), responses were reverse-coded where necessary (higher scores = more knowledge) and average scores were calculated. *Behavior* is a total score derived from *Habits*, *Parent-Child Relationship*, *Temperament*, and *Handling Child*. *Stress* assessed participants' knowledge about the relationship between stress and mental health, and stress and caring for children (e.g., Parents who are not stressed are better able to care for their children). *Habits* assessed participants' knowledge about the reason children develop habits (e.g., Children may develop habits to help them cope with stress). *Parent-Child Relationship* assessed participants' knowledge about the effects of parent-child relationships (e.g., A good parent and child relationship at home makes for a good teacher and child relationship at school). *Temperament* assessed participants' knowledge about temperament (e.g., It is possible to change children's temperament). *Handling Child* assessed participants' knowledge about handling children's behavior (e.g., Children like it when parents talk and listen to them). *Disease* assessed participants' knowledge about the relationship between unhealthy habits and cigarette smoking and children's wellbeing (e.g., Baby-bottle syndrome is not a real health problem). Means and standard deviations of the health literacy for behavioral functioning and stress at pretest, posttest, and follow-up are presented in Table 4.

Parent depressive symptoms and stress were measured using the Center for Epidemiological Studies- Depression Scale (CES-D; Radloff, 1977) and Perceived Social Stress -14 (PSS-14; Cohen & Williamson, 1988) respectively. The CES-D is a 20-item measure of depressive symptoms intended to measure symptoms in the general population and is not used as a clinical tool. Individuals are asked to report their

Table 4. Descriptive statistics for behavioral functioning and stress variables

Variable		Pretest (*N*=21)		Posttest (*N*=13)		Follow-up (*N*=9)	
	α	M	SD	M	SD	M	SD
HL Child Behavior	0.79	3.14	0.33	3.19	0.36	3.08	0.42
HL Stress	0.80	3.02	0.57	3.40	0.45	3.25	0.60
HL Habits	0.62	2.92	0.46	3.15	0.48	3.17	0.56
HL Relationship	0.72	3.30	0.50	3.31	0.55	3.33	0.56
HL Temperament	0.50	2.98	0.44	2.92	0.31	2.84	0.44
HL Handling Child	0.69	3.31	0.43	3.35	0.37	3.08	0.35
HL Disease	0.85	3.16	0.51	3.19	0.53	3.03	0.87
CESD	0.89	33.33	10.04	31.15	9.29	33.50	8.49
PSS	0.57	39.75	6.30	39.00	5.19	36.22	8.47
Coping	0.70	20.90	5.31	20.92	5.28	20.78	6.36
Doctor Visit	0.33	6.56	1.58	6.67	1.83	5.89	3.06
PedsQL Physical	0.89	72.89	31.55	79.58	24.54	85.56	26.15
PedsQL Emotional	0.78	78.29	18.79	70.83	20.87	88.89	11.17
PedsQL Social	0.79	69.74	26.09	21.25	21.36	79.63	25.04
PedsQL Psychosocial	0.86	72.86	20.65	78.51	16.68	80.30	17.16
PedsQL Total	0.91	73.25	22.15	78.82	18.61	81.94	18.83
Eyberg	0.86	89.60	18.47	87.09	26.71	89.89	50.24

Note. HL = health literacy; CESD = Center for Epidemiological Studies- Depression Scale; PSS = Perceived Social Stress -14; PedsQL = Pediatric Quality of Life Inventory

depressive symptoms for the last week in 4 domains (Depressed Affect, Positive Affect, Somatic and Retarded Activity, Interpersonal; Radloff, 1977). They respond on a 4-point scale ranging from Rarely or None of the Time (< 1 day) to Most or All the Time (5-7 days). The CES-D was designed to be sensitive to change and, therefore, a good measure for this study. The CES-D has proven to be reliable with good internal consistency, acceptable test-retest reliability, good concurrent validity and construct validity, and is reliable across ethnic groups (Roberts, 1980). The PSS-14 is a 14-item

measure of individuals' perception that the situations in their lives are stressful and is not used as a diagnostic tool. Individuals are asked to report on their thoughts and feelings in the last month on a 5-point scale ranging from Never (1) to Very Often (5). The PSS-14 has good internal consistency (reliability alpha = 0.75) and construct validity (Cohen & Williamson, 1988).

To assess parent coping and doctor visit behaviors, a study-specific measure was created. *Coping* (7 items) was a measure of the extent to which participants used healthy coping strategies to deal with stress (e.g., Used deep breathing to help me relax and/or cope with stress). Participants' responded on a 5-point Likert scale (1 = Never, 2 = Almost Never, 3 = Sometimes, 4 = Fairly Often, 5 = Very Often). *Doctor visit behavior* (10 items) assessed how prepared participants' were for their children's doctors' visits and how well they prepared their children for the visits (e.g., Did you ask your pediatrician if your child was growing and developing normally?). Participants responded yes or no to the questions.

Children's HRQoL was assessed using the Pediatric Quality of Life Inventory – Short Form- Parent Report for Toddlers (PedsQL; Chan, Mangione-Smith, Burwinkle, Rosen & Varni, 2005; Varni, Seid, & Rode, 1999; Varni, Seid, & Kurtin, 2001). The PedsQL is a 15-item multidimensional measure designed to assess children's HRQoL. Parents are asked to report their children's physical, social, emotional, and school functioning on a 5-point scale ranging from Never to Almost Always. In addition to the scale scores, the PedsQL yields three summary scores: *Total Scale Score*, *Physical Health Summary Score*, and *Psychosocial Health Summary* Score. The PedsQL Parent

Proxy Report has shown good reliability (reliability coefficient = 0.9), and validity. It was designed to be used with community, school, and clinical pediatric populations, and is responsive to change over time (Varni et al., 2001).

Children's behavioral functioning was assessed using the Eyberg Child Behavior Inventory (ECBI; Eyberg, 1974). The ECBI is a 36-item parent rating of child behavior problems. Parents are asked to report on their children's behavior on a 7-point scale ranging from *Never* to *Always* and indicate if they view the behavior as a problem. The ECBI yields an Intensity Scale (frequency of problem) and a Problem Scale (tolerance of behavior and distress behavior causes).

Means and standard deviations of behavioral functioning and stress behaviors at pretest, posttest, and follow-up are presented in Table 4.

Procedures/Research Design

This study was completed in three phases over a 2-year period. The justification for the use of this research design was highlighted in *The Bioecological Framework for Understanding Preventive Care for Young Children* and *The Prevention Intervention Research Model* sections of the introduction.

Phase I – Focus Groups. In keeping with the tenets of community based participatory research approaches (i.e., meaningful community involvement in the early phases of planning), I conducted three community-based focus groups to gather more information about parents' risk and protective factors for health literacy and adopting healthy lifestyle choices. Before focus groups were conducted, the project was approved by the Texas A&M University Institutional Review Board (IRB) and College Station

Independent School District policy council. All focus groups were recorded and all participants completed consent forms. Focus groups were transcribed and content analyzed using thematic analyses (Appendix I), in addition to specific suggestions for interventions. The information gathered was compared with what was already outlined in the literature, and any information not addressed in the literature was added to the list of ideas to be incorporated in the intervention.

Focus Group 1. Head Start administrators, teachers, and family service workers were recruited with the help of the Head Start Program Director and asked to openly discuss their experiences on the barriers and protective factors to parents engaging in the targeted behaviors, the type of interventions they thought would work best and how they thought my project could build on what they already had in place. Upon completion of the focus group, participants received a $30 gift card for participation. See Appendix I(Focus Groups Summaries) for themes.

Focus Groups 2 and 3. The second and third focus groups comprised of Head Start parents (English- and Spanish-speaking). These parents were recruited through fliers and with the help of Head Start facilitators. Eight parents attended the English-speaking focus group and 10 parents attended the Spanish-speaking focus group. Parents were asked to discuss the barriers and protective factors to their engagement in healthy lifestyle choices, their general attitude towards healthy lifestyle choices, what type of interventions they would prefer, and their knowledge about risk and benefits about healthy lifestyle choices. Head Start parents were also asked to complete a demographic questionnaire. Upon

completion of the focus groups, parents received a $30 gift card for participation. See Appendix I (Focus Groups Summaries) for themes.

Phase II – Intervention Development. This phase coincides with Step 3 of IOM's Prevention Science Research Model and also considers Heller's (1996) criticism of the model. A group intervention was developed from the findings in the literature and the data gathered from the focus groups. As stated in the review, the intervention was experiential and designed to target parents. Further the intervention aimed to improve health literacy and healthy lifestyle choices and practices for four targeted areas: diet/nutrition, physical activity, sleep hygiene, and mental health. Instead of providing child care only, I developed activities for the children to engage in while their parents were in the group. The activities developed were designed to align with the areas of intervention for the group. For example, while parents engaged in the diet/nutrition module, children had opportunities to taste fresh fruits and vegetables, and the facilitator discussed why it was healthy for them.

Diet/nutrition, physical activity, sleep hygiene, parenting skills and mental wellness were the focus of the intervention because of information gathered from the focus groups. The data on risk and protective variables gathered from focus groups results were also utilized in the development of the intervention to ensure that the intervention addressed the needs of the parents. For example, parents identified neighborhood safety and money as barriers to physical activity for their children. To address this in the intervention, a book of indoor physical activities that required the use of items commonly found in the home was created for distribution. The book used bright

colors, graphics, and minimum words to illustrate how to engage in the activities to appeal to children, and the children played some of the games while parents were involved in the group session. Another example of how information from the focus groups was incorporated in the intervention was the addition of the behavior modification module. Parents discussed not knowing how to manage their children diagnosed with externalizing behavior problems beyond medicating them and reducing children's unhealthy habits. The parenting skills module included a variety of skills to address behavioral problems and there were several opportunities for practice during the session, while parents engaged in this module, children learned the appropriate and inappropriate way to behave in a variety of situations (e.g., how best to get approval from parents).

After the intervention was developed, Head Start administrators were asked to review the intervention and give feedback. The feedback received was used to modify the intervention where necessary. An amendment was sent to IRB for approval of the preliminary version of the intervention. The intervention was then implemented on a pilot group of five Head Start parents (randomly chosen from those who attended the focus groups), who gave feedback on the appropriateness of the language used and suggestions for components that should be added or changed. Feedback included change in the layout of some materials, addition of information and materials that could be used in the home to exercise (e.g., bottle of water as weights, foot under chair while doing sit ups) and resources for families with children with food allergies. This feedback was used to further modify the intervention.

During this phase, I also developed instruments to measure intervention-specific variables to be used as outcome measures in addition to the standardized measures that were discussed in the *Measures* subsection. A parent manual and other materials needed to carry out the intervention were also developed.

Phase III – Pilot Intervention. This phase also coincides with Step 3 of IOM's Prevention Science Research Model, which requires conducting and analyzing pilot studies. This phase allowed for sufficient data to be collected to estimate sample size needed for assessment of the intervention on a wider scale before dissemination and for further modifications to be made to the intervention. As mentioned, recruitment of participants was done by Head Start facilitators and Aggieland Pregnancy Outreach Coordinators. Fliers with information about the intervention and an interest form (for interested participants to complete) were provided to the agencies and they recruited participants during meetings, home visits, and by sending fliers home with students. The agencies provided me with a list of interested individuals and I contacted them directly by phone. Four possible day/time slots (to remain constant for five consecutive weeks) for groups were provided to participants and they chose the day and time that was most convenient to them. Groups were held on Monday mornings, and Monday, Tuesday, and Wednesday evenings. Three of the groups were held at the Aggieland Pregnancy Outreach premises and one was held at Barbara Bush Parent Center. These locations had separate daycare rooms and participants were familiar with both locations. Breakfast was provided for the morning group meetings and dinner was provided for the evening group meetings.

I implemented the four group interventions. The intervention was five sessions lasting an hour and a half each. Participants met once a week for a session. Each week a new topic was covered in the intervention (Week 1 – diet/nutrition, Week 2 – physical activity, Week 3 – sleep, Week 4 – bringing out the best in children, also known as, positive parenting, and Week 5 – stress reduction and navigating the health care system). Each session had a health literacy and health behavior component and followed the manual created for the intervention. Participants received information weekly related to the topic to add to their parent manual that was distributed on the first day. They also received practical materials related to the topic such as kitchen scales, meal planners, and blank grocery shopping lists during the diet/nutrition week. As stated before, participants' children also did activities related to the weekly topic while their parents were involved in the session. Undergraduate research assistants were trained to carry out the activities with the children and this was also manualized.

All participants completed a consent form, demographic questionnaire, and pretest measures at the beginning of the intervention. At the end of the intervention, participants completed posttest measures. Participants completed follow-up measures one month after the completion of the intervention. Participants also completed module evaluations and behavior practice forms each week. Pretest, posttest, and follow-up measures took approximately 30 – 45 minutes to complete while module evaluations and behavior practice forms took less than two minutes to complete. In addition to intervention materials, participants received monetary compensation for their time (see Table 5 for payment schedule).

Table 5. Payment schedule for participants

Activity	Payment
Measures – Time 1 – pretest	$10
Measures – Time 2 – posttest	$10
Measures – Time 3 – 1 month follow-up	$20
Group Intervention – Week 1	$10
Group Intervention – Week 2	$10
Group Intervention – Week 3	$10
Group Intervention – Week 4	$10
Group Intervention – Week 5	$10

Statistical Analyses

Descriptive statistics for each time point were computed and presented in Tables 1 through 4. Correlations within target behaviors were also computed at each time point and presented in Appendices II through XIII. To address the project objectives, several questions were analyzed. First, it was hypothesized that parents' preventive health behaviors for themselves and their children would be predictive of their health literacy. Multiple regression analyses were used to evaluate this hypothesis. Results reflecting health behaviors significantly predicting health literacy would confirm this hypothesis. To test the second hypothesis of difference in health literacy from pretest to posttest were correlated with difference in behavior from pretest to posttest, pretest-posttest difference scores (descriptive statistics for difference scores presented in Appendices XIV through XVII) were computed and Pearson correlations were computed. To test hypotheses three and four (the intervention would lead to increased health literacy and preventive health behavior for parents and children over time), multilevel model analyses were conducted. All analyses were conducted using SPSS 16.0.

RESULTS

Note: All of the health literacy measures and some of the behavior measures were created for the study. The sample size was not large enough to allow for reliability and validity statistics to be calculated. Therefore, the extent to which items that were grouped together to form variable scores actually reliably fit together cannot be determined and this should be kept in mind when interpreting the results. A major limitation of this project was the lack of a comparison group. The results and discussions regarding hypotheses 3 and 4 should be viewed with caution because assumptions are being made about the role of the intervention in health literacy and behavior change. However, in order to confirm this relationship, a comparison group should have been used.

Hypothesis 1

Diet/Nutrition. Of the diet/nutrition health literacy variables, food knowledge and disease were predicted by diet/nutrition behaviors (Table 6). Specifically, FI on fruits and vegetables was somewhat negatively related to food knowledge (β = -0.81, p = 0.05), such that participants with more factual knowledge about foods were *less* likely to encourage their children to eat fruits and vegetables. Conversely, being enrolled in WIC was positively related to food knowledge (β = 0.67, p = 0.02). FI on fruits and vegetables (β = 0.89, p = 0.02) was positively related to disease and somewhat negatively related to grocery shopping behavior (β = -0.71, p = 0.05), suggesting that participants' who were knowledgeable about the relationship between disease and diet/nutrition were more likely to encourage their children to eat fruits and vegetables but less likely to engage in

positive grocery shopping behavior. Children's fruits and vegetables consumption were also predicted by participants' diet/nutrition behaviors (Table 7). Specifically, income (β = -0.57, p = 0.04) was negatively related to children's fruits consumption and FI on low fat foods consumption (β = 0.87, p = 0.02) was positively related to children's fruit consumption. Similarly, children's vegetable consumption was positively related to FI on low fat foods consumption (β = 0.90, p = 0.04), suggesting that children of participants who encouraged them to eat low fat foods consumed more fruits and vegetables than those whose parents did not encourage them to eat low fat foods.

Table 6. Hypothesis 1: Multiple regression estimates for predicting health literacy from diet/nutrition behavior

Variable	HL Food Knowledge	HL Disease	HL Diet Beliefs	HL General Diet	HL General Food	HL Child Diet
	β	β	β	β	β	β
Education	0.48	-0.47†	-0.00	-0.06	-0.07	0.07
WIC	0.67*	0.08	-0.48†	-0.54	-0.41	-0.36
Income	-0.35	0.20	0.05	0.25	0.13	-0.19
FI Fruits & Vegetables	-0.81†	0.89*	-0.07	0.20	-0.16	-0.07
FI Low Fat	0.47	0.08	0.04	-0.57	0.31	0.09
DNPA Lifestyle	0.22	0.04	0.46	0.27	0.36	0.50
Grocery Shopping	-0.24	-0.71†	-0.39	-0.02	-0.27	-0.56
R^2	0.56	0.66	0.59	0.41	0.49	0.57
Adjusted R^2	0.31	0.46	0.35	0.03	0.16	0.31
F	2.21	3.28*	2.43†	1.07	1.48	2.24

Note. HL = health literacy; WIC = Women Infant and Child Program, FI = family influence, DNPA = diet/nutrition physical activity.† $p < 0.10$; * $p < 0.05$.

Table 7. Hypothesis 1: Multiple regression estimates for predicting children and participants' fruits and vegetables consumption from diet/nutrition behavior

Variable	Child Fruits β	Child Vegetables β	Parent Fruits β	Parent Vegetables β
Education	0.19	-0.12	-0.07	0.11
WIC	-0.06	0.49	-0.27	0.20
Income	-0.57*	-0.40	-0.44	-0.16
FI Fruits & Vegetables	-0.11	0.24	-0.13	-0.25
FI Low Fat	0.87*	0.90*	0.51	0.80†
DNPA Lifestyle	0.27	-0.28	0.29	0.07
Grocery Shopping	-0.38	-0.64	-0.09	-0.13
R^2	0.71	0.56	0.38	0.35
Adjusted R^2	0.49	0.21	-0.01	-0.06
F	3.20*	1.60	0.96	0.86

Note. WIC = Women Infant and Child Program, FI = family influence, DNPA = diet/nutrition physical activity.
† $p < 0.10$; * $p < 0.05$.

Physical Activity. Of physical activity health literacy variables, physical activity knowledge was predicted by participants' physical activity behaviors (Table 8). Specifically, the relationship with FI on sedentary activity and physical activity knowledge was negative ($\beta = -0.54$, $p = 0.04$), suggesting that participants who discouraged their children from engaging in sedentary activity had less factual knowledge about physical activity. Participants' reported sedentary activity, physical activity with their children, and sedentary activity with their children were also predicted by their other physical activity behaviors (Table 9). For participants' sedentary activity, the amount of hours worked ($\beta = -0.74$, $p = 0.02$) was negatively related to the behavior,

while income (β = 0.59, p = 0.09) was somewhat positively correlated with the behavior. For participants' reported physical activity with children, income was negatively related to the behavior (β = -0.87, p = 0.04), while DNPA lifestyle was negatively predictive of participants' reported sedentary activity with their children.

Table 8. Hypothesis 1: Multiple regression estimates predicting health literacy from physical activity behaviors

Variable	HL PA Beliefs β	HL PA Knowledge β	HL General PA β	HL PA Disease β	HL Child PA β
Education	0.22	-0.28	0.01	0.22	0.26
Income	-0.02	0.09	0.11	-0.16	-0.04
FI PA	-0.21	-0.28	-0.27	-0.31	0.02
FI SA	-0.26	-0.54*	-0.04	-0.23	-0.27
DNPA Lifestyle	0.30	-0.01	0.15	0.34	0.26
R^2	0.25	0.41	0.12	0.27	0.20
Adjusted R^2	-0.04	0.19	-0.22	-0.02	-0.17
F	0.85	1.92	0.36	0.94	0.54

Note. HL = health literacy; FI = family influence; PA = physical activity; SA = sedentary activity; DNPA = diet/nutrition physical activity.
† $p < 0.10$; * $p < 0.05$.

Table 9. Hypothesis 1: Multiple regression estimates for prediction children's and participants' physical and sedentary activity from physical activity behaviors

Variable	Child PA Mins. β	Child SA Mins. β	Parent PA Mins. β	Parent SA Mins. β	Parent/Child PA β	Parent/Child SA β
Education	-0.13	0.15	-0.34	-0.09	-0.09	-0.12
Income	-0.77	-0.29	-0.32	0.59†	-0.87*	-0.18
Hours work/week	0.63	0.03	0.16	-0.74*	0.60	-0.03
FI PA	-0.07	0.18	0.04	-0.19	-0.16	0.14
FI SA	0.08	-0.10	-0.11	-0.33	0.21	0.04
DNPA	-0.07	-0.43	0.02	-0.34	0.28	-0.54*
Lifestyle						
R^2	0.32	0.36	0.22	0.57	0.40	0.43
Adjusted R^2	-0.10	-0.03	-0.14	0.36	0.11	0.14
F	0.77	0.94	0.62	2.68†	1.35	1.50

Note. FI = family influence; PA = physical activity; SA = sedentary activity; DNPA = diet/nutrition physical activity, Mins. = minutes. † $p < 0.10$; * $p < 0.05$.

Sleep Hygiene. Of sleep health literacy variables, beliefs, knowledge, disease, and child sleep problems were predicted by participants' sleep behaviors (Table 10). Specifically, participants' settling their children by movement (PIBBS-C; $\beta = -1.13$, $p = 0.02$) and engaging children in active physical comforting (PIBBS-A; $\beta = 1.93$, $p < 0.01$) was related to overall beliefs about sleep, such that participants with higher belief scores were less likely to settle their children by movement and more likely to engage in active physical comforting. Additionally, education ($\beta = 0.45$, $p = 0.09$) and parent interventions ($\beta = -0.53$, $p = 0.06$) approached significance in predicting sleep beliefs, such that beliefs health literacy was related to more education and less parent

interventions. Regarding knowledge, participants with more factual knowledge about sleep tended to have somewhat lower education (β = -0.82, p = 0.05) and somewhat lower core sleep problems (β = -0.95, p = 0.06). They also had lower parent interventions (β = -1.07, p = 0.02) and somewhat higher social comforting of children (PIBBS-E; β = 0.94, p = 0.09). Participants with more knowledge about the relationship between sleep and health (Disease) had lower parent interventions (β = -0.57, p = 0.04) and settling children by movement (PIBBS-C; β = -1.06, p = 0.02), but significantly higher active physical comforting (PIBBS-A; β = 2.14, p < 0.01). Regarding child sleep problems, participants with more knowledge about common sleep problems in children reported higher levels of education (β = 0.53, p = 0.03), income (β = 0.43, p = 0.04), and active physical comforting of children (PIBBS-A; β = 1.22, p = 0.01). Participants with more knowledge about common sleep problems also reported lower passive physical comforting (PIBBS-D; β = -0.76, p < 0.01) and somewhat lower encouragement of autonomy (PIBBS-B; β = -0.42, p = 0.07). No sleep behaviors predicted participants' knowledge of the influence of sleep on children's wellbeing.

Table 10. Hypothesis 1: Multiple regression estimates for predicting health literacy from sleep behaviors

Variable	HL Beliefs β	HL Knowledge β	HL Disease β	HL Child Sleep β	HL Child Sleep Problems β
Education	0.45†	-0.82†	0.36	0.30	0.53*
Income	0.21	-0.01	-0.08	0.01	0.43*
TCSQ Core Sleep Problems	-0.22	-0.95†	-0.47	0.01	0.21
TCSQ Parent Interventions	-0.53†	-1.07*	-0.57*	-0.43	-0.22
PIBBS-A	1.93**	0.77	2.14**	1.02	1.22*
PIBBS-B	-0.02	0.27	0.16	0.16	-0.42†
PIBBS-C	-1.13*	-0.58	-1.06*	-1.07	-0.10
PIBBS-D	-0.12	-0.23	-0.05	0.41	-0.76**
PIBBS-E	-0.06	0.94†	-0.25	-0.33	0.10
R^2	0.91	0.80	0.92	0.63	0.94
Adjusted R^2	0.74	0.44	0.77	-0.04	0.82
F	5.50*	2.20	6.09*	0.94	7.96*

Note. HL = health literacy; TCSQ = Tayside Child Sleep Questionnaire; PIBBS = Parent Interactive Bedtime Behaviour Scale.
† $p < 0.10$; * $p < 0.05$; ** $p \leq 0.01$.

Behavioral Functioning and Stress. Of the health literacy for stress and child behavioral functioning variables, stress, habits, parent-child relationship, and disease were predicted by participants' stress and children's behavior (Table 11). Specifically, participants with higher levels of education ($\beta = 0.90$, $p = 0.03$), higher levels of stress ($\beta = 1.24$, $p = 0.03$), lower levels of depression ($\beta = -1.23$, $p = 0.01$) and whose children had a higher physical HRQoL ($\beta = 0.81$, $p = 0.04$) had more knowledge about the relationship between stress and mental health. Children having somewhat lower

emotional (β = -0.79, p = 0.07) and higher social (β = 0.63, p = 0.08) HRQoL was also associated with more knowledge about the relationship between stress and mental health in participants. Regarding health literacy for habits, lower levels of depression (β = -1.36, p = 0.06) was somewhat related to more knowledge about habits. Regarding health literacy for parent-child relationships, participants with higher perceived stress (β = 1.51, p < 0.01) and lower levels of depression (β = -1.05, p = 0.02) had more knowledge about the effect of parent-child relationships. Lower emotional (β = -0.55, p = 0.08) and higher social (β = 0.62, p = 0.09) HRQoL was also somewhat related to participants' knowledge of the effect of parent-child relationships. Regarding health literacy for disease, higher levels of perceived stress (β = 1.67, p = 0.08) was somewhat related to participants' knowledge about the relationship between unhealthy habits and cigarette smoking and children's wellbeing. Children's behavioral problems were also related to participants' stress and children's HRQOL (Table 12). Participants with somewhat lower depression scores (β = -1.00, p = 0.05) and higher physical HRQoL (β = 0.85, p = 0.04) for their children reported higher intensity of behavioral problems for their children. Higher intensity of children's behavioral problems was also related to somewhat higher perceived stress (β = 1.04, p = 0.06) and lower emotional HRQOL (β = -0.80, p = 0.07).

Table 11. Hypothesis 1: Multiple regression estimates for predicting health literacy from behavioral functioning and stress

Variable	HL Child Behavior β	HL Stress β	HL Habits β	HL Relationship β	HL Temper-ament β	HL Handling Child β	HL Disease β
Education	0.28	0.90*	0.25	0.36	0.17	0.23	0.59
Income	-0.14	-0.36	-0.22	0.04	0.18	-0.45	-0.63
PSS	0.62	1.24*	0.91	1.51**	0.13	0.19	1.67†
CESD	-0.72	-1.13*	-1.36†	-1.05*	-0.43	-0.23	-1.42
Eyberg	-0.05	N/A	-0.29	-0.25	0.07	-0.08	-0.45
PedsQL Emotional	-0.38	-0.79†	-0.89	-0.55†	-0.27	-0.14	-0.97
PedsQL Social	0.49	0.63†	0.46	0.62†	0.31	0.17	0.83
PedsQL Physical	N/A	0.81*	0.77	N/A	N/A	N/A	0.87
Coping	N/A	0.32	N/A	N/A	N/A	N/A	0.34
R^2	0.30	0.77	0.59	0.65	0.38	0.14	0.56
Adjusted R^2	-0.31	0.47	0.12	0.34	-0.16	-0.62	-0.11
F	0.50	2.52	1.26	2.09	0.71	0.18	0.83

Note. HL = health literacy; PSS = perceived social stress; CESD = Center for Epidemiological Studies Depression Scale; PedsQL = pediatric quality of life; N/A = not applicable.

† $p < 0.10$; * $p < 0.05$; ** $p \leq 0.01$.

Table 12. Hypothesis 1: Multiple regression estimates for predicting behavior from children and participants' functioning

Variable	Eyberg β	Doctor's Visit β
Education	0.44	0.21
Income	-0.32	-0.15
PSS	1.04†	-0.37
CESD	-1.00†	0.43
Eyberg	N/A	-0.38
PedsQL Emotional	-0.80†	0.82
PedsQL Social	-0.10	-0.42
PedsQL Physical	0.85*	-0.19
R^2	0.61	0.54
Adjusted R^2	0.27	-0.07
F	1.77	0.88

Note. HL = health literacy; PSS = perceived social stress; CESD = Center for Epidemiological Studies Depression Scale; PedsQL = pediatric quality of life; N/A = not applicable.
† $p < 0.10$; * $p < 0.05$.

Hypothesis 2

Diet/Nutrition. When the pretest-posttest difference scores for health literacy for diet/nutrition were correlated with the pretest-posttest difference scores for diet/nutrition behaviors, food knowledge and parent vegetables were negatively correlated (r = -0.58, p = 0.05). These results suggest that as participants' factual knowledge about food improved, their reported consumption of vegetables decreased. A similar trend was found for general food knowledge and children's fruits consumption (r = -0.63, p = 0.10), such that as participants' knowledge and beliefs about foods and eating became more accurate, their children's fruit consumption decreased. The relationship between

general diet and DNPA lifestyle ($r = 0.52$, $p = 0.10$) was somewhat positive, suggesting that as participants' knowledge about diet and nutrition improved, their lifestyle choices for both diet/nutrition and physical activity in the home also improved. Correlations of difference scores for health literacy of diet/nutrition and diet/nutrition behaviors are presented on Table 13.

Table 13. Hypothesis 2: Correlations of pretest-posttest difference scores for health literacy for diet/nutrition compared with pretest-posttest difference scores for diet/nutrition behaviors

Variable	HL Food Knowledge *r*	HL Disease *r*	HL Diet Beliefs *r*	HL General Diet *r*	HL General Food *r*	HL Child Diet *r*
Child Fruits	0.09	-0.38	-0.28	-0.09	-0.63†	0.20
Child Vegetables	-0.04	0.00	-0.47	-0.21	-0.51	-0.17
Parent Fruits	-0.32	0.26	-0.13	-0.04	-0.16	-0.26
Parent Vegetables	-0.58†	-0.01	0.06	-0.18	0.16	-0.02
FI Fruits & Vegetables	-0.26	0.09	-0.45	-0.31	-0.27	-0.39
FI Low Fat	-0.6	0.37	-0.24	-0.08	-0.11	-0.45
DNPA Lifestyle	0.24	-0.11	0.40	0.52†	0.29	0.10
Grocery Shopping	0.41	0.48	0.33	0.25	0.31	0.10

Note. HL = health literacy, FI = family influence, DNPA = diet/nutrition physical activity.
† $p < 0.10$.

Physical Activity. When the pretest-posttest difference scores for health literacy for physical activity were correlated with the pretest-posttest difference scores for physical activity behaviors, physical activity knowledge and FI on sedentary activity

were negatively correlated (r = -0.58, p = 0.05). This suggests that as participants' factual knowledge about physical activity improved, they spent less time discouraging their children from engaging in sedentary activity. Conversely, as factual knowledge for physical activity increased, participants' reported physical activity somewhat increased (r = 0.50, p = 0.10). The relationship between DNPA Lifestyle and Child Physical Activity (r = -0.72, p < 0.01) was negative, suggesting that as participants' knowledge about the relationship between physical activity and children's well-being improved, their diet/nutrition and physical activity lifestyle choices for the home worsened. Similarly, the relationship between Child Physical Activity and participants' reported sedentary activity with their children was somewhat negative (r = -0.55, p = 0.08), such that as participants' knowledge about the relationship between physical activity and children's well-being improved, they spent less time engaging in sedentary activity with their children. Correlations of difference scores for health literacy of physical activity and physical activity behaviors are presented on Table 14.

Table 14. Hypothesis 2: Correlations of pretest-posttest difference scores for health literacy for physical activity with pretest-posttest difference scores for physical activity behaviors

Variable	HL PA Beliefs *r*	HL PA Knowledge *r*	HL General PA *r*	HL PA Disease *r*	HL Child PA *r*
FI PA	0.08	-0.11	-0.01	-0.17	0.09
FI SA	-0.03	-0.58†	0.18	0.24	-0.24
DNPA Lifestyle	-0.47	-0.44	0.03	0.12	-0.72*
Child PA Mins.	-0.27	0.48	-0.49	-0.08	-0.07
Child SA Mins.	-0.25	-0.31	0.01	-0.14	-0.40
Parent PA Mins.	0.27	0.50†	-0.03	-0.37	0.39
Parent SA Mins.	0.10	-0.24	0.40	-0.02	-0.20
Parent/Child PA	0.16	0.21	0.03	0.26	0.14
Parent/Child SA	-0.44	-0.14	-0.24	0.37	-0.55†

Note. FI = family influence; PA = physical activity; SA = sedentary activity; DNPA = diet/nutrition physical activity; Mins. = minutes.
† $p < 0.10$; * $p \leq 0.01$.

Sleep Hygiene. When the pretest-posttest difference scores for health literacy for sleep were correlated with the pretest-posttest difference scores for sleep behaviors, sleep beliefs was correlated with a few variables. Specifically, sleep beliefs was positively correlated with settle by movement (PIBBS-C; $r = 0.68$, $p = 0.02$) and somewhat positively correlated with active physical comforting (PIBBS-A; $r = 0.62$, $p = 0.06$), and total parent bedtime behaviors (PIBBS-Total; $r = 0.60$, $p = 0.07$). This suggests that as participants' general beliefs about sleep improved, their unhealthy bedtime behaviors worsened. Conversely as participants' knowledge about the relationship between sleep and children's wellbeing improved, children's sleep problems

(TCSQ Core Sleep Problems) decreased (r = -0.84, p = 0.02). As participants' knowledge about common sleep problems in children improved, their settle by movement behaviors (PIBBS-C; r = 0.62, p = 0.03) and total child sleep problem behaviors (TCSQ-Total; r = 0.82, p = 0.05) became worse, while total parent bedtime behaviors (PIBBS-Total; r = 0.56, p = 0.10) also worsened. Correlations of difference scores for health literacy of sleep and sleep behaviors are presented on Table 15.

Table 15. Hypothesis 2: Correlations of pretest-posttest difference scores for health literacy for sleep with pretest-posttest difference scores for sleep behaviors

	HL Beliefs	HL Knowledge	HL Disease	HL Child Sleep	HL Child Sleep Problems
Variable	*r*	*r*	*r*	*r*	*r*
PIBBS-A	0.62†	0.27	0.28	0.10	0.53
PIBBS-B	0.35	0.43	0.17	0.20	0.29
PIBBS-C	0.68*	0.16	0.25	0.17	0.61*
PIBBS-D	0.10	-0.22	0.06	0.12	-0.18
PIBBS-E	0.44	0.21	0.09	0.07	0.36
PIBBS-Total	0.60†	0.20	0.22	0.08	0.56†
TCSQ Total	-0.13	-0.23	-0.17	-0.66	0.82†
TCSQ Core Sleep Problems	-0.31	-0.35	-0.34	-0.84*	0.20
TCSQ Parent Intervention	0.28	-0.52	0.30	-0.17	0.29

Note. HL = health literacy; TCSQ = Tayside Child Sleep Questionnaire; PIBBS = Parent Interactive Bedtime Behaviour Scale.
† $p < 0.10$; * $p < 0.05$.

Behavioral Functioning and Stress. When the pretest-posttest difference scores for health literacy for behavioral functioning and stress were correlated with the pretest-posttest difference scores for child behavior and stress variables, health literacy for child behavior and parent coping behaviors were positively correlated ($r = 0.66$, $p = 0.01$). This result suggests that improvements in knowledge about children's behavior were related to improvements in parents' stress management for themselves. As parents' knowledge about the effect of parent-child relationships ($r = -0.72$, $p = 0.01$) and unhealthy habits/children's wellbeing relationship improved ($r = -0.69$, $p = 0.03$), the intensity of child behavioral problems significantly decreased. An increase in knowledge about handling children's behavior was also related to an increase in perceived stress ($r = 0.62$, $p = 0.04$). An increase in participants' level of depression was somewhat related to an increase in participants' knowledge about the effect of parent-child relationships ($r = 0.58$, $p = 0.06$). Conversely, an increase in knowledge about children's habits was somewhat related to a decrease in depression ($r = -0.53$, $p = 0.09$). An increase in knowledge about children's habits was also somewhat related to a decrease in participants' preparedness for their children's doctors' visits ($r = -0.55$, $p = 0.08$). An increase in participants' knowledge about the relationship between stress and mental health was somewhat related to a decrease in use of coping skills for stress ($r = -0.48$, $p = 0.10$), while an improvement in participants' knowledge of the effects of parent-child relationships was related to an increase in the use of coping skills ($r = 0.50$, $p = 0.09$). Correlations of difference scores for health literacy for behavioral functioning and stress and child behavior and reported stress are presented on Table 16.

Table 16. Hypothesis 2: Correlations of pretest-posttest difference scores for health literacy for behavioral functioning and stress with pretest-posttest difference scores for behavioral functioning and stress behaviors

Variable	HL Behavior *r*	HL Stress *r*	HL Habits *r*	HL Relationship *r*	HL Temperament *r*	HL Handling Child *r*	HL Disease *r*
CESD	0.07	-0.04	-0.53†	0.58†	-0.24	0.28	0.38
PSS	0.20	0.13	-0.24	0.44	-0.35	0.62*	0.33
Coping	0.66*	-0.48†	0.39	0.50†	0.43	-0.00	-0.10
Doctor Visit	-0.07	0.32	-0.55†	0.41	-0.20	0.11	0.29
PedsQL Physical	0.19	-0.17	-0.28	0.50	0.10	-0.03	0.41
PedsQL Emotional	0.06	0.10	-0.24	0.40	-0.10	0.00	0.33
PedsQL Social	-0.04	-0.10	-0.13	0.24	0.17	-0.46	0.28
PedsQL Psychosocial	-0.14	0.13	-0.25	0.31	-0.04	-0.40	0.32
PedsQL Total	-0.08	0.07	-0.32	0.44	-0.10	-0.29	0.42
Eyberg	-0.21	-0.06	0.22	-0.72*	0.31	-0.19	-0.69*

Note. HL = health literacy; PSS = perceived social stress; CESD = Center for Epidemiological Studies Depression Scale; PedsQL = pediatric quality of life; N/A = not applicable.
† $p < 0.10$; * $p < 0.05$.

Hypotheses 3 & 4

Diet/Nutrition. Results for multi-level models for all diet/nutrition variables are presented in Table 17 and Table 18. Participants' knowledge of the relationship between

diet/nutrition and disease was significantly lower at posttest (B = -0.32, t = -2.07, p = 0.05) and somewhat lower at follow-up (B = -0.33, t = -1.72, p = 0.10) when compared to pretest. These results suggest that the intervention was not successful at improving participants' knowledge of the relationship between diet/nutrition and disease. Participants' knowledge of the relationship between diet/nutrition and disease was somewhat positively related to education (B = 0.08, t = 1.80, p = 0.10). Participants' overall knowledge and beliefs about diet/nutrition, including its impact on their children and healthy eating (Diet Beliefs), did not change from pretest to posttest (B = 0.13, t = 1.66, p = 0.12) or from posttest to follow-up (B = 0.10, t = 1.00, p = 0.33), however it improved from pretest to follow-up (B = 0.23, t = 2.35, p = 0.03). Regarding participants' specific knowledge and beliefs about diet/nutrition (General Diet), an improvement was seen at posttest (B = 0.53, t = 3.27, $p < 0.01$) and follow-up (B = 0.56, t = 3.01, $p < 0.01$) when compared to pretest, while no significant change was seen between posttest and follow-up (B = 0.03, t = 0.17, p = 0.86), suggesting that the intervention may have been successful in improving health literacy in the domain and these improvements were maintained for at least one month post-intervention. Both knowledge and beliefs about foods and healthy eating (General Food) and influence of diet/nutrition on children's wellbeing (Child Diet) were only predicted by participants' education with the relationship being positive.

Regarding behaviors, children's reported vegetable consumption increased from pretest to follow-up (B = 0.93, t = 2.16, p = 0.05), but did not significantly increase from pretest to posttest (B = 0.36, t = 0.91, p = 0.34) and posttest to follow-up (B = -0.01, t = -0.06, p = 0.96). Participants' reported fruit consumption increased from pretest to posttest (B = 0.68, t = 2.84, p = 0.01), but no significant changes were noted from pretest to follow-up (B = 0.20, t = 0.70, p = 0.49) or posttest to follow-up (B = -0.48, t = -1.66, p = 0.12). Similarly, participants' reported vegetable consumption increased from pretest to posttest (B = 0.93, t = 2.25, p = 0.04), but no significant changes were noted from pretest to follow-up (B = 0.59, t = 1.20, p = 0.25) or posttest to follow-up (B = -0.34, t = -0.67, p = 0.51). No significant changes between time points were noted for Food Knowledge, General Food, Child Diet, Child Fruits, FI on Fruits and Vegetables, FI on Low Fat, DNPA Lifestyle, and Grocery Shopping Behavior.

Table 17. Hypotheses 3 & 4: Multilevel model predicting change in diet/nutrition variables with pretest as the reference group

Dependent Variables	Parameters	B	Std Error	*t*	*p-value*
HL Knowledge	Education	0.08	0.16	0.46	0.653
	Income	-0.06	0.10	-0.56	0.583
	Posttest vs. Pretest	0.29	0.50	0.58	0.569
	Follow-up vs. Pretest	-0.44	0.61	-0.72	0.481
HL Disease	Education	0.08	0.05	1.80	0.099
	Income	0.04	0.03	1.28	0.221
	Posttest vs. Pretest	-0.32	0.16	-2.07	0.050
	Follow-up vs. Pretest	-0.33	0.19	-1.72	0.097
HL Diet Beliefs	Education	0.10	0.04	2.31	0.039
	Income	0.02	0.03	0.74	0.473
	Posttest vs. Pretest	0.13	0.08	1.66	0.115
	Follow-up vs. Pretest	0.23	0.10	2.35	0.031
HL General Diet	Education	0.12	0.07	1.75	0.102
	Income	0.02	0.04	0.46	0.652
	Posttest vs. Pretest	0.53	0.16	3.27	0.003
	Follow-up vs. Pretest	0.56	0.19	3.01	0.007
HL General Food	Education	0.05	0.03	1.94	0.086
	Income	0.03	0.02	1.67	0.122
	Posttest vs. Pretest	0.12	0.08	1.50	0.151
	Follow-up vs. Pretest	0.17	0.10	1.73	0.101
HL Child Diet	Education	0.18	0.08	2.15	0.052
	Income	-0.00	0.05	-0.04	0.971
	Posttest vs. Pretest	-0.01	0.13	-0.08	0.939
	Follow-up vs. Pretest	0.21	0.16	1.26	0.225
Child Fruits	Education	0.17	0.20	0.84	0.418
	Income	-0.07	0.11	-0.60	0.556
	Posttest vs. Pretest	0.52	0.32	1.65	0.117
	Follow-up vs. Pretest	0.11	0.34	0.31	0.759

Note. HL = health literacy; FI = family influence; DNPA = diet/nutrition physical activity.

Table 17. Continued

Dependent Variables	Parameters	B	Std Error	*t*	*p-value*
Child Vegetables	Education	0.13	0.25	0.53	0.609
	Income	-0.01	0.14	-0.04	0.967
	Posttest vs. Pretest	0.36	0.40	0.91	0.375
	Follow-up vs. Pretest	0.93	0.43	2.16	0.046
Parent Fruits	Education	-0.09	0.21	-0.40	0.692
	Income	-0.17	0.12	-1.36	0.194
	Posttest vs. Pretest	0.68	0.24	2.84	0.011
	Follow-up vs. Pretest	0.20	0.29	0.70	0.494
Parent Vegetables	Education	0.05	0.21	0.24	0.810
	Income	0.06	0.13	0.46	0.653
	Posttest vs. Pretest	0.93	0.41	2.25	0.036
	Follow-up vs. Pretest	0.59	0.49	1.20	0.245
FI Fruits & Vegetables	Education	0.03	0.08	0.41	0.688
	Income	0.06	0.06	1.08	0.290
	Posttest vs. Pretest	-0.12	0.34	-0.35	0.727
	Follow-up vs. Pretest	-0.27	0.38	-0.71	0.481
FI Low Fat	Education	-0.00	0.10	-0.04	0.970
	Income	0.07	0.07	1.01	0.337
	Posttest vs. Pretest	-0.07	0.37	-0.20	0.844
	Follow-up vs. Pretest	0.29	0.42	0.70	0.491
DNPA Lifestyle	Education	-0.03	0.08	-0.35	0.740
	Income	0.07	0.05	1.43	0.186
	Posttest vs. Pretest	-0.08	0.20	-0.39	0.702
	Follow-up vs. Pretest	0.22	0.24	0.91	0.377
Grocery Shopping Behavior	Education	-0.08	0.05	-1.51	0.164
	Income	-0.01	0.03	-0.34	0.737
	Posttest vs. Pretest	-0.11	0.15	-0.72	0.483
	Follow-up vs. Pretest	0.05	0.18	0.27	0.792

Note. HL = health literacy; FI = family influence; DNPA = diet/nutrition physical activity.

Table 18. Hypotheses 3 & 4: Multilevel model predicting change in diet/nutrition variables with posttest as the reference group

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
HL Food Knowledge	Education	0.08	0.16	0.46	0.653
	Income	-0.06	0.10	-0.56	0.583
	Pretest vs. Posttest	-0.29	0.50	-0.58	0.569
	Follow-up vs. Posttest	-0.73	0.65	-1.13	0.269
HL Disease	Education	0.08	0.05	1.80	0.099
	Income	0.04	0.03	1.28	0.221
	Pretest vs. Posttest	0.32	0.16	2.07	0.050
	Follow-up vs. Posttest	-0.01	0.20	-0.06	0.955
HL Diet Beliefs	Education	0.10	0.04	2.31	0.039
	Income	0.02	0.03	0.74	0.473
	Pretest vs. Posttest	-0.13	0.08	-1.66	0.115
	Follow-up vs. Posttest	0.10	0.10	1.00	0.330
HL General Diet	Education	0.12	0.07	1.75	0.102
	Income	0.02	0.04	0.46	0.652
	Pretest vs. Posttest	-0.53	0.16	-3.27	0.003
	Follow-up vs. Posttest	0.03	0.19	0.17	0.864
HL General Food	Education	0.05	0.03	1.94	0.086
	Income	0.03	0.02	1.67	0.122
	Posttest vs. Pretest	-0.12	0.08	-1.50	0.151
	Follow-up vs. Pretest	0.05	0.10	0.46	0.654
HL Child Diet	Education	0.18	0.08	2.15	0.052
	Income	-0.00	0.05	-0.04	0.971
	Pretest vs. Posttest	0.01	0.13	0.08	0.939
	Follow-up vs. Posttest	0.22	0.17	1.31	0.210
Child Fruits	Education	0.17	0.20	0.84	0.418
	Income	-0.07	0.11	-0.60	0.556
	Pretest vs. Posttest	-0.52	0.32	-1.65	0.117
	Follow-up vs. Posttest	-0.42	0.35	-1.20	0.249

Note. HL = health literacy; FI = family influence; DNPA = diet/nutrition physical activity.

Table 18. Continued

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
Child Vegetables	Education	0.13	0.25	0.53	0.609
	Income	-0.01	0.14	-0.04	0.967
	Pretest vs. Posttest	-0.36	0.40	-0.91	0.375
	Follow-up vs. Posttest	0.56	0.44	1.28	0.220
Parent Fruits	Education	-0.09	0.21	-0.40	0.692
	Income	-0.17	0.12	-1.36	0.194
	Pretest vs. Posttest	-0.68	0.24	-2.84	0.011
	Follow-up vs. Posttest	-0.48	0.29	-1.66	0.116
Parent Vegetables	Education	0.05	0.21	0.24	0.810
	Income	0.06	0.13	0.46	0.653
	Pretest vs. Posttest	-0.93	0.41	-2.25	0.036
	Follow-up vs. Posttest	-0.34	0.51	-0.67	0.511
FI Fruits & Vegetables	Education	0.03	0.08	0.41	0.688
	Income	0.06	0.06	1.08	0.290
	Pretest vs. Posttest	0.12	0.34	0.35	0.727
	Follow-up vs. Posttest	-0.15	0.41	-0.37	0.713
FI Low Fat	Education	-0.00	0.10	-0.04	0.970
	Income	0.07	0.07	1.01	0.337
	Pretest vs. Posttest	0.074	0.37	0.20	0.844
	Follow-up vs. Posttest	0.37	0.45	0.82	0.422
DNPA Lifestyle	Education	-0.03	0.08	-0.35	0.740
	Income	0.07	0.05	1.43	0.186
	Pretest vs. Posttest	0.08	0.20	0.39	0.702
	Follow-up vs. Posttest	0.30	0.25	1.192	0.257
Grocery Shopping Behavior	Education	-0.08	0.05	-1.51	0.164
	Income	-0.01	0.03	-0.74	0.737
	Pretest vs. Posttest	0.11	0.15	0.48	0.483
	Follow-up vs. Posttest	0.15	0.18	0.42	0.416

Note. HL = health literacy; FI = family influence; DNPA = diet/nutrition physical activity.

Physical Activity. Results for all multilevel models for all physical activity variables are presented in Table 19 and Table 20. Participants' factual knowledge about physical activity (Physical Activity Knowledge) did improve from pretest to posttest (B = 0.85, $t = 2.50$, $p = 0.02$), however no significant change were found between pretest and follow-up (B = 0.45, $t = 1.13$, $p = 0.27$), and from posttest to follow-up (B = -0.40, $t = -1.00$, $p = 0.35$).

Regarding behaviors, the amount of time participants spent encouraging their children to engage in physical activity decreased from pretest to follow-up (B = -0.78, $t = -2.15$, $p = 0.04$), but no noteworthy change was seen from pretest to posttest (B = -0.38, $t = -1.19$, $p = 0.25$), or from posttest to follow-up (B = -0.40, $t = -1.07$, $p = 0.30$). Participants' knowledge of the relationship between physical activity and children's well-being (Child PA) was somewhat positively related to education (B = 0.11, $t = 2.00$, $p = 0.07$), while the extent to which participants' discouraged children from engaging in sedentary activity (FI Sedentary Activity) was somewhat negatively related to education (B = -0.13, $t = -1.78$, $p = 0.09$). Children's sedentary activity was positively related to participants' education (B = 30.56, $t = 2.37$, $p = 0.04$) and somewhat negatively related to participants' income (B = -16.06, $t = -1.93$, $p = 0.07$). No significant changes between time points were noted for Physical Activity Beliefs, General Physical Activity, Disease, Child Physical Activity, FI on Sedentary Activity, DNPA Lifestyle, Child Physical & Sedentary Activity Minutes, Parent Physical and Sedentary Activity Minutes, and Parent Physical and Sedentary Activity with Child.

Table 19. Hypotheses 3 and 4: Multilevel model predicting change in physical activity variables with pretest as the reference group.

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
HL PA Beliefs	Education	0.06	0.04	1.55	0.144
	Income	0.01	0.02	0.29	0.779
	Posttest vs. Pretest	0.06	0.10	0.59	0.562
	Follow-up vs. Pretest	0.14	0.12	1.17	0.256
HL PA Knowledge	Education	-0.07	0.10	-0.66	0.520
	Income	0.05	0.07	0.79	0.442
	Posttest vs. Pretest	0.85	0.34	2.50	0.019
	Follow-up vs. Pretest	0.45	0.40	1.13	0.269
HL General PA	Education	0.01	0.04	0.24	0.816
	Income	0.02	0.03	0.62	0.546
	Posttest vs. Pretest	0.08	0.12	0.68	0.501
	Follow-up vs. Pretest	0.18	0.14	1.24	0.225
HL Disease	Education	0.09	0.07	1.27	0.226
	Income	-0.00	0.04	-0.01	0.993
	Posttest vs. Pretest	0.09	0.13	0.68	0.502
	Follow-up vs. Pretest	0.13	0.15	0.84	0.409
HL Child PA	Education	0.11	0.05	2.00	0.074
	Income	-0.01	0.03	-0.16	0.876
	Posttest vs. Pretest	0.07	0.15	0.47	0.642
	Follow-up vs. Pretest	0.07	0.17	0.41	0.687
FI PA	Education	-0.01	0.15	-0.07	0.944
	Income	-0.01	0.09	-0.09	0.929
	Posttest vs. Pretest	-0.38	0.32	-1.19	0.248
	Follow-up vs. Pretest	-0.78	0.36	-2.15	0.044
FI SA	Education	-0.13	0.07	-1.78	0.085
	Income	0.04	0.05	0.83	0.412
	Posttest vs. Pretest	0.26	0.30	0.86	0.398
	Follow-up vs. Pretest	0.20	0.34	0.60	0.556

Note. HL = health literacy; FI = family influence; PA = physical activity; SA = sedentary activity; DNPA = diet/nutrition physical activity, Mins. = minutes.

Table 19. Continued

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
DNPA Lifestyle	Education	-0.03	0.08	-0.35	0.740
	Income	0.07	0.05	1.43	0.186
	Posttest vs. Pretest	-0.08	0.20	-0.39	0.702
	Follow-up vs. Pretest	0.22	0.24	0.91	0.377
Child PA Mins.	Education	-6.95	31.01	-0.22	0.826
	Income	-6.39	16.65	-0.38	0.707
	Posttest vs. Pretest	-7.24	26.38	-0.27	0.788
	Follow-up vs. Pretest	-30.24	27.93	-1.08	0.299
Child SA Mins.	Education	30.56	12.92	2.37	0.039
	Income	-16.06	8.31	-1.93	0.070
	Posttest vs. Pretest	44.57	45.90	0.97	0.342
	Follow-up vs. Pretest	12.70	50.39	0.25	0.803
Parent PA Mins.	Education	-39.60	34.68	-1.14	0.271
	Income	-13.65	20.39	-0.67	0.513
	Posttest vs. Pretest	-23.38	21.20	-1.10	0.285
	Follow-up vs. Pretest	9.83	24.01	0.41	0.687
Parent SA Mins.	Education	18.71	11.76	1.59	0.142
	Income	-9.34	7.92	-1.18	0253
	Posttest vs. Pretest	-3.09	46.08	-0.07	0.947
	Follow-up vs. Pretest	62.89	52.00	1.21	0.237
Parent/Child PA	Education	-18.44	21.22	-0.87	0.402
	Income	-10.52	12.51	-0.84	0.416
	Posttest vs. Pretest	-40.63	25.66	-1.58	0.134
	Follow-up vs. Pretest	2.01	28.00	0.07	0.943
Parent/Child SA	Education	2.16	6.33	0.34	0.736
	Income	-6.79	4.30	-1.58	0.125
	Posttest vs. Pretest	40.20	26.40	1.52	0.138
	Follow-up vs. Pretest	4.63	28.70	0.16	0.873

Note. HL = health literacy; FI = family influence; PA = physical activity; SA = sedentary activity; DNPA = diet/nutrition physical activity, Mins. = minutes.

Table 20. Hypotheses 3 and 4: Multilevel model predicting change in physical activity variables with posttest as the reference group.

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
HL PA Beliefs	Education	0.06	0.04	1.55	0.144
	Income	0.01	0.02	0.29	0.779
	Pretest vs. Posttest	-0.06	0.10	-0.59	0.562
	Follow-up vs. Posttest	0.08	0.13	0.64	0.527
HL PA Knowledge	Education	-0.07	0.10	-0.66	0.520
	Income	0.05	0.07	0.79	0.442
	Pretest vs. Posttest	-0.85	0.34	-2.50	0.019
	Follow-up vs. Posttest	-0.40	0.42	-0.96	0.349
HL General PA	Education	0.01	0.04	0.24	0.816
	Income	0.02	0.03	0.62	0.546
	Pretest vs. Posttest	-0.08	0.12	-0.68	0.501
	Follow-up vs. Posttest	0.09	0.15	0.64	0.530
HL PA Disease	Education	0.09	0.07	1.27	0.226
	Income	-0.00	0.04	-0.01	0.993
	Pretest vs. Posttest	-0.09	0.13	-0.68	0.502
	Follow-up vs. Posttest	0.04	0.15	0.26	0.800
HL Child PA	Education	0.11	0.05	2.00	0.074
	Income	-0.01	0.03	-0.16	0.876
	Pretest vs. Posttest	-0.07	0.15	-0.48	0.642
	Follow-up vs. Posttest	0.00	0.18	0.01	0.996
FI PA	Education	-0.01	0.15	-0.07	0.944
	Income	-0.01	0.09	-0.09	0.929
	Pretest vs. Posttest	0.38	0.32	1.19	0.248
	Follow-up vs. Posttest	-0.40	0.37	-1.07	0.299
FI SA	Education	-0.13	0.07	-1.78	0.085
	Income	0.04	0.05	0.83	0.412
	Pretest vs. Posttest	-0.26	0.30	-0.86	0.398
	Follow-up vs. Posttest	-0.06	0.36	-0.16	0.878

Note. HL = health literacy; FI = family influence; PA = physical activity; SA = sedentary activity; DNPA = diet/nutrition physical activity; Mins. = minutes.

Table 20. Continued

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
DNPA Lifestyle	Education	-0.03	0.08	-0.35	0.740
	Income	0.07	0.05	1.43	0.186
	Pretest vs. Posttest	0.08	0.20	0.39	0.702
	Follow-up vs. Posttest	0.30	0.25	1.19	0.257
Child PA Mins.	Education	-6.95	31.01	-0.22	0.826
	Income	-6.39	16.65	-0.38	0.707
	Pretest vs. Posttest	7.24	26.38	0.27	0.788
	Follow-up vs. Posttest	-23.00	28.10	-0.82	0.428
Child SA Mins.	Education	30.56	12.92	2.37	0.039
	Income	-16.06	8.31	-1.93	0.070
	Pretest vs. Posttest	-44.57	45.90	-0.97	0.342
	Follow-up vs. Posttest	-31.87	54.54	-0.58	0.566
Parent PA Mins.	Education	-39.60	34.68	-1.14	0.271
	Income	-13.66	20.39	-0.67	0.513
	Pretest vs. Posttest	23.38	21.20	1.10	0.285
	Follow-up vs. Posttest	33.20	24.08	1.34	0.186
Parent SA Mins.	Education	18.71	11.76	1.59	0.142
	Income	-9.34	7.92	-1.18	0.256
	Pretest vs. Posttest	3.09	46.08	0.07	0.947
	Follow-up vs. Posttest	65.98	55.77	1.18	0.249
Parent/Child PA	Education	-18.44	21.22	-0.87	0.402
	Income	-10.52	12.51	-0.84	0.416
	Pretest vs. Posttest	40.63	25.66	1.58	0.134
	Follow-up vs. Posttest	42.64	28.30	1.51	0.153
Parent/Child SA	Education	2.16	6.33	0.34	0.736
	Income	-6.79	4.30	-1.58	0.125
	Pretest vs. Posttest	-40.20	26.39	-1.52	0.138
	Follow-up vs. Posttest	-35.57	31.23	-1.14	0.264

Note. HL = health literacy; FI = family influence; PA = physical activity; SA = sedentary activity; DNPA = diet/nutrition physical activity; Mins. = minutes.

Sleep Hygiene. Results for all multilevel models for all sleep variables are presented in Table 21 and Table 22. Participants' overall beliefs about sleep were significantly higher at posttest (B = 0.26, t = 2.48, p = 0.02) and follow-up (B = 0.27, t = 2.25, p = 0.03) when compared to pretest, but no significant change was found from posttest to follow-up (B = 0.01, t = 0.10, p = 0.92), suggesting that the intervention was successful in improving beliefs and these improvements were sustained at least one month post-intervention. Education was also related to beliefs (B = 0.11, t = 2.67, p = 0.02). Participants' factual knowledge about sleep improved from pretest to posttest (B = 0.57, t = 3.34, p < 0.01), however it decreased from posttest to follow-up (B = -0.57, t = -2.61, p = 0.02), suggesting that the intervention was successful in improving knowledge but the improvement was not long term. Similar to beliefs, participants' knowledge of the relationship between sleep and health (Disease) was higher at posttest (B = 0.47, t = 2.74, p = 0.01) and follow-up (B = 0.33, t = 1.74, p = 0.09) when compared to pretest, but no significant change was found from posttest to follow-up (B = -0.14, t = -0.66, p = 0.52), suggesting that the intervention was successful in improving health literacy for sleep disease and these improvements were sustained at least one month post-intervention. Education was also significantly related to Disease (B = 0.14, t = 2.66, p = 0.02). A similar pattern was also found for Child Sleep Problems, that is, participants' knowledge of common sleep problems increased at posttest (B = 0.44, t = 3.69, p = 0.001) and follow-up (B = 0.46, t = 3.33, p < 0.01) when compared to pretest, but no significant change was found from posttest to follow-up (B = 0.02, t = 0.13, p = 0.90). This suggests that the intervention was successful in improving knowledge about

common sleep problems in children and this improvement in health literacy was sustained at least one month post-intervention.

Regarding participants' bedtime behavior change, active physical comforting (PIBBS-A; B = -28.33, t = -3.80, p = 0.001), encourage autonomy (PIBBS-B; B = -26.36, t = -3.23, $p < 0.01$), settle by movement (PIBBS-C; B = -29.32, t = -3.15, $p < 0.01$), passive physical comforting (PIBBS-D; B = -24.09, t = -3.18, $p < 0.01$), social comforting (PIBBS-E; B = -34.57, t = -3.18, $p < 0.01$) and total parent bedtime behaviors (PIBBS-Total; B = -17.91, t = -4.06, p = 0.001) were lower at follow-up than at pretest. Similarly, active physical comforting (PIBBS-A; B = -23.05, t = -2.96, $p < 0.01$), encourage autonomy (PIBBS-B; B = -37.22, t = -4.26, $p < 0.001$), settle by movement (PIBBS-C; B = -40.19, t = -4.07, $p < 0.001$), passive physical comforting (PIBBS-D; B = -14.18, t = -1.77, p = 0.09), social comforting (PIBBS-E; B = -34.08, t = -2.93, $p < 0.01$) and total parent bedtime behaviors (PIBBS-Total; B = -13.53, t = -2.96, p =.001) were lower at follow-up than at posttest. However no significant changes were found from pretest to posttest for active physical comforting (PIBBS-A; B = -5.28, t = -0.77, p = 0.45), encourage autonomy (PIBBS-B; B = 10.86, t = 1.49, p = 0.15), settle by movement (PIBBS-C; B = 10.87, t = 1.31, p = 0.20), passive physical comforting (PIBBS-D; B = -9.91, t = -1.45, p = 0.16), social comforting (PIBBS-E; B = -0.49, t = -0.05, p = 0.96) and total parent bedtime behaviors (PIBBS-Total; B = -4.38, t = -1.08, p = 0.29). With the exception of encourage autonomy (PIBBS-B), these results suggest that the intervention resulted in long term reduction in parent problematic bedtime behaviors. For encourage autonomy, the results suggest that the intervention was not

successful in improving encouraging autonomy behaviors which was a goal of the intervention. Income was somewhat related to active physical comforting (PIBBS-A; B = -3.46, t = -2.03, p = 0.05) and social comforting (PIBBS-E; B = -4.38, t = -2.12, p = 0.05). Children's sleep problem behaviors (TCSQ Total) decreased from pretest to posttest (B = -2.87, t = -1.80, p = 0.10) but no significant change was noted from posttest to follow-up (B = -0.26, t = -0.14, p = 0.90). This suggests that the intervention may have been successful in reducing children's sleep problems and these changes were maintained for at least one month. Education was related to children's total sleep problem behaviors (B = -2.41, t = -2.53, p = 0.03), core sleep problems (TCSQ Core Sleep Problems; B = -1.05, t = -2.08, p = 0.06) and parent intervention (TCSQ Parent Intervention; B = -0.88, t = -3.23, $p < 0.01$). No significant changes over time were found for Child Sleep, TCSQ Core Sleep Problems, and TCSQ Parent Interventions.

Table 21. Hypotheses 3 and 4: Multilevel model predicting change in sleep variables with pretest as the reference group.

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
HL Beliefs	Education	0.11	0.04	2.67	0.020
	Income	-0.00	0.03	-0.09	0.927
	Posttest vs. Pretest	0.26	0.10	2.48	0.021
	Follow-up vs. Pretest	0.27	0.12	2.25	0.034
HL Knowledge	Education	0.11	0.06	1.75	0.103
	Income	-0.03	0.04	-0.82	0.423
	Posttest vs. Pretest	0.57	0.17	3.34	0.003
	Follow-up vs. Pretest	0.00	0.20	0.01	0.993
HL Disease	Education	0.14	0.05	2.66	0.026
	Income	-0.04	0.03	-1.07	0.303
	Posttest vs. Pretest	0.47	0.17	2.74	0.012
	Follow-up vs. Pretest	0.33	0.19	1.74	0.096
HL Child Sleep	Education	0.10	0.06	1.70	0.109
	Income	-0.00	0.03	-0.12	0.904
	Posttest vs. Pretest	0.10	0.12	0.79	0.440
	Follow-up vs. Pretest	0.13	0.14	0.92	0.368
HL Child Sleep Problems	Education	0.11	0.04	2.42	0.039
	Income	0.02	0.03	0.85	0.410
	Posttest vs. Pretest	0.44	0.12	3.69	0.001
	Follow-up vs. Pretest	0.46	0.14	3.33	0.003
PIBBS-A	Education	-0.21	2.77	-0.08	0.940
	Income	-3.46	1.70	-2.03	0.059
	Posttest vs. Pretest	-5.28	6.90	-0.77	0.452
	Follow-up vs. Pretest	-28.33	7.47	-3.80	0.001
PIBBS-B	Education	-1.20	2.46	-0.49	0.635
	Income	-2.35	1.54	-1.52	0.150
	Posttest vs. Pretest	10.86	7.31	1.49	0.151
	Follow-up vs. Pretest	-26.36	8.16	-3.23	0.004

Note. HL = health literacy; TCSQ = Tayside Child Sleep Questionnaire; PIBBS = Parent Interactive Bedtime Behaviour Scale.

Table 21. Continued

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
PIBBS-C	Education	2.36	3.35	0.70	0.495
	Income	-3.53	2.05	-1.72	0.104
	Posttest vs. Pretest	10.87	8.31	1.31	0.204
	Follow-up vs. Pretest	-29.32	9.30	-3.15	0.004
PIBBS-D	Education	1.45	3.34	0.44	0.671
	Income	-2.29	2.00	-1.15	0.268
	Posttest vs. Pretest	-9.91	6.77	-1.45	0.158
	Follow-up vs. Pretest	-24.09	7.59	-3.18	0.004
PIBBS-E	Education	2.31	3.31	0.70	0.497
	Income	-4.38	2.07	-2.12	0.049
	Posttest vs. Pretest	-0.49	9.74	-0.05	0.960
	Follow-up vs. Pretest	-34.57	10.88	-3.18	0.004
PIBBS-Total	Education	1.44	1.79	0.80	0.435
	Income	-1.89	1.09	-1.73	0.102
	Posttest vs. Pretest	-4.38	4.07	-1.08	0.293
	Follow-up vs. Pretest	-17.91	4.41	-4.06	0.001
TCSQ Total	Education	-2.41	0.95	-2.52	0.026
	Income	-0.24	0.64	-0.38	0.713
	Posttest vs. Pretest	-2.87	1.60	-1.80	0.096
	Follow-up vs. Pretest	-3.13	1.90	-1.65	0.123
TCSQ Core Sleep Problems	Education	-1.05	0.50	-2.08	0.057
	Income	-0.06	0.29	-0.20	0.846
	Posttest vs. Pretest	-0.77	0.71	-1.09	0.293
	Follow-up vs. Pretest	-0.56	0.90	-0.62	0.542
TCSQ Parent Interventions	Education	-0.78	0.24	-3.23	0.006
	Income	-0.09	0.14	-0.63	0.541
	Posttest vs. Pretest	-0.21	0.58	-0.36	0.726
	Follow-up vs. Pretest	-0.77	0.74	-1.04	0.311

Note. HL = health literacy; TCSQ = Tayside Child Sleep Questionnaire; PIBBS = Parent Interactive Bedtime Behaviour Scale.

Table 22. Hypotheses 3 and 4: Multilevel model predicting change in sleep variables with posttest as the reference group.

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
HL Beliefs	Education	0.11	0.04	2.67	0.020
	Income	-0.00	0.03	-0.09	0.927
	Pretest vs. Posttest	-0.26	0.10	-2.48	0.021
	Follow-up vs. Posttest	0.01	0.13	0.10	0.921
HL Knowledge	Education	0.11	0.06	1.75	0.103
	Income	-0.03	0.04	-0.82	0.423
	Pretest vs. Posttest	-0.57	0.17	-3.34	0.003
	Follow-up vs. Posttest	-0.57	0.22	-2.61	0.015
HL Disease	Education	0.14	0.05	2.66	0.026
	Income	-0.04	0.03	-1.07	0.303
	Pretest vs. Posttest	-0.47	0.17	-2.74	0.012
	Follow-up vs. Posttest	-0.14	0.21	-0.66	0.517
HL Child Sleep	Education	0.10	0.06	1.70	0.109
	Income	-0.00	0.03	-0.12	0.904
	Pretest vs. Posttest	-0.10	0.12	-0.79	0.440
	Follow-up vs. Posttest	0.03	0.15	0.22	0.828
HL Child Sleep Problems	Education	0.11	0.04	2.42	0.039
	Income	0.02	0.03	0.85	0.410
	Pretest vs. Posttest	-0.44	0.12	-3.69	0.001
	Follow-up vs. Posttest	0.02	0.15	0.13	0.901
PIBBS-A	Education	-0.21	2.77	-0.08	0.940
	Income	-3.46	1.70	-2.03	0.059
	Pretest vs. Posttest	5.28	6.89	0.77	0.452
	Follow-up vs. Posttest	-23.05	7.78	-2.96	0.008
PIBBS-B	Education	-1.20	2.46	-0.49	0.635
	Income	-2.35	1.54	-1.52	0.150
	Pretest vs. Posttest	-10.86	7.31	-1.49	0.151
	Follow-up vs. Posttest	-37.22	8.74	-4.26	0.000

Note. HL = health literacy; TCSQ = Tayside Child Sleep Questionnaire; PIBBS = Parent Interactive Bedtime Behaviour Scale.

Table 22. Continued

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
PIBBS-C	Education	2.36	3.35	0.70	0.495
	Income	-3.53	2.05	-1.72	0.104
	Pretest vs. Posttest	-10.87	8.31	-1.31	0.204
	Follow-up vs. Posttest	-40.19	9.88	-4.07	0.001
PIBBS-D	Education	1.45	3.34	0.44	0.671
	Income	-2.29	2.00	-1.15	0.268
	Pretest vs. Posttest	9.91	6.77	1.46	0.158
	Follow-up vs. Posttest	-14.18	8.00	-1.77	0.091
PIBBS-E	Education	2.31	3.31	0.70	0.497
	Income	-4.38	2.07	-2.12	0.049
	Pretest vs. Posttest	0.49	9.74	0.05	0.960
	Follow-up vs. Posttest	-34.08	11.64	-2.93	0.008
PIBBS-Total	Education	1.44	1.79	0.80	0.435
	Income	-1.89	1.09	-1.73	0.102
	Pretest vs. Posttest	4.38	4.07	1.08	0.293
	Follow-up vs. Posttest	-13.53	4.57	-2.96	0.008
TCSQ Total	Education	-2.41	0.95	-2.53	0.026
	Income	0.24	0.64	-0.38	0.713
	Pretest vs. Posttest	2.86	1.60	1.80	0.096
	Follow-up vs. Posttest	-0.26	1.94	-0.14	0.895
TCSQ Core Sleep	Education	-1.05	0.50	-2.08	0.057
	Income	-0.06	0.59	-0.20	0.846
	Pretest vs. Posttest	0.77	0.71	1.09	0.293
	Follow-up vs. Posttest	0.20	0.95	0.22	0.832
TCSQ Parent Intervention	Education	-0.88	0.24	-3.23	0.006
	Income	-0.09	0.14	-0.63	0.541
	Pretest vs. Posttest	0.21	0.58	0.36	0.726
	Follow-up vs. Posttest	-0.57	0.79	-0.72	0.480

Note. HL = health literacy; TCSQ = Tayside Child Sleep Questionnaire; PIBBS = Parent Interactive Bedtime Behaviour Scale.

Behavioral Functioning and Stress. Results for all multilevel models for all behavior and stress variables are presented in Table 23 and Table 24. Participants' knowledge about the relationship between stress and mental health increased from pretest to posttest (B = 0.28, t = 2.33, p = 0.03), although no significant change was found from posttest to follow-up (B = -0.23, t = -1.54, p = 0.14), suggesting that the intervention may have been successful in improving stress health literacy and these improvements were maintained for at least one month post-intervention. Children's emotional HRQoL improved from pretest to follow-up (B = 10.58, t = 2.30, p = 0.03) and from posttest to follow-up (B = 15.98, t = 3.33, $p < 0.01$), suggesting that the intervention may have resulted in long term improvements in children's emotional HRQoL. Participants' perceived stress was lower at follow-up than at posttest (B = -3.64, t = -2.56, p = 0.02). Education was related to health literacy for stress (B = 0.16, t = 2.61, p = 0.02), health literacy for disease (B = 0.11, t = 1.83, p = 0.09), and perceived stress (B = -1.66, t = -2.28, p = 0.04). Income was related to social HRQoL (B = 3.27, t = 1.84, p = 0.09). No significant change over time was found for health literacy for Behavior, Habits, Relationship, Temperament, Handling Child and Disease. Regarding behaviors, no significant change over time was found for depression, coping, doctors' visit, physical HRQoL, social HRQOL, psychosocial HRQoL, total HRQoL, and child behavior problems.

Table 23. Hypotheses 3 and 4: Multilevel model predicting change in behavioral functioning and stress variables with pretest as the reference group.

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
HL Behavior	Education	0.06	0.05	1.42	0.177
	Income	-0.00	0.03	-0.08	0.939
	Posttest vs. Pretest	0.02	0.08	0.23	0.823
	Follow-up vs. Pretest	-0.11	0.09	-1.19	0.248
HL Stress	Education	0.16	0.06	2.61	0.020
	Income	-0.01	0.04	-0.21	0.835
	Posttest vs. Pretest	0.28	0.12	2.33	0.030
	Follow-up vs. Pretest	0.05	0.14	0.31	0.757
HL Habits	Education	0.08	0.06	1.47	0.173
	Income	0.03	0.03	0.79	0.444
	Posttest vs. Pretest	0.19	0.13	1.50	0.154
	Follow-up vs. Pretest	0.14	0.15	0.92	0.371
HL Relationship	Education	0.06	0.07	0.91	0.375
	Income	0.02	0.04	0.44	0.663
	Posttest vs. Pretest	0.01	0.11	0.08	0.934
	Follow-up vs. Pretest	-0.03	0.13	-0.25	0.803
HL Temperament	Education	0.06	0.04	1.41	0.181
	Income	0.02	0.03	0.74	0.471
	Posttest vs. Pretest	-0.11	0.12	-0.87	0.395
	Follow-up vs. Pretest	-0.21	0.15	-1.44	0.161
HL Handling Child	Education	0.07	0.05	1.48	0.163
	Income	-0.04	0.03	-1.49	0.155
	Posttest vs. Pretest	0.03	0.12	0.24	0.810
	Follow-up vs. Pretest	-0.20	0.14	-1.46	0.159
HL Disease	Education	0.11	0.06	1.83	0.093
	Income	0.00	0.04	0.06	0.955
	Posttest vs. Pretest	-0.02	0.19	-0.13	0.901
	Follow-up vs. Pretest	-0.17	0.23	-0.74	0.464

Note. HL = health literacy; PSS = perceived social stress; CESD = Center for Epidemiological Studies Depression Scale; PedsQL = pediatric quality of life.

Table 23. Continued

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
CESD	Education	-1.32	1.13	-1.17	0.260
	Income	-0.59	0.67	-0.88	0.393
	Posttest vs. Pretest	-2.91	2.35	-1.24	0.229
	Follow-up vs. Pretest	-0.91	2.86	-0.32	0.753
PSS	Education	-1.66	0.73	-2.28	0.037
	Income	-0.51	0.43	-1.19	0.250
	Posttest vs. Pretest	1.62	1.20	1.35	0.193
	Follow-up vs. Pretest	-2.01	1.36	-1.48	0.154
Coping	Education	0.24	0.71	0.34	0.738
	Income	0.10	0.43	0.25	0.809
	Posttest vs. Pretest	0.24	1.47	0.16	0.874
	Follow-up vs. Pretest	0.90	1.71	0.53	0.604
Doctor Visit	Education	0.10	0.26	0.40	0.692
	Income	-0.01	0.16	-0.05	0.964
	Posttest vs. Pretest	0.18	0.62	0.30	0.769
	Follow-up vs. Pretest	-0.50	0.68	-0.73	0.471
PedsQL Physical	Education	2.20	3.84	0.57	0.578
	Income	1.94	2.31	0.84	0.416
	Posttest vs. Pretest	2.51	7.98	0.31	0.757
	Follow-up vs. Pretest	7.47	8.78	0.85	0.406
PedsQL Emotional	Education	1.34	2.55	0.53	0.607
	Income	0.44	1.51	0.29	0.776
	Posttest vs. Pretest	-5.40	4.19	-1.29	0.212
	Follow-up vs. Pretest	10.58	4.60	2.30	0.032
PedsQL Social	Education	0.66	2.88	0.23	0.825
	Income	3.27	1.78	1.84	0.091
	Posttest vs. Pretest	10.71	7.34	1.46	0.161
	Follow-up vs. Pretest	10.77	8.11	1.33	0.201

Note. HL = health literacy; PSS = perceived social stress; CESD = Center for Epidemiological Studies Depression Scale; PedsQL = pediatric quality of life.

Table 23. Continued

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
PedsQL	Education	1.10	2.07	0.53	0.612
Psychosocial	Income	1.78	1.29	1.38	0.198
	Posttest vs. Pretest	4.87	6.40	0.76	0.457
	Follow-up vs. Pretest	7.43	7.15	1.04	0.313
PedsQL Total	Education	1.82	2.34	0.78	0.462
	Income	1.74	1.45	1.20	0.257
	Posttest vs. Pretest	3.82	6.71	0.57	0.577
	Follow-up vs. Pretest	7.44	7.52	0.99	0.336
Eyberg	Education	-2.04	3.61	-0.57	0.580
	Income	-0.85	2.22	-0.38	0.707
	Posttest vs. Pretest	-4.99	6.55	-0.52	0.606
	Follow-up vs. Pretest	-2.89	10.38	-0.28	0.783

Note. HL = health literacy; PSS = perceived social stress; CESD = Center for Epidemiological Studies Depression Scale; PedsQL = pediatric quality of life.

Table 24. Hypotheses 3 and 4: Multilevel model predicting change in behavioral functioning and stress variables with posttest as the reference group.

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
HL Behavior	Education	0.06	0.05	1.42	0.177
	Income	-0.00	0.03	-0.08	0.939
	Pretest vs. Posttest	-0.02	0.08	-0.23	0.823
	Follow-up vs. Posttest	-0.13	0.10	-1.32	0.203
HL Stress	Education	0.16	0.06	2.61	0.020
	Income	-0.01	0.04	-0.21	0.835
	Pretest vs. Posttest	-0.28	0.12	-2.33	0.030
	Follow-up vs. Posttest	-0.23	0.15	-1.54	0.140
HL Habits	Education	0.08	0.06	1.47	0.173
	Income	0.03	0.03	0.79	0.444
	Pretest vs. Posttest	-0.19	0.13	-1.50	0.154
	Follow-up vs. Posttest	-0.05	0.16	-0.31	0.765
HL Relationship	Education	0.06	0.07	0.91	0.375
	Income	0.02	0.04	0.44	0.663
	Pretest vs. Posttest	-0.01	0.11	-0.08	0.934
	Follow-up vs. Posttest	-0.04	0.14	-0.31	0.761
HL Temperament	Education	0.06	0.04	1.41	0.181
	Income	0.02	0.03	0.74	0.471
	Pretest vs. Posttest	0.11	0.12	0.87	0.395
	Follow-up vs. Posttest	-0.10	0.16	-0.68	0.506
HL Handling Child	Education	0.07	0.05	1.48	0.163
	Income	-0.04	0.03	-1.49	0.155
	Pretest vs. Posttest	-0.03	0.12	-0.24	0.810
	Follow-up vs. Posttest	-0.23	0.15	-1.57	0.132
HL Disease	Education	0.11	0.06	1.83	0.093
	Income	0.00	0.04	0.06	0.955
	Pretest vs. Posttest	0.02	0.19	0.13	0.901
	Follow-up vs. Posttest	-0.14	0.24	-0.60	0.555

Note. HL = health literacy; PSS = perceived social stress; CESD = Center for Epidemiological Studies Depression Scale; PedsQL = pediatric quality of life.

Table 24. Continued

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
CESD	Education	-1.32	1.13	-1.17	0.260
	Income	-0.59	0.67	-0.88	0.393
	Pretest vs. Posttest	2.92	2.35	1.24	0.229
	Follow-up vs. Posttest	2.00	2.85	0.70	0.490
PSS	Education	-1.67	0.73	-2.28	0.037
	Income	-0.51	0.43	-1.19	0.250
	Pretest vs. Posttest	-1.62	1.20	-1.35	0.193
	Follow-up vs. Posttest	-3.64	1.42	-2.56	0.019
Coping	Education	0.24	0.71	0.34	0.738
	Income	0.10	0.43	0.25	0.809
	Pretest vs. Posttest	-0.24	1.47	-0.16	0.874
	Follow-up vs. Posttest	0.66	1.79	0.37	0.715
Doctor Visit	Education	0.10	0.26	0.40	0.692
	Income	-0.01	0.16	-0.05	0.964
	Pretest vs. Posttest	-0.18	0.62	-0.30	0.769
	Follow-up vs. Posttest	-0.68	0.72	-0.95	0.352
PedsQL Physical	Education	2.20	3.84	0.57	0.578
	Income	1.94	2.31	0.84	0.416
	Pretest vs. Posttest	-2.51	7.98	-0.31	0.757
	Follow-up vs. Posttest	4.96	9.23	0.54	0.598
PedsQL Emotional	Education	1.34	2.55	0.53	0.607
	Income	0.44	1.51	0.29	0.776
	Pretest vs. Posttest	5.40	4.19	1.29	0.212
	Follow-up vs. Posttest	15.98	4.81	3.33	0.004
PedsQL Social	Education	0.66	2.88	0.23	0.825
	Income	3.27	1.78	1.84	0.091
	Pretest vs. Posttest	-10.71	7.34	-1.45	0.161
	Follow-up vs. Posttest	0.06	8.57	0.01	0.994

Note. HL = health literacy; PSS = perceived social stress; CESD = Center for Epidemiological Studies Depression Scale; PedsQL = pediatric quality of life.

Table 24. Continued

Dependent Variables	Parameters	B Estimates	Std Error	*t*	*p-value*
PedsQL	Education	1.10	2.07	0.53	0.612
Psychosocial	Income	1.78	1.29	1.38	0.198
	Pretest vs. Posttest	-4.87	6.40	-0.76	0.457
	Follow-up vs. Posttest	2.56	7.33	0.35	0.732
PedsQL Total	Education	1.82	2.34	0.78	0.462
	Income	1.74	1.44	1.20	0.257
	Pretest vs. Posttest	-3.82	6.71	-0.57	0.577
	Follow-up vs. Posttest	3.61	7.65	0.47	0.644
Eyberg	Education	-2.04	3.61	-0.57	0.580
	Income	-0.85	2.22	-0.38	0.707
	Pretest vs. Posttest	0.499	9.55	0.52	0.606
	Follow-up vs. Posttest	2.09	11.36	0.18	0.855

Note. HL = health literacy; PSS = perceived social stress; CESD = Center for Epidemiological Studies Depression Scale; PedsQL = pediatric quality of life.

DISCUSSION AND SUMMARY

Diet/Nutrition

As stated previously, there was reason to believe that a strong relationship would emerge between diet/nutrition behaviors and health literacy for diet/nutrition such that behaviors would predict health literacy. The results were partially supportive of this hypothesis. We included WIC as a covariate in the analyses because participants' enrolled in WIC programs are offered at least two voluntary nutrition education classes at time of certification (Besharov & Germanis, 2000). Although the extent to which participants use this opportunity and the effectiveness of these classes is debatable (Fox, Burstein, Golay, & Price, 1999), we anticipated that it would affect participants' health literacy. As expected, being enrolled in WIC was positively related to factual knowledge about diet/nutrition; however, it was not related to any other domain of health literacy for diet/nutrition. This suggests that the educational classes may be limited in the information it provides to WIC enrollees or that the classes participants' chose to go to are limited in scope. Education and income not being significant predictors of health literacy is contrary to what has been presented in the literature (IOM, 2004), I propose that my findings may be due to the homogeneity of the sample and the small sample size making it difficult to achieve significant results.

An unexpected finding was FI on fruits and vegetables being negatively related to participants' factual knowledge about diet/nutrition. One possible explanation is that knowledge may not necessarily be translating into behavior and other factors, such as

time (Birkett et al., 2004) or participants not being aware of the need to encourage their children to eat fruits and vegetables, may be contributing to the relationship.

Mixed results were found for behaviors predicting participants' knowledge about the relationship between diet/nutrition and diseases. As expected, those who were more knowledgeable about the relationship between diet/nutrition and diseases spent more time encouraging their children to eat fruits and vegetables. This is indirectly related to Variyam's (2001) findings that parents who were knowledgeable about obesity were less likely to have overweight children, in that parents' knowledge of disease led them to be more proactive in their children's health via encouraging diet nutrition. Gibson, Wardle, and Watts (1998) also found a strong relationship between parents understanding the diet/nutrition - disease relationship and their behaviors for fruits and vegetables consumption for their children. Opposite to what was hypothesized, participants who reported less grocery shopping behavior conducive to good diet/nutrition for the family reported *higher* levels of knowledge of the relationship between diet/nutrition and disease. I speculate that these findings could be due to lack of tools (e.g., knowing how to read nutrition label) to engage in good grocery shopping behavior, a barrier identified by parents in Birkett et al. (2004). Participants' encouragement of low fat foods being predictive of both fruits and vegetables consumption for children and to a lesser extent vegetables consumption for participants may be explained by participants having fat free foods, such as fruits and vegetables, more available in their home for their children to consume.

The second hypothesis tested the extent to which pretest-posttest difference scores for health literacy was related to pretest-posttest difference scores for diet/nutrition behaviors. It was important to explore this because the results could give some indication about the extent to which improvements or declines in health literacy is related to improvements or declines in diet/nutrition post-intervention. Thus, providing some indication about the extent to which targeting health literacy may be related to improvements in behavior or vice versa and the extent to which this intervention met the goal of improving health literacy as defined by USDHHS (2000). It will also help in understanding the health literacy/behavior relationship and health literacy variables that should be included when developing behavioral interventions.

Contrary to what was expected, as factual knowledge of diet/nutrition improved, participants' vegetables consumption *decreased*. One possible explanation for this finding is that consumption of vegetables was a sample of the previous day and participants' consumption may have fluctuated naturally, using a diary may have provided a better sample of participants' consumption habits. A similar trend was seen between participants' knowledge about food and eating and children's fruits consumption. A somewhat positive relationship was found for participants' knowledge about diet and nutrition and their diet/ nutrition and physical activity lifestyle choices in the home, suggesting that targeting one or both of the variables may be related to improvements in the other. These findings also suggest that interventions targeting diet/nutrition lifestyle choices should incorporate knowledge about diet and nutrition.

The last two hypotheses tested the efficacy of the intervention. As hypothesized, participants' knowledge about diet/nutrition increased from pretest to posttest and from pretest to follow-up; however, no significant improvements were seen from posttest to follow-up. These results suggest that the intervention may have been successful in not only improving knowledge about diet/nutrition but also in maintaining these changes at least one month post-intervention. Participants' overall knowledge about diet/nutrition, healthy eating, and the relationship between diet/nutrition and health improved from pretest to follow-up, but no improvements were seen from pretest to posttest or posttest to follow-up. One possible explanation for this is that participants may have sought additional information on their own after the completion of the intervention. A similar pattern was also found for children's vegetables consumption. Two possible explanations for children's vegetables increasing from pretest to follow-up only are that because vegetables consumption was a one day sample it was not a good measure of improvements in overall consumption while another explanation may be that availability of vegetables for children's consumption was a gradual process hence no posttest changes. Participants' fruits and vegetables increased from pretest to posttest, however no significant changes were found from pretest to follow-up or posttest to follow-up, suggesting that the intervention may have resulted in temporary immediate improvements in consumption, but failed in promoting long-term change at least at one month. Similar to children's vegetables consumption, it is difficult to determine the extent to which the changes are related to the intervention because consumption was a one day sample and many variables may have influenced what the participant consumed

the previous day. A weakness of this study is that there was no comparison group; therefore, it is possible that the significant results found here may be either partially or completely explained by extraneous variables and not the intervention.

Physical Activity

I proposed that there would be a strong relationship between physical activity behaviors and health literacy for physical activity. Similar to diet/nutrition, education and income were not significant correlates of health literacy. Contrary to what was expected, with more factual knowledge about physical activity did not discourage their children from engaging in sedentary activity. Although unexpected, these findings allude to research showing that there is not a direct relationship with physical activity and sedentary activity , that is, because one is encouraging physical activity, it does not mean they are discouraging sedentary activity and vice versa (Bauer, Nelson, Boutelle & Neumark-Sztainer, 2008). Similarly, because individuals are knowledgeable about physical activity, it does not mean they are discouraging sedentary activity.

I also explored the relationship between participants' influential behaviors and reported physical and sedentary activity for themselves and their children. Income, education, and hours of work were entered as covariates because these variables have been identified as barriers to physical activity (Kirchhoff, Elliott, Schlichting & Chin, 2009; Lindsay et al., 2009). Participants with lower incomes and more work-week hours reported significantly less sedentary activity. Participants with lower incomes may be employed in more manual jobs that require less time sitting than those with higher incomes and may also have to work longer work weeks. Participants with higher

incomes spending less time engaging in physical activity with their children may add support for research showing that children of working mothers engage in more sedentary activity (Brown, Broom, Nicholson, & Bittman, 2010). Although, another possible explanation might be that these participants are able to afford afterschool and extracurricular activities for themselves and children which do not create an opportunity for them to interact (Hofferth & Curtin, 2005). Participants' diet/nutrition and physical activity lifestyle choices for the home were the only variable predictive of time participants spent engaging in sedentary activity with their children. As participants' lifestyle choices for the home improved, the time spent in sedentary activity with their children decreased, since lifestyle choices includes rules and opportunities for behaviors, the results confirm several studies about the relationship between household rules and sedentary activity behavior (Granich, Rosenberg, Knuiman, & Timperio, 2008; Quarmby, Dagkas, & Bridge, 2011).

Regarding the second hypothesis, increase in factual knowledge in physical activity from pretest to posttest was related to a decrease in discouraging children from engaging in sedentary activity. Interventions targeting only sedentary activity may not need to incorporate factual knowledge about physical activity, since improvements in one is not related to improvements in the other. A similar relationship was seen for participants' knowledge of the influence of physical activity on children's wellbeing and lifestyle choices in the home. Conversely, the positive correlation for factual knowledge and the amount of time participants spend engaging in physical activity suggest a relationship between health literacy and behavior whereby interventions may be most

effective if both variables are targeted. These findings are consistent with USDHHS' (2000) definition of the health literacy as the ability to acquire knowledge and use that information to make good health decisions. As participants' knowledge about the influence of physical activity on children's wellbeing improved, they spent less time engaging in sedentary activity with their children, also confirming a relationship between health literacy and behavior. Additionally, it provides some evidence for to the potential benefits of incorporating information about the influence of physical activity on children's wellbeing in interventions aimed at decreasing time parents spend modeling and engaging in sedentary activity with their children.

Regarding the efficacy of the intervention, factual knowledge of physical activity improved from pretest to posttest but no meaningful improvements were found from pretest to follow-up, nor from posttest to follow-up suggesting that the intervention may have been successful in immediately improving knowledge. Participants' encouragement of their children to engage in physical activity decreased from pretest to follow-up but was unchanged from pretest to posttest and posttest to follow-up. These results confirm that the intervention was not successful at improving behavior.

Sleep Hygiene

Results of sleep behaviors explaining health literacy for sleep variables are consistent with other findings on the relationship between health literacy and health outcomes (Mancuso & Rincon, 2006b; Schillinger et al., 2002). Parental interventions being negatively related to general knowledge and factual knowledge about sleep, and the relationship between sleep and health provided evidence for continued focus on

improving health literacy to improve sleep behaviors, hence improving children's behavioral functioning and classroom performance. Similarly, participants' strategy of settling their children by movement was negatively related to general knowledge and beliefs about sleep and the relationship between sleep and health providing further confirmation of the relationship between health literacy and ability to engage in preventive health behaviors (Scott et al., 2002). Noteworthy is the negative relationship between participants' knowledge about common sleep problems in children and their strategy of engaging in passive physical comforting. Some common sleep problems such as bedtime problems and night waking are maintained by parent behaviors such as parents' presence in the room (Adair et al., 1991), thus it is no surprise that participants who lack knowledge about these problems engage in behaviors that encourage continuation of these problems. Also noteworthy is active physical comforting being positively indicative of general knowledge and beliefs about sleep, the relationship between sleep and health, and knowledge of childhood sleep problems. This relationship was not expected. However, one possible explanation for these results might be that participants' may view this behavior as an acceptable bedtime behavior due to problematic cognitions (e.g., difficulty setting limits, doubt about parenting competence) about child sleep or as a response to child temperament (Johnson & McMahon, 2008; Morrell & Steele, 2003). Consistent with health literacy research (IOM, 2004), income and education were positively related to participants knowledge about common sleep problems confirming that these variables are risk factors for health literacy for sleep. The

negative relationship between education and factual knowledge about the sleep was unexpected and reasons for this relationship should be explored further.

The second hypothesis tested the extent to which change in health literacy from pretest to posttest was related to change in sleep behaviors from pretest to posttest. Contrary to what was hypothesized, improvements in participants' total knowledge and beliefs about sleep were related to worsened active physical comforting, settle by movement, and total participant interactive bedtime behavior problems from pretest to posttest. These results suggest that beliefs about sleep may not be important to include in sleep behavior interventions. However, given that the pattern for change for behaviors were no change at posttest and significant change at follow-up, the results here could be indicative of stagnant or slightly elevated sleep behavior scores being compared to elevated health literacy scores. Improvements in knowledge about common sleep problems in children was also related to worsened settle by movement, total participant interactive bedtime behavior problems, and total child sleep problems. The increase in knowledge being related to increase in total child sleep problems may be explained by participants' increased ability to identify sleep problems. As made apparent from the focus groups (see Appendix I), participants are not always aware that their children are having sleep problems because they may not be aware of what would be considered a sleep problem. Noteworthy are improvements in knowledge of the influence of sleep on children's wellbeing was related with reduction in sleep problems. This provides further evidence for the need to incorporate information on the influence on sleep in behavioral interventions targeting sleep problems in children.

Regarding the efficacy of the intervention, general knowledge and beliefs about sleep, knowledge about the relationship between sleep and health, and knowledge about common childhood sleep problems improved from pretest to posttest and from pretest to follow-up but no significant improvements were seen from posttest to follow-up. These results provide evidence that the intervention may have been successful in improving health literacy in these three areas (Beliefs, Disease, Child Sleep Problems) and these improvements were maintained at least one month post-intervention. Factual knowledge about sleep improved from pretest to posttest but decreased from posttest to follow-up suggesting that although the intervention may have successfully improved factual knowledge immediately the improvement was short term. Additional methods of imparting this knowledge in a meaningful way so as to produce long term change will be addressed before the intervention is administered to future participants.

All parent interaction behaviors at bedtime decreased from pretest to follow-up and from posttest to follow-up suggesting that the intervention may have been successful in reducing participants' bedtime interactions with children that are indicative of sleep problems (Morell & Cortina-Borja, 2002). Noteworthy is that this pattern seen for participants' strategy of encouraging autonomy was not a goal of this intervention. I predicted that this behavior will increase over time as seen in Morell & Cortina-Borja (2002) and because it sets children up for healthy bedtime behaviors, this pattern may be indicative of participants' not having to engage in any bedtime behaviors with their children over time (which might be due to the intervention). It also questions the extent to which the intervention was successful in increasing positive bedtime behaviors which

cannot be answered because it was not explicitly measured beyond this variable. Participants' total sleep problems for their children decreased from pretest to posttest and from posttest to follow-up but not from pretest to follow-up suggesting that the intervention was successful in reducing sleep behavior problems for at least one month post intervention. Significant changes being noted mostly at follow-up for sleep behaviors reiterate the need to measure the effects of behavioral interventions longitudinally.

Behavioral Functioning and Stress

Behavioral functioning and stress being indicative of health literacy of behavioral functioning and stress was partially confirmed. Education was positively related to participants' knowledge about the stress – mental health relationship. However, education and income was not related to any other health literacy variables. Participants with more knowledge about the relationship between stress and mental health and the effect of parent-child relationships reported higher levels of stress and fewer depression symptoms. One possible explanation for these results might be that knowledge about stress and parent-child relationship act as a protective variable for depression, however it does not take away from daily stressors. Another explanation might be that participants with fewer depressive symptoms, although being more stressed, are better equipped to seek out knowledge regarding their stress and their relationship with their children. Noteworthy is the negative trend for emotional HRQoL and positive trend for social HRQoL for health literacy for stress and parent-child relationship. These results suggest that participants' being knowledgeable about stress and parent-child relationship may act

as a protective variable for children's social HRQoL, however this knowledge is not transferable in protecting children's emotional HRQoL. Also of note is the positive relationship between children's physical HRQoL and participants' knowledge about the relationship between stress and mental health. Knowledgeable participants' also tended not to be depressed and research has shown that depression is related to parents' seeking preventive health services for their children (Kavanaugh et al., 2006; Minkovitz et al., 2005). Consistent with the general health literacy literature (IOM, 2004), participants with higher levels of education reported more knowledge about the relationship between stress and mental health.

In examining the relationship between the pretest-posttest difference scores for health literacy and behavioral functioning and stress, several encouraging relationships emerged. A reduction in the intensity of behavioral problems was related to improved knowledge about the effects of parent-child relationships and the relationship between habits and children's wellbeing. These findings reiterate the strong relationship between health literacy and behavior and the need to include a knowledge component in behavioral interventions, especially those targeting behavioral problems in children. Also encouraging are that improvements in coping with stress strategies were related to improvements in participants' knowledge about children's behavioral functioning and the effects of parent-child relationships and improvements in knowledge about habits was correlated with reduced depressive symptoms. These results suggest that interventions targeting parent stress should have a component educating parents about children's behavior since child behavior has been identified as a major source of stress

particularly in underserved populations (Ceballos & Bratton, 2010; Chang et al., 2004). Improvements in knowledge about handling children's behavior was related to increased perceived participant stress, improvements in knowledge about stress was related to lower use of coping strategies, and improvements in knowledge about the effects parent-child relationships was related to increased depression. These relationships were unexpected and should be explored further.

Regarding the efficacy of the intervention, the intervention had very limited success in changing behavioral functioning and stress variables. Knowledge about the relationship between stress and mental health improved from pretest to posttest but no significant changes were found from pretest or posttest to follow-up. These results suggest that the intervention may have been successful in improving knowledge immediately but these changes were not long lasting. Children's emotional HRQoL improved from pretest to follow-up and from posttest to follow-up suggesting some more lasting (1 month) effects of the intervention.

Limitations and Future Directions

Measurement. All of the health literacy measures and some of the behavior measures were created for the study. The sample size was not large enough to allow for reliability and validity statistics to be calculated. Therefore, the extent to which items that were grouped together to form variable scores actually reliably fit together cannot be determined and this should be kept in mind when interpreting the results. Future research should include validation of the scales before carrying out the intervention on a larger scale. An additional measurement issue was that the consumption of fruits and

vegetables and reported physical and sedentary activity behavior was an estimation of the previous day's behavior. Measuring these variables in this manner did not take into account day to day variability in participants' and their children's behavior and also rely heavily on participants' ability to recall and provide a good estimate of past behavior. Future studies should measure fruits and vegetables consumption and physical and sedentary activity using daily diaries or more extensive recall measures spanning more than one day. Measurement of positive sleep behaviors and positive parenting should also be included in future studies.

Generalizability. The small sample was very homogeneous with no significant variability or range in income and education. The goal of this study was to create an intervention in which education and income would not be barriers to health literacy and healthy behaviors. The extent to which these barriers were addressed cannot be determined from this data because of the limited range of the barrier variables. Additionally, this study was conducted with participants who were part of agencies whose missions are to promote child social and cognitive development; therefore, the extent to which these findings may be replicated in non-help seeking parents is debatable. The restrictive location which this sample represents also questions the generalizability of the results. At least two of the target behaviors, diet/nutrition and physical activity, are highly influenced by environmental variables (Swinburn, Caterson, Seidell, & James, 2004); therefore, studying changing in these variables in a restricted population may be misleading. To address the problem of generalizability, future studies should do several things. Firstly, it is imperative that the sample size is increased and

representative of the population demographics. Also, future studies should use a multisite approach and the intervention should not be restricted to parents enrolled in Head Start or other agencies.

Power. The small sample size meant that the study had very low power and significant relationships between variables or improvements post-intervention and at follow-up may have went undetected. The results of this study should be used to calculate the sample size needed to achieve 0.80 power and this should be used as a guide for recruitment of a sample in further evaluations of this intervention. Future directions of this study should involve Step 3 and Step 4 of the IOM committee's research cycle (see Figure 2). Although Step 3 of the research cycle includes piloting the intervention (as was done in this study), there is still the need to replicate and confirm trials before moving to testing the effectiveness of the study. Replication and confirmation of the intervention after addressing limitations, including lack of comparison group, validation of measures, and homogeneity of the sample, will allow for more precise calculations of power needed for testing the effectiveness of the study (Step 4). Conducting large scale trials, as proposed in Step 4, should involve multisite testing of the intervention and success of this should lead to dissemination (Step 5) possibly via public health policy or federal agencies such as Head Start.

Other Limitations. A major limitation of this project was the lack of a comparison group. The results and discussions regarding hypotheses 3 and 4 should be viewed with caution because assumptions are being made about the role of the intervention in health literacy and behavior change. However, in order to confirm this

relationship, a comparison group should have been used. Future studies should include a comparison group to confirm these results. Another limitation of this study was the low retention rate. The intervention was conducted during late November and early December and drop out might be due to participants becoming busy during this time of year. This may also mean that the participants who completed the intervention may have been better at time management and since time was a barrier to some behaviors, the extent to which the intervention addressed this barrier may be questionable due to self-selection bias.

Other Future Directions. Other future directions include reviewing the evaluation and behavior practice forms to identify areas of improvement for the intervention. Future research should also involve conducting community focus groups to gather more information on risk and protective variables for health literacy and healthy lifestyle choices to further improve the intervention. Additionally, the intervention should be modified to include additional risk and protective variables identified by the parents in the Spanish-speaking focus group and a Spanish-speaking version of the intervention should be created and evaluated. Future evaluations of the intervention should also include more follow-up assessment sessions over a longer period of time to confirm the long term effects of the intervention. Lastly, since the interrelatedness of the variables were highlighted throughout the introduction of the paper, the intervention should be conceptualized as a multiple health behavior intervention and analyses of the data (with sufficient power) should reflect this conceptualization.

Conclusions

The main objective of this study was to design and pilot an experiential intervention targeting health literacy and healthy lifestyle choices of parents of young children. Topics for the intervention were elicited from parents and Head Start facilitators and included diet/nutrition, physical activity, sleep, and mental health. The targeted behaviors varied in the extent to which improvements were made with the least post-intervention change being seen for mental health and the most change being noted for sleep. The efficacy of the intervention cannot be fully commented on due to lack of a comparison group and limited power, however the results do provide some evidence that the intervention may be of some value to underserved parents and should evaluated further.

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APPENDIX I

Focus group summaries

Focus Group 1—Head Start Facilitators' Focus Group Summarized: The facilitator focus group was held during the Facilitator Forum at the beginning of the Spring 2010 Semester. Six facilitators and the program director were present, and facilitators experience with Head Start families ranged from 3 months to 18 years. The group was moderated by me. The facilitators identified sleep, diet/nutrition, physical activity, navigating the health care system, mental health, smoke exposure, baby bottle syndrome, and general hygiene as targetable areas for intervention for their families. Facilitators were most concerned with sleep and diet/nutrition. Areas of concern reported included that some Head Start parents served are unaware or do not understand: (a) how much sleep young children need, (b) the influence of their children's diet/nutrition on their school performance, and (c) the positive influence of preventive health and healthy lifestyle choices on children's overall functioning. Facilitators identified barriers to preventive health behaviors and healthy lifestyle choices for the families they serve, including money, transportation, knowledge, language barriers (both English-speaking and non-English-speaking), time, neighborhood safety, and parent mental wellness/health issues. The facilitators suggested that families they serve will benefit from hands-on training in the targetable areas, and information presented to them should use simple language, few words, and many pictures. They also suggested that parents will attend programs, such as the one we plan to implement, if there are tangible benefits for the children and meals are provided. Facilitators also gave specific examples of

activities that could be incorporated in the intervention to make the lesson salient and meaningful to the parents, such as pouring sugar in a measuring cup to demonstrate the sugar content of the drinks.

Focus Groups 2 & 3—Head Start Parents' Focus Groups Summarized: Two parent focus groups were conducted, including a group for primarily Spanish-speaking families. I moderated the English focus group and a research assistant and a Spanish-speaking Head Start facilitator moderated the Spanish-speaking focus group. I was present at the Spanish-speaking focus group and explained the project with the help of the Head Start facilitator. Generally, both focus groups identified similar targetable areas for intervention and barriers to engaging in preventive health behaviors for their children. Specifically, parents identified diet/nutrition, physical activities, physician appointments, oral health, sleep, and mental wellness/health as important connections to preventive health behaviors and healthy lifestyle choices. They reported that it was important to engage in these healthy behavior patterns because of the long term positive effects on their children's physical well-being, and social and emotional health. Parents identified lack of transportation and health insurance, knowledge, neighborhood safety, time constraints, poor communication with their children's pediatrician (including readability of pamphlets—both English and Spanish), living conditions (e.g., children sharing bedroom), managing their households (e.g., behavioral problems in children) and financial resources to be major barriers to engaging in preventive health and healthy lifestyle choices for their children. When asked about what could be done to help parents engage in more preventive health and healthy lifestyle choices for their children, parents

reported that more seminars, group meetings, and classes aimed at creating awareness and helping parents remember the benefits of the behavior were important. Both groups particularly stressed the need for more information. Please note that the parent groups only identified sleep issues to be targeted for intervention after they were prompted by the group facilitators (prompt was made due to Head Start facilitators and program director identifying this as a major concern).

APPENDIX II

DIET/NUTRITION VARIABLES CORRELATIONS

Correlations for diet/nutrition variables at pretest

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1 Food Knowledge	1.00													
2 Disease	-0.77	1.00												
3 Diet Beliefs	0.05	0.56**	1.00											
4 General Diet	0.03	0.47*	0.70***	1.00										
5 General Food	-0.07	0.39†	0.83***	0.39	1.00									
6 Child Diet	0.14	0.51*	0.90***	0.53*	0.62**	1.00								
7 Child Fruits	-0.03	0.49*	0.45†	0.13	0.47†	0.45†	1.00							
8 Child Vegetables	0.13	0.22	-0.00	-0.01	0.11	0.00	0.59*	1.00						
9 Parent Fruits	-0.15	0.35	0.21	-0.07	0.15	0.25	0.69**	-0.01	1.00					
10 Parent Vegetables	0.04	0.22	0.14	0.09	0.25	0.00	0.49*	0.48*	0.33	1.00				
11 FI Fruits & Vegetables	-0.35	0.63**	0.19	0.00	0.24	0.16	0.57*	0.40	0.34	0.34	1.00			
12 FI Low Fat	-0.20	0.49*	0.18	-0.15	0.37	0.11	0.67**	0.52*	0.41†	0.55*	0.74***	1.00		
13 DNPA Lifestyle	-0.09	0.41†	0.21	0.05	0.25	0.16	0.35	0.07	0.27	0.27	0.64**	0.51*	1.00	
14 Grocery Shopping	-0.02	-0.16	-0.49*	-0.37	-0.30	-0.53	0.00	0.06	0.15	0.18	0.31	0.32	0.41†	1.00

Note. FI = family influence, DNPA = diet/nutrition physical activity. † $p < 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

Correlations for diet/nutrition variables at posttest

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1 Food Knowledge	1.00													
2 Disease	0.04	1.00												
3 Diet Beliefs	0.32	0.72*	1.00											
4 General Diet	0.24	0.68**	0.89***	1.00										
5 General Food	0.28	0.65*	0.85***	0.60*	1.00									
6 Child Diet	0.26	0.54†	0.93***	0.79***	0.69*	1.00								
7 Child Fruits	-0.35	-0.03	0.32	0.33	0.43	0.50	1.00							
8 Child Vegetables	-0.38	0.12	0.45	0.43	0.37	0.50	0.50	1.00						
9 Parent Fruits	-0.28	-0.15	-0.11	-0.15	-0.26	-0.09	0.30	0.06	1.00					
10 Parent Vegetables	-0.37	0.05	0.29	0.18	0.13	0.38	0.41	0.94***	0.33	1.00				
11 FI Fruits & Vegetables	-0.06	-0.03	-0.08	-0.11	-0.07	-0.06	-0.11	0.03	-0.49	0.08	1.00			
12 FI Low Fat	0.15	-0.00	-0.02	0.07	0.01	-0.14	0.01	0.08	-0.57†	-0.11	0.68*	1.00		
13 DNPA Lifestyle	-0.32	0.24	0.29	0.16	0.41	0.22	0.14	0.44	-0.26	0.18	0.44	0.20	1.00	
14 Grocery Shopping	0.02	0.28	0.01	0.12	-0.23	-0.21	-0.36	0.04	-0.22	-0.09	0.49	0.61*	0.45	1.00

Note. FI = family influence, DNPA = diet/nutrition physical activity. † $p < 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

Correlations for diet/nutrition variables at follow-up

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1 Food Knowledge	1.00													
2 Disease	-0.65	1.00												
3 Diet Beliefs	-0.08	0.59	1.00											
4 General Diet	0.10	0.33	0.85**	1.00										
5 General Food	-0.16	0.57	0.97***	0.72*	1.00									
6 Child Diet	-0.05	0.67†	0.97***	0.79*	0.90**	1.00								
7 Child Fruits	0.21	-0.22	0.15	0.13	-0.05	0.17	1.00							
8 Child Vegetables	0.18	-0.30	0.23	0.57	0.02	0.20	0.59	1.00						
9 Parent Fruits	0.49	-0.43	-0.34	-0.25	-0.48	-0.24	0.82*	0.34	1.00					
10 Parent Vegetables	0.11	0.17	0.65	0.60	0.47	0.63	0.82*	0.80*	0.43	1.00				
11 FI Fruits & Vegetables	-0.04	0.75	0.86**	0.74*	0.80*	0.87**	-0.36	0.12	-0.50	0.15	1.00			
12 FI Low Fat	-0.10	0.68†	0.59	0.61†	0.51	0.58	-0.44	0.03	-0.58	-0.07	0.84**	1.00		
13 DNPA Lifestyle	0.50	-0.46	0.17	0.48	0.10	0.13	-0.33	0.42	-0.49	0.10	0.31	0.34	1.00	
14 Grocery Shopping	-0.35	0.74†	0.30	0.48	0.17	0.37	-0.58	0.04	-0.67	-0.19	0.63†	0.85**	0.33	1.00

Note. FI = family influence, DNPA = diet/nutrition physical activity. † $p < 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

APPENDIX III

PHYSICAL ACTIVITY VARIABLES CORRELATIONS

Correlations for physical activity variables at pretest

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1 PA Beliefs	1.00										
2 PA Knowledge	0.31	1.00									
3 General PA	0.66**	0.06	1.00								
4 PA Disease	0.80***	0.45*	0.31	1.00							
5 Child PA	0.94***	0.21	0.42†	0.76***	1.00						
6 FI PA	-0.24	-0.41†	-0.28	-0.00	-0.03	1.00					
7 FI SA	-0.28	-0.52*	-0.06	-0.28	-0.27	0.26	1.00				
8 DNPA Lifestyle	0.19	-0.22	0.13	0.19	0.17	0.15	0.32	1.00			
9 Child PA Min.	-0.01	0.43†	0.07	-0.02	-0.09	0.07	-0.00	-0.13	1.00		
10 Child SA Min.	0.18	0.30	0.23	0.05	0.08	0.14	-0.25	-0.49*	0.60**	1.00	
11 Parent PA Min.	-0.05	0.40†	0.04	-0.07	-0.13	0.11	-0.00	-0.07	0.96**	0.56*	1.00
12 Parent SA Min.	0.20	0.26	0.19	0.21	0.06	-0.38	-0.37	-0.46*	0.10	0.51*	0.31
13 Parent/ Child PA	-0.07	0.15	-0.08	-0.05	-0.09	0.07	0.20	0.21	0.69**	0.03	0.68***
14 Parent/ Child SA	-0.10	0.42†	-0.06	0.04	-0.14	0.12	-0.06	-0.56*	0.64**	0.87***	0.56*

Note. FI = family influence; PA = physical activity; SA = sedentary activity; DNPA = diet/nutrition physical activity; Mins. = minutes. † $p < 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

Correlations for physical activity variables at pretest (continued)

	12	**13**	**14**
12 Parent SA Min.	1.00		
13 Parent/ Child PA	-0.22	1.00	
14 Parent/ Child SA	0.39†	0.14	1.00

Note. PA = physical activity; SA = sedentary activity; Mins. = minutes.
† $p < 0.10$.

Correlations for physical activity variables at posttest

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1 PA Beliefs	1.00										
2 PA Knowledge	0.14	1.00									
3 General PA	0.83***	-0.29	1.00								
4 PA Disease	0.72**	0.13	0.43	1.00							
5 Child PA	0.96***	0.25	0.71**	0.78**	1.00						
6 FI PA	-0.30	-0.01	-0.25	0.03	-0.40	1.00					
7 FI SA	-0.21	-0.20	-0.18	0.06	-0.36	0.46	1.00				
8 DNPA Lifestyle	-0.14	-0.29	-0.11	0.18	-0.14	0.58*	0.09	1.00			
9 Child PA Min.	-0.16	-0.21	0.01	-0.17	-0.22	-0.19	0.51	-0.23	1.00		
10 Child SA Min.	-0.13	-0.33	0.12	0.06	-0.21	0.33	0.31	0.08	-0.25	1.00	
11 Parent PA Min.	-0.45	-0.07	0.35	-0.29	-0.38	-0.32	0.28	-0.42	0.87***	-0.21	1.00
12 Parent SA Min.	0.16	-0.42	0.52†	0.04	0.01	0.09	0.22	-0.31	0.12	0.71*	-0.18
13 Parent/ Child PA	-0.23	-0.31	-0.01	-0.36	-0.24	-0.25	0.00	-0.44	0.50	-0.32	0.59†
14 Parent/ Child SA	-0.16	-0.44	0.16	0.05	-0.20	0.22	0.14	0.12	-0.23	0.93***	-0.05

Note. FI = family influence; PA = physical activity; SA = sedentary activity; DNPA = diet/nutrition physical activity; Min. = minutes.
† $p < 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

Correlations for physical activity variables at posttest (continued)

	12	**13**	**14**
12 Parent SA Min.	1.00		
13 Parent/ Child PA	0.29	1.00	
14 Parent/ Child SA	0.73**	-0.04	1.00

Note. PA = physical activity; SA = sedentary activity; Min. = minutes.
** $p \leq 0.01$.

Correlations for physical activity variables at follow-up

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1 PA Beliefs	1.00										
2 PA Knowledge	-0.25	1.00									
3 General PA	0.74*	-0.34	1.00								
4 PA Disease	0.76*	-0.07	0.51	1.00							
5 Child PA	0.91***	-0.19	0.41	0.69*	1.00						
6 FI PA	-0.08	0.49	-0.30	-0.26	0.13	1.00					
7 FI SA	0.20	0.23	0.07	0.36	0.16	0.13	1.00				
8 DNPA Lifestyle	-0.19	-0.46	-0.23	0.26	-0.13	-0.41	0.21	1.00			
9 Child PA Min.	-0.46	0.30	-0.62	-0.19	-0.17	0.84*	-0.11	0.22	1.00		
10 Child SA Min.	-0.45	-0.25	-0.60	-0.27	-0.19	0.25	0.06	0.38	0.63	1.00	
11 Parent PA Min.	-0.62†	0.48	-0.31	-0.61†	-0.62†	0.34	-0.19	-0.57	0.33	0.23	1.00
12 Parent SA Min.	-0.03	-0.51	-0.14	-0.00	0.07	-0.34	-0.08	0.13	-0.01	0.75*	0.10
13 Parent/ Child PA	-0.63†	0.48	-0.33	-0.62†	-0.62†	0.35	-0.19	-0.57	0.35	0.24	1.00***
14 Parent/ Child SA	-0.46	-0.02	-0.52	-0.49	-0.23	0.46	-0.31	-0.18	0.73†	0.86*	0.61†

Note. FI = family influence; PA = physical activity; SA = sedentary activity; DNPA = diet/nutrition physical activity; Min. = minutes.
† $p < 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

Correlations for physical activity variables at follow-up (continued)

	12	**13**	**14**
12 Parent SA Min.	1.00		
13 Parent/ Child PA	0.11	1.00	
14 Parent/ Child SA	0.54	0.63[†]	1.00

Note. PA = physical activity; SA = sedentary activity; Min. = minutes.
[†] $p < 0.10$.

APPENDIX IV

SLEEP VARIABLES CORRELATIONS

Correlations for sleep variables at pretest

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1 Beliefs	1.00												
2 Know-ledge	0.00	1.00											
3 Disease	0.88***	-0.00	1.00										
4 Child Sleep	0.79***	0.12	0.62**	1.00									
5 Child Sleep Problems	0.70***	-0.03	0.50*	0.22	1.00								
6 TCSQ Total	0.13	-0.45	0.24	0.17	0.07	1.00							
7 PIBBS-A	0.22	0.14	0.43†	0.00	0.18	0.68**	1.00						
8 PIBBS-B	-0.20	0.17	-0.04	-0.22	-0.15	0.47†	0.61**	1.00					
9 PIBBS-C	-0.04	0.15	0.18	-0.16	0.03	0.34	0.71***	0.54*	1.00				
10 PIBBS-D	-0.01	0.15	0.06	0.12	-0.20	0.28	0.51*	0.34	0.39†	1.00			
11 PIBBS-E	0.06	0.30	0.21	-0.08	0.11	0.29	0.75***	0.62**	0.82***	0.49*	1.00		
12 PIBBS-Total	0.15	0.11	0.32	-0.05	0.17	0.54†	0.87***	0.53*	0.84***	0.68**	0.90****	1.00	
13 TCSQ CSP	0.18	-0.14	0.21	0.13	0.19	0.88***	0.71**	0.54*	0.39	0.34	0.53*	0.57*	1.00
14 TCSQ PI	-0.28	-0.29	-0.08	-0.32	-0.24	0.90*	0.54*	0.47*	0.27	0.05	0.27	0.39	0.40

Note. TCSQ = Tayside Child Sleep Questionnaire; CSP = Core Sleep Problems; PI = Parent Interactions; PIBBS = Parent Interactive Bedtime Behaviour Scale. † $p < 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

Correlations for sleep variables at posttest

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Beliefs	1.00												
2 Know-ledge	0.48†	1.00											
3 Disease	0.93***	0.49	1.00										
4 Child Sleep	0.88***	0.42	0.75**	1.00									
5 Child Sleep Problems	0.86***	0.48†	0.79**	0.59*	1.00								
6 TCSQ Total	-0.67*	-0.70*	-0.48	-0.60†	-0.64†	1.00							
7 PIBBS-A	0.23	-0.37	0.20	0.22	-0.00	0.12	1.00						
8 PIBBS-B	0.13	-0.11	0.25	0.27	-0.06	0.08	0.75**	1.00					
9 PIBBS-C	0.04	-0.32	0.01	-0.01	0.00	0.04	0.80**	0.75**	1.00				
10 PIBBS-D	0.24	-0.21	0.34	0.31	0.00	0.06	0.69*	0.57†	0.68*	1.00			
11 PIBBS-E	0.16	-0.08	0.24	0.21	-0.11	0.03	0.73**	0.81***	0.63*	0.60*	1.00		
12 PIBBS-Total	0.24	-0.30	0.26	0.15	0.04	-0.07	0.92***	0.67*	0.85***	0.81**	0.78**	1.00	
13 TCSQ CSP	-0.34	-0.64*	-0.17	-0.36	-0.24	0.97***	0.29	0.03	0.11	0.31	-0.05	0.20	1.00
14 TCSQ PI	-0.44	-0.69*	-0.32	-0.41	-0.37	0.97***	0.30	0.18	0.20	0.21	0.08	0.11	0.89***

Note. TCSQ = Tayside Child Sleep Questionnaire; CSP = Core Sleep Problems; PI = Parent Interactions; PIBBS = Parent Interactive Bedtime Behaviour Scale.† $p < 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

Correlations for sleep variables at follow-up

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1 Beliefs	1.00												
2 Know-ledge	0.70†	1.00											
3 Disease	0.94***	0.75*	1.00										
4 Child Sleep	0.95***	0.58	0.79*	1.00									
5 Child Sleep Problems	0.99***	0.72*	0.96****	0.91***	1.00								
6 TCSQ Total	-0.047	-0.25	-0.08	-0.10	-0.02	1.00							
7 PIBBS-A	-0.02	0.10	-0.10	0.01	0.03	0.44	1.00						
8 PIBBS-B	-0.41	-0.27	-0.51	-0.30	-0.40	0.56	0.55	1.00					
9 PIBBS-C	-0.28	0.18	-0.16	-0.41	-0.20	0.65	0.74*	0.43	1.00				
10 PIBBS-D	0.32	0.42	0.26	0.35	0.35	0.23	0.83**	0.30	0.52	1.00			
11 PIBBS-E	-0.27	-0.41	-0.39	-0.13	-0.29	0.64	0.20	0.83**	0.00	0.16	1.00		
12 PIBBS-Total	0.04	0.15	-0.01	0.06	0.08	0.70	0.91***	0.57	0.68*	0.91***	0.41	1.00	
13 TCSQ CSP	-0.52	-0.08	-0.59	-0.42	-0.50	0.99***	0.66	0.69	0.69	0.64	0.55	0.86*	1.00
14 TCSQ PI	-0.44	0.22	-0.49	-0.37	-0.41	-0.98*	0.77†	0.75†	0.84*	0.75†	0.43	0.89*	0.92**

Note. TCSQ = Tayside Child Sleep Questionnaire; CSP = Core Sleep Problems; PI = Parent Interactions; PIBBS = Parent Interactive Bedtime Behaviour Scale. † $p < 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

APPENDIX V

BEHAVIOR FUNCTIONING AND STRESS VARIABLES CORRELATIONS

Correlations for behavior functioning and stress variables at pretest

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1 HL Child Behavior	1.00									
2 HL Stress	0.44*	1.00								
3 HL Habits	0.79***	0.35	1.00							
4 HL Relationship	0.70***	0.36	0.37†	1.00						
5 HL Temperament	0.78***	0.45*	0.76***	0.50*	1.00					
6 HL Handling Child	0.64**	0.16	0.28	0.25	0.12	1.00				
7 HL Disease	0.74***	0.28	0.47*	0.59**	0.35	0.70***	1.00			
8 CESD	-0.38	-0.39	-0.57*	-0.20	-0.47*	-0.01	-0.15	1.00		
9 PSS	-0.19	-0.11	-0.46*	0.25	-0.45*	0.05	0.03	0.65**	1.00	
10 Coping	0.00	-0.02	-0.04	0.12	0.12	-0.15	0.02	0.11	0.05	1.00
11 Doctor Visit	0.28	0.05	0.11	0.01	0.16	0.44†	0.37	-0.02	-0.00	0.56*
12 PedsQL Physical	0.09	0.24	0.22	-0.09	0.33	-0.14	0.08	-0.01	-0.29	-0.29
13 PedsQL Emotional	0.04	0.26	0.15	-0.02	0.03	-0.02	0.21	-0.41	-0.12	0.06
14 PedsQL Social	0.23	0.23	0.43†	0.01	0.35	-0.02	0.29	-0.33	-0.63**	-0.12
15 PedsQL Psychosocial	0.21	0.34	0.36	0.08	0.32	-0.05	0.41	-0.44	-0.44	-0.04
16 PedsQL Total	0.17	0.33	0.31	-0.01	0.33	-0.07	0.33	-0.29	-0.43†	-0.15
17 Eyberg	0.04	0.26	0.04	0.02	-0.01	0.06	-0.07	-0.01	0.26	-0.47*

Note. HL = health literacy; PSS = perceived social stress; CESD = Center for Epidemiological Studies Depression Scale; PedsQL = pediatric quality of life.

† $p < 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

Correlations for behavior functioning and stress variables at pretest (continued)

	11	**12**	**13**	**14**	**15**	**16**	**17**
11 Doctor Visit	1.00						
12 PedsQL Physical	0.12	1.00					
13 PedsQL Emotional	0.50*	0.52*	1.00				
14 PedsQL Social	0.01	0.43†	0.34	1.00			
15 PedsQL Psychosocial	0.30	0.70**	0.81***	0.75***	1.00		
16 PedsQL Total	0.26	0.89***	0.75***	0.68**	0.95***	1.00	
17 Eyberg	-0.36	0.09	-0.09	-0.38	-0.16	-0.03	1.00

Note. PedsQL = pediatric quality of life.
† $p < 0.10$; ** $p \leq 0.01$; *** $p \leq 0.001$.

Correlations for behavior functioning and stress variables at posttest

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1 HL Child Behavior	1.00									
2 HL Stress	0.77**	1.00								
3 HL Habits	0.88***	0.59*	1.00							
4 HL Relationship	0.89***	0.92***	0.75**	1.00						
5 HL Temperament	0.83***	0.60*	0.64*	0.71**	1.00					
6 HL Handling Child	0.85***	0.53†	0.67*	0.60*	0.59*	1.00				
7 HL Disease	0.69**	0.61*	0.69**	0.73**	0.32	0.61*	1.00			
8 CESD	-0.42	0.09	-0.61*	-0.13	-0.15	-0.53†	-0.42	1.00		
9 PSS	-0.70*	-0.50†	-0.69*	-0.66*	-0.53†	-0.56†	-0.42	0.50†	1.00	
10 Coping	0.26	0.13	0.29	0.15	0.19	0.26	0.05	-0.33	-0.78**	1.00
11 Doctor Visit	0.30	0.48	0.23	0.35	0.13	0.31	0.32	0.06	-0.61*	0.77**
12 PedsQL Physical	0.54†	0.38	0.54†	0.59*	0.56†	0.25	0.37	-0.46	-0.47	0.18
13 PedsQL Emotional	0.32	-0.01	0.51†	0.16	0.32	0.19	0.08	-0.65*	-0.34	0.22
14 PedsQL Social	0.20	0.02	0.13	0.25	0.22	0.11	0.09	-0.37	-0.27	-0.07
15 PedsQL Psychosocial	0.40	0.12	0.50†	0.35	0.45	0.18	0.21	-0.57*	-0.45	0.16
16 PedsQL Total	0.47	0.23	0.53†	0.46	0.51†	0.22	0.28	-0.54†	-0.48	0.18
17 Eyberg	-0.03	-0.12	-0.00	-0.02	0.03	-0.09	-0.01	0.10	0.58†	-0.81**

Note. HL = health literacy; PSS = perceived social stress; CESD = Center for Epidemiological Studies Depression Scale; PedsQL = pediatric quality of life.

† $p < 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

Correlations for behavior function and stress variables at posttest (continued)

	11	**12**	**13**	**14**	**15**	**16**	**17**
11 Doctor Visit	1.00						
12 PedsQL Physical	-0.11	1.00					
13 PedsQL Emotional	-0.28	0.73**	1.00				
14 PedsQL Social	-0.33	0.75**	0.45	1.00			
15 PedsQL Psychosocial	-0.24	0.89***	0.85***	0.74**	1.00		
16 PedsQL Total	-0.19	0.96***	0.82***	0.76**	0.98***	1.00	
17 Eyberg	-0.78**	0.03	0.15	0.02	0.03	0.02	1.00

Note. PedsQL = pediatric quality of life.
** $p \leq 0.01$; *** $p \leq 0.001$.

Correlations for behavior functioning and stress variables at follow-up

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1 HL Child Behavior	1.00									
2 HL Stress	0.94***	1.00								
3 HL Habits	0.87**	0.81*	1.00							
4 HL Relationship	0.98***	0.98***	0.85**	1.00						
5 HL Temperament	0.84**	0.81*	0.50	0.81*	1.00					
6 HL Handling Child	0.93***	0.79*	0.79*	0.86**	0.68†	1.00				
7 HL Disease	0.91***	0.84**	0.81*	0.87**	0.69†	0.92***	1.00			
8 CESD	-0.38	-0.51	-0.25	-0.45	-0.19	-0.48	-0.43	1.00		
9 PSS	0.04	-0.20	-0.11	-0.12	0.17	0.20	0.00	0.51	1.00	
10 Coping	-0.35	-0.11	-0.32	-0.24	-0.17	-0.51	-0.31	-0.36	-0.75*	1.00
11 Doctor Visit	0.03	0.21	-0.08	0.17	0.17	-0.15	-0.31	-0.34	-0.29	0.31
12 PedsQL Physical	0.24	0.30	0.11	0.21	0.28	0.25	0.44	-0.45	-0.32	0.60†
13 PedsQL Emotional	-0.17	0.08	-0.38	-0.05	0.00	-0.18	-0.05	-0.66†	-0.35	0.34
14 PedsQL Social	0.36	0.28	0.24	0.29	0.19	0.57	0.54	-0.67†	-0.06	0.05
15 PedsQL Psychosocial	0.31	0.31	0.16	0.27	0.18	0.49	0.52	-0.77*	-0.12	0.15
16 PedsQL Total	0.29	0.32	0.15	0.26	0.23	0.41	0.51	-0.66†	-0.21	0.35
17 Eyberg	0.00	-0.11	-0.03	-0.04	0.05	0.01	0.12	0.67†	0.32	-0.31

Note. HL = health literacy; PSS = perceived social stress; CESD = Center for Epidemiological Studies Depression Scale; PedsQL = pediatric quality of life.

† $p < 0.10$; * $p \leq 0.05$; ** $p \leq 0.01$.

Correlations for behavior function and stress variables at follow-up (continued)

	11	**12**	**13**	**14**	**15**	**16**	**17**
11 Doctor Visit	1.00						
12 PedsQL Physical	-0.16	1.00					
13 PedsQL Emotional	0.07	0.29	1.00				
14 PedsQL Social	-0.33	0.70*	0.30	1.00			
15 PedsQL Psychosocial	-0.25	0.77*	0.48	0.94***			
16 PedsQL Total	-0.23	0.92***	0.42	0.89***	0.96***	1.00	
17 Eyberg	-0.26	-0.21	-0.40	-0.44	-0.35	-0.31	1.00

Note. PedsQL = pediatric quality of life.
* $p \leq 0.05$; *** $p \leq 0.001$.

APPENDIX VI

DESCRIPTIVES

Descriptives of pretest-posttest difference scores for diet/nutrition

Variable	M	SD	Range
HL Food Knowledge	-0.08	1.85	-3.00 – 4.00
HL Disease	-0.32	0.61	-1.40 – 0.40
HL Diet Beliefs	0.11	0.23	-0.28 – 0.54
HL General Diet	0.50	0.67	-0.25 – 2.25
HL General Food	0.13	0.20	-0.21 – 0.43
HL Child Diet	-0.04	0.42	-1.00 – 0.62
Child Fruits	0.56	0.73	-1.00 – 1.00
Child Vegetables	0.44	1.42	-2.00 – 3.00
Parent Fruits	0.83	0.94	0.00 – 3.00
Parent Vegetables	0.83	1.59	-1.00 – 4.00
FI Fruits & Vegetables	0.23	1.28	-1.25 – 3.50
FI Low Fat	0.27	1.64	-1.50 – 3.75
DNPA Lifestyle	0.01	0.56	-0.80 – 1.40
Grocery Shopping	-0.01	0.50	-0.91 – 0.55

Note. HL = health literacy; FI = family influence; DNPA = diet/nutrition physical activity.

Descriptives of pretest-posttest difference scores for physical activity

Variable	M	SD	Range
HL PA Beliefs	0.07	0.26	-0.30 – 0.45
HL SA Beliefs	0.21	0.43	-0.50 – 1.00
HL PA Knowledge	0.62	1.26	-1.00 – 2.00
HL General PA	0.11	0.29	-0.38 – 0.50
HL PA Disease	0.13	0.44	-1.00 – 0.67
HL Child PA	0.10	0.36	-0.43 – 0.57
FI PA	-0.31	1.14	-2.25 – 2.00
FI SA	0.50	1.37	-1.20 – 3.00
DNPA Lifestyle	0.01	0.56	-0.80 – 1.40
Child PA Min.	1.11	75.07	-60.00 – 180.00
Child SA Min.	46.67	166.73	-120.00 – 450.00
Parent PA Min.	-37.08	85.88	-185.00 – 70.00
Parent SA Min.	5.00	169.67	-390.00 – 270.00
Parent/ Child PA	-50.45	79.45	-180.00 – 60.00
Parent/ Child SA	31.36	121.04	-120.00 – 300.00

Note. HL = health literacy; FI = family influence; PA = physical activity; SA = sedentary activity; DNPA = diet/nutrition physical activity.

Descriptives of pretest-posttest difference scores for sleep

Variable	M	SD	Range
HL Beliefs	0.26	0.20	0.00 – 0.65
HL Knowledge	0.62	0.77	-1.00 – 2.00
HL Disease	0.40	0.48	-0.50 – 1.25
HL Child Sleep	0.14	0.28	-0.17 – 0.83
HL Child Sleep Problems	0.40	0.32	0.00 – 1.00
TCSQ Total	-2.14	4.38	-8.00 – 6.00
PIBBS-A	-5.42	28.19	-33.33 – 66.67
PIBBS-B	9.72	27.02	-33.33 – 75.00
PIBBS-C	8.33	34.68	-37.50 – 100.00
PIBBS-D	-9.74	26.72	-50.00 – 50.00
PIBBS-E	-5.73	32.14	-37.50 – 75.00
PIBBS-Total	-5.34	16.24	-20.83 – 33.33
TCSQ Core Sleep Problems	-0.73	2.57	-5.00 – 4.00
TCSQ Parent Interventions	-0.27	1.49	-3.00 – 3.00

Note. HL = health literacy; TCSQ = Tayside Child Sleep Questionnaire; PIBBS = Parent Interactive Bedtime Behaviour Scale.

Descriptives of pretest-posttest difference scores for stress and behavioral functioning

Variable	M	SD	Range
HL Child Behavior	0.02	0.19	-0.33 – 0.02
HL Stress	0.26	0.37	0.00 – 1.00
HL Habits	0.21	0.35	-0.67 – 0.67
HL Relationship	0.03	0.46	-1.00 – 1.00
HL Temperament	-0.17	0.48	-1.00 – 0.75
HL Handling Child	0.05	0.32	-0.60 – 0.60
HL Disease	-0.02	0.48	-1.00 - 0.75
CESD	-4.45	9.06	-26.00 – 6.00
PSS	1.55	3.88	-7.00 – 7.00
Coping	0.38	5.06	-4.00 – 10.00
Doctor Visit	0.18	1.66	-2.00 - 3.00
PedsQL Physical	0.00	28.90	-65.00 – 45.00
PedsQL Emotional	-4.55	13.72	-25.00 - 12.50
PedsQL Social	9.85	25.50	-41.67 – 41.67
PedsQL Psychosocial	3.31	18.22	-29.55 – 34.09
PedsQL Total	0.83	19.60	-32.81 – 34.38
Eyberg	-6.09	20.50	-50.00 – 22.00

Note. HL = health literacy; PSS = perceived social stress; CESD = Center for Epidemiological Studies Depression Scale; PedsQL = pediatric quality of life.

SASHA A. FLEARY

Curriculum Vitae

CONTACT INFORMATION

Texas A&M University
Department of Psychology
College Station, Texas 77843-4235
Phone: 646-244-8939
Fax: 979-845-5191
sfleary@tamu.edu

EDUCATION

May 2012	Doctor of Philosophy Texas A&M University, College Station, TX *Major*: Psychology *Dissertation Title*: A Parent-Focused Intervention to Increase Parent Health Literacy and Healthy Lifestyle Choices for Young Children and Families. *Additional Certificate*: Graduate Certificate in Education and Social Sciences Advanced Research Methods
December 2008	Master of Science Texas A&M University, College Station, TX *Major*: Psychology *Thesis Title*: Application of the Bioecological Model and Health Belief Model to Self-Reported Health Risk Behaviors of Adolescents in the United States.
June 2007	Bachelor of Arts CUNY – City College of New York, New York, NY *Major*: Psychology

AWARDS AND HONORS

2011	American Psychological Association – Minority Fellowship Program Psychology Summer Institute Fellow
2011	U.S. Senator Phil Gramm Doctoral Fellowship ($5000)
2011	Susan M. Arseven ’75 Make-A-Difference Memorial Award, Women in Science and Engineering ($1000)
2009	Clinical Area Distinguished Student Service Award, Department of Psychology, Texas A&M University
2007-2010	Graduate Diversity Fellowship, Office of Graduate Studies, Texas A&M University ($84 000)
2007	Joseph E. Barmack Award for Best Honors Thesis, College of Liberal Arts and Sciences, City College of New York
2007	Inducted member of Psi Chi, National Honor Society in Psychology
2006	Inducted member of the Golden Key International Honors Society