

5-11-2018

A Review of Childhood Obesity Prevention Efforts among Evidence-Based Home Visiting Programs

Olga Costa
Georgia State University

Follow this and additional works at: https://scholarworks.gsu.edu/iph_capstone

Recommended Citation

Costa, Olga, "A Review of Childhood Obesity Prevention Efforts among Evidence-Based Home Visiting Programs." , Georgia State University, 2018.
https://scholarworks.gsu.edu/iph_capstone/93

This Capstone Project is brought to you for free and open access by the School of Public Health at ScholarWorks @ Georgia State University. It has been accepted for inclusion in Public Health Capstone Projects by an authorized administrator of ScholarWorks @ Georgia State University. For more information, please contact scholarworks@gsu.edu.

A Review of Childhood Obesity Prevention Efforts among Evidence-Based Home Visiting Programs

By

Olga Costa

April 19, 2018

ABSTRACT

Childhood obesity is a major health concern. A high body mass index (BMI) is associated with the onset of several chronic diseases and can impact physical, mental, and emotional health. Several lifestyle factors have played a role in the rising prevalence of obesity over recent decades, including poor diet and lack of physical activity. Previous obesity intervention efforts have focused on reversing obesity rather than addressing risk factors prior to weight gain. The evidence-base of best practices for childhood obesity prevention is weak, and few interventions have indicated long-term success on weight reduction and maintenance. Parents play a major role in influencing behaviors related to eating and exercise, thus home visiting programs may present an opportunity for addressing risk factors for obesity. Many of these programs aim to prevent adverse experiences in early childhood by working with parents and caregivers and have been successful in improving child outcomes. This setting has recently been explored in the context of childhood obesity prevention and research has indicated that such efforts may be effective. This project examines the extent to which childhood obesity is addressed among 8 evidence-based home visiting programs. These programs' efforts are compared to expert recommendations for childhood obesity prevention and opportunities for future consideration are discussed. Finally, recommendations from the literature are made for integrating best practices for maintaining a healthy weight into home visiting programs.

A Review of Childhood Obesity Prevention Efforts among Evidence-Based Home Visiting
Programs

by

Olga Costa

B.A., The University of Georgia

A Capstone Submitted to the Graduate Faculty
of Georgia State University in Partial Fulfillment
of the
Requirements for the Degree

MASTER OF PUBLIC HEALTH

ATLANTA, GEORGIA
30303

APPROVAL PAGE

A Review of Childhood Obesity Prevention Efforts among Evidence-Based Home Visiting
Programs

by

Olga Costa

Approved:

Daniel J. Whitaker, PhD
Committee Chair

Rodney Lyn, PhD
Committee Member

April 19, 2018
Date

Author's Statement Page

In presenting this capstone as a partial fulfillment of the requirements for an advanced degree from Georgia State University, I agree that the Library of the University shall make it available for inspection and circulation in accordance with its regulations governing materials of this type. I agree that permission to quote from, to copy from, or to publish this capstone may be granted by the author or, in his/her absence, by the professor under whose direction it was written, or in his/her absence, by the Associate Dean, School of Public Health. Such quoting, copying, or publishing must be solely for scholarly purposes and will not involve potential financial gain. It is understood that any copying from or publication of this capstone which involves potential financial gain will not be allowed without written permission of the author.

Olga Costa

TABLE OF CONTENTS

List of Tables	v
Introduction	1
Background	1
Implications & Consequences	2
Risk during childhood	2
Risk tracks into adulthood.....	3
Economic burden.....	4
Effect on Low Income & Minority Populations	4
Determinants	7
Diet.....	7
Physical Activity	9
Family	10
Nutrition & Physical Activity Guidelines	11
Literature Review	15
Childhood Obesity Prevention Efforts	15
Home Visiting Programs	17
Home Visiting as a Setting for Obesity Prevention	19
Related Studies	22
Healthy Beginnings Trial.....	23
Intervention Nurses Start Infants Growing on Healthy Trajectories (INSIGHT).....	24
Incorporation into evidence-based programs	25
Minding the Baby.....	26
Parents as Teachers.....	27
Implications	28
Purpose & Methods	30
Findings	32
Discussion	36
Gaps & Opportunities	36
Recommendations	37
Conclusion	41
References	43

List of Tables

Table 1: An overview of obesity prevention efforts among evidence-based home visiting programs

Introduction

Background

Childhood obesity is a major health concern both in the United States (Kitsantas & Gaffney, 2010; Ogden, Carroll, Kit, & Flegal, 2014) and globally (Guo, Wu, Chumlea, & Roche, 2002; Han, Lawlor, & Kimm, 2010; Must & Strauss, 1999), affecting children of all age, gender, ethnicity, and socioeconomic status (Ebbeling, Pawlak, & Ludwig, 2002; IOM, 2005). Data on weight and height from the 2013-2014 National Health and Nutrition Examination Survey (NHANES) estimate the prevalence of overweight or obesity among children aged 2-19 years to be 33.4%, with 17.2% attributed solely to obesity (Fryar, Carroll, & Ogden, 2016). By the 2015-2016 survey, obesity had increased to 18.5% (Hales, Carroll, Fryar, & Ogden, 2017).

A high body mass index (BMI) is associated with significant health risks (Ebbeling et al., 2002; Guo et al., 2002; Han et al., 2010; Must & Strauss, 1999). For children aged 2 years and older, BMI provides a ratio of weight to height as defined by the Centers for Disease Control and Prevention (CDC) sex-specific BMI-for-age growth chart (Ogden et al., 2014). Children between the 85th and 95th percentile of the CDC growth chart are said to be overweight, while those at or above the 95th percentile are said to be obese (Ogden et al., 2014). For children younger than 2 years, the World Health Organization (WHO) weight for recumbent length growth standards define excess weight at or above the 97.7th percentile and CDC sex-specific weight for recumbent length growth chart defines excess weight at or above the 95th percentile (Ogden et al., 2014).

NHANES data from previous years reveal the increasing trend in obesity over time. Between 1976-1980, the obesity prevalence among 2-5 year olds was estimated at 5%

(Freedman et al., 2016; Fryar et al., 2016; Kitsantas & Gaffney, 2010; Ogden et al., 2014). By 2003-2004, the prevalence had risen to 13.9% (Freedman et al., 2016; Kitsantas & Gaffney, 2010; Ogden et al., 2014). While this number has actually decreased since then, by 2015-2016 prevalence had again reached nearly 14% (Skinner, Ravanbakht, Skelton, Perrin, & Armstrong, 2018). In about the same amount of time, obesity has tripled among 6-11 year old children and almost quadrupled among 12-19 year old adolescents (Fryar et al., 2016).

There is no formal definition for obesity among the 0-2 age group (Ogden et al., 2014), thus trends in weight for length in relation to obesity among infants are less documented (Freedman et al., 2014). Between 1976-1980, the prevalence of obesity among infants between 0-2 years was estimated at 7.2% (Freedman et al., 2016). By 1999-2000, the prevalence had increased to 11.6% (Freedman et al., 2016). Recent estimates using available NHANES data report that among the 0-2 age group, the prevalence of obesity is currently 8.1% using CDC growth charts (7.1% using WHO growth standards) (Ogden et al., 2014). Although this trend has been inconsistent over time, prevalence still remains high for this young age group (Freedman et al., 2016).

Implications & Consequences

Risk during childhood. Risk factors for subsequent obesity can be observed as early as during infancy (Freedman et al., 2016). Children who are obese are at risk of developing serious conditions that can have both short and long-term impacts on their health (Han et al., 2010; IOM, 2005; Must & Strauss, 1999; Pan et al., 2016). Even before chronic complications associated with excess weight are apparent in a child, early evidence of metabolic syndrome, insulin resistance, and risk factors for cardiovascular disease have

been recognized in children (Ebbeling et al., 2002; Han et al., 2010; IOM, 2005; Must & Strauss, 1999), some as young as 5 years old (Ebbeling et al., 2002). In addition to signs of risk factors, children have been increasingly diagnosed with chronic conditions such as diabetes, hypertension, and fatty liver disease (Ebbeling et al., 2002; Han et al., 2010; IOM, 2005; Must & Strauss, 1999). Type II diabetes, once considered to be a condition developed almost exclusively in adulthood (Ebbeling et al., 2002; Must & Strauss, 1999), has increasingly been diagnosed in children as young as 10 years old (Must & Strauss, 1999). In the Bogalusa Heart Study, 2.4% of overweight children developed type II diabetes by age 30 compared to none of the children who were of normal weight in childhood (Must & Strauss, 1999).

In addition to the impact of obesity on physical health, mental and emotional effects are also increasingly evident (Ebbeling et al., 2002; IOM, 2005; Kitsantas & Gaffney, 2010; Must & Strauss, 1999). Weight status can lead to discrimination by others, distorted body image, and low self-esteem among young children (IOM, 2005), particularly girls (Ebbeling et al., 2002; Must & Strauss, 1999). These consequences can impact social development (IOM, 2005; Kitsantas & Gaffney, 2010). Children and, consequently, women who experience weight discrimination are more likely to have lower academic achievement (IOM, 2005; Kitsantas & Gaffney, 2010) and consequential downward social and economic mobility (IOM, 2005; Must & Strauss, 1999).

Risk tracks into adulthood. Childhood obesity is linked to persistence of obesity in adulthood (Guo et al., 2002; Must & Strauss, 1999). Several studies have found a relationship between high weight for length among infants and future weight status (Freedman et al., 2016), which poses additional significant health risks such as type II

diabetes and certain other chronic diseases and cancers (Ebbeling et al., 2002; IOM, 2005; Must & Strauss, 1999; Pan et al., 2016). Studies provide evidence of an association between obesity in childhood and an elevated risk for the development of cardiovascular disease in adulthood (Han et al., 2010; Kitsantas & Gaffney, 2010; Must & Strauss, 1999; Pan et al., 2016). Data from the Muscatine Study indicate that obese children are 9-10 times more likely to develop high blood pressure in adulthood (Must & Strauss, 1999). In the Bogalusa Heart Study, data show that being overweight in adolescence increases the likelihood of hypertension by 8.5 times compared to normal weight adolescents (Must & Strauss, 1999). The long-term impact of childhood obesity on morbidity in adulthood has also been suggested by the Third Harvard Growth Study, which found an increased risk of the development of certain illness in adults who had been overweight as children (Must & Strauss, 1999). Similarly, studies on the effects of obesity on adult mortality suggest an increased risk as well (Must & Strauss, 1999).

Economic burden. In addition to the consequences of obesity on health, the growing epidemic contributes to rising health care costs (Ebbeling et al., 2002; IOM, 2005). A recent estimate of health care costs related to overweight and obesity in children and adolescents amount to \$14.1 billion (Segal, Rayburn, & Martín, 2016). Including adults, this total amounts to \$147 billion or more in yearly costs (Finkelstein, Trogon, Cohen, & Dietz, 2009). Indirect costs associated with quality of life and years of life lost place an additional burden on society (Ebbeling et al., 2002; IOM 2005).

Effect on Low Income & Minority Populations

Obesity prevalence is notably higher among minority racial and ethnic groups in the United States (Anderson & Whitaker, 2009; Ebbeling et al., 2002). While the trend in

obesity prevalence for race and ethnicity follows a similar pattern for all children, American Indian/Alaska Natives and Hispanics have a greater percentage of obesity (Anderson & Whitaker, 2009; Pan et al., 2016). By the time a child reaches 4 years of age, disparities in weight among ethnic groups can already be identified (Anderson & Whitaker, 2009). Health risks associated with obesity can also vary by racial and ethnic groups, further exacerbating some of the disparities related to weight (Anderson & Whitaker, 2009; Ebbeling et al., 2002).

Disparities in weight status have also been documented among low-income populations (Freedman et al., 2016; Pan et al., 2016). Data from participants in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) reveal the trend in obesity among low-income families (Freedman et al., 2016; Pan et al., 2016). Among participants in the program aged 2-4 years, obesity prevalence increased from 14% to 15.9% between 2000 and 2010, and then decreased to 14.5% in 2014 (Pan et al., 2016). Comparatively, the prevalence of obesity among all children 2-5 years of age was 9.4% in 2014 (Fryar et al., 2016). However, only 50% of eligible WIC participants are enrolled in the program, thus the data does not include all children from low-income families (Pan et al., 2016).

In contrast, 83% of infants between 0-12 months eligible for WIC are enrolled in the program (Freedman et al., 2016). Using the same WIC data for infants, the prevalence of high weight for length was 13.4% in 2000, increasing to 14.5% in 2004 and decreasing to 12.3% in 2014 (Freedman et al., 2016). Differences in weight for length among racial and ethnic groups are already apparent at this age, affecting American Indian/Alaska Native and Hispanic children in greater proportion (Freedman et al., 2016). There are also

substantial effects of low family income on weight for length among infants who participate in the WIC program (Freedman et al., 2016).

Nonetheless, the downward trend since 2010 in obesity prevalence is consistent in both the WIC group among all racial/ethnic groups and overall (Freedman et al., 2016; Pan et al., 2016). This is likely attributed to the increased attention to the issue (Freedman et al., 2016; Pan et al., 2016). Still, there need to be additional efforts to address the factors that cause obesity in low-income populations.

The WIC program, available in all US states and territories, supports low-income mothers and children up to 5 years of age at risk for poor nutrition by providing supplemental foods and nutrition education (Freedman et al., 2016; Pan et al., 2016). The program uses recommendations from the Dietary Guidelines for Americans and the American Academy of Pediatrics to support the nutritional needs of both women and their infants and children (Freedman et al., 2016; Pan et al., 2016). This has led to an increase in access to and consumption of fruits, vegetables, whole grains, and other nutritious foods (Freedman et al., 2016; Pan et al., 2016).

However, declines in the obesity prevalence are consistent with that of the overall 0-2 and 2-5 age group, suggesting that other factors may be leading to the decline (Pan et al., 2016). This might suggest that the program does not go far enough in addressing the factors that lead to child weight gain in this population. In addition, since 50% of children eligible for WIC do not participate in the program (Pan et al., 2016), it is important to explore other means of specifically targeting this population to address obesity.

Determinants

The rise in childhood obesity rates over time can be attributed to a number of biological, behavioral, and environmental factors (Han et al., 2010). While genetics can play a role in the onset of obesity, the rising prevalence among various populations globally indicates that other factors may be at play (IOM, 2005). Thus, it is largely the lifestyle factors leading to an excess consumption of high calorie foods coupled with inadequate energy expenditure that have led to the increase in obesity (Dietz & Gortmaker, 2001; Han et al., 2010; IOM, 2005).

However, as suggested by the socio-ecological model, a range of social, economic, cultural, environmental, and political factors influence individual food intake and exercise patterns (IOM, 2005). This includes the role of family, school, and community settings (IOM, 2005). Additional determinants for the development of childhood obesity have been explored in several studies (Kitsantas & Gaffney, 2010). A detailed description of many of these causes are beyond the scope of this paper, but several important factors are mentioned below. It is important to target these components through an ecological perspective (IOM, 2005) as part of intervention strategies for preventing childhood obesity.

Diet. Good nutrition is critical not only for maintaining a healthy weight, but also for obtaining the essential nutrients required for healthy growth and development (Freedman et al., 2016; Pan et al., 2016; Segal et al., 2016). Developing healthy eating habits in early childhood is important for maintaining this behavior throughout adolescence and adulthood when behavior change is more difficult to materialize (Segal et al., 2016).

However, as food options have become increasingly accessible and available in recent decades, trends in consumption have also shifted upward (Dietz & Gortmaker, 2001; IOM, 2005). This includes both fast food and packaged food items (Ebbeling et al., 2002; IOM, 2005). The role of soda and sugar-sweetened beverages in the rising obesity prevalence has also been noted (IOM, 2005). These foods and drinks are often high in calories, large in portion size, and low in cost, making them increasingly appealing for consumers (Ebbeling et al., 2002; IOM, 2005). However, these items tend to be low in nutritional quality (IOM, 2005) and lack essential nutrients that support good health (Ebbeling et al., 2002). In addition, excess consumption of these foods can cause children to become less responsive to satiety cues and eat regardless of hunger, leading to additional risk of weight gain (Ebbeling et al., 2002).

As food is increasingly eaten in the form of highly processed packaged snack items and fast food, children are less likely to meet the daily-recommended servings for fruits and vegetables (IOM, 2005). Eating meals in the home is typically associated with greater fruit and vegetable consumption (Dietz & Gortmaker, 2001). Adequate fruit and vegetable consumption helps to support a healthy weight as these items are high in nutrients and low in calories. However, the comparatively higher cost of fruits and vegetables and lower accessibility can present a barrier to adequate intake (Ebbeling et al., 2002).

For infants, breastfeeding is associated with health benefits for both mother and child (Segal et al., 2016). Not only are mothers who breastfeed more likely to lose weight, but studies also suggest a reduced risk of subsequent obesity in children as well (Segal et al., 2016). While the evidence-base of breastfeeding on its protective effects on child obesity is mixed (Han et al., 2010; Kitsantas & Gaffney, 2010; Woo Baidal et al., 2016),

findings suggest that some factors related to breastfeeding promote a healthy weight trajectory (Kitsantas & Gaffney, 2010).

Physical Activity. Exercise can also be protective against weight gain and reduces an individual's risk of developing certain health conditions, including those related to obesity (Dietz & Gortmaker, 2001; IOM, 2005). Yet much of the population, including children, does not meet recommendations for adequate daily physical activity (IOM, 2005). This has been found to be particularly true among minority populations, a likely contributing factor to the disparities seen in obesity prevalence (IOM, 2005).

Changes in the physical and built environment over time have greatly contributed to decreased levels of physical activity (Dietz & Gortmaker, 2001; Ebbeling et al., 2002; IOM, 2005). Technological advances are linked to greater convenience and ease of daily activities; meanwhile a greater reliance on cars has replaced other forms of active transport such as walking or bicycling (Ebbeling et al., 2002; IOM, 2005). Some neighborhoods are also not conducive for physical activity, particularly where it is unsafe or there is a lack of opportunity to be active (Ebbeling et al., 2002; IOM, 2005).

While few data exists on physical activity levels of young children, enrollment in physical education classes in schools are reportedly low (IOM, 2005). In addition, longitudinal data indicates that over half of 9-13 year olds do not participate in organized sports or activities outside of school and another quarter do not engage in any physical activity in their free time (IOM, 2005). Sedentary activities have largely displaced physical ones, which has been a contributing factor in obesity (IOM, 2005).

As technology has proliferated in the home, more time has been devoted to sedentary pursuits such as watching television, playing videogames, and spending time on

the Internet (Ebbeling et al., 2002; IOM, 2005). Time spent in these sedentary activities not only displaces time spent in other activities such as exercise, but watching television has also been linked to increased exposure to food advertising (Dietz & Gortmaker, 2001) and increased snacking (Ebbeling et al., 2002).

Family. As suggested by the social-ecological model, families, especially parents or caregivers, play an important role in their children's lives. This includes influencing child exposures and behaviors. Parents can act as role models when it comes to food consumption, physical activity, and media exposure, as children are likely to model their parents' behaviors (Barlow & the Expert Committee, 2007). Parents can also act as gatekeepers, limiting exposure to certain unhealthy foods and limiting sedentary activities (Barlow & the Expert Committee, 2007). It is therefore essential that parents are equipped with the knowledge, skills, and behaviors to help their children lead healthy lives (Dietz & Gortmaker, 2001).

Parents of young children largely influence what their children eat and the types of activities they engage in. Infancy is a critical time for the development of food preferences and eating behaviors later in childhood (Hohman, Paul, Birch, & Savage, 2017). Parents and caregivers play a large role in this, as they as they decide what and when to feed infants (Hohman et al., 2017). This often starts with the decision to breastfeed or formula feed in the first few months of life (Dietz & Gortmaker, 2001) and the timing of exposure to solid foods per expert recommendations (Barlow & the Expert Committee, 2007). Parents are also responsible for making food choices for their children during early childhood (Dietz & Gortmaker, 2001). In addition, parent participation in or encouragement of physical activity is linked to greater exercise uptake by their children (Ebbeling et al., 2002).

Meanwhile, children with obese parents are at greater risk of becoming obese in adulthood, even if their BMI is in a normal range during childhood (Barlow & the Expert Committee, 2007). Other family factors can also impact obesity outcomes for children (Dietz & Gortmaker, 2001). Data from the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B) linked several maternal characteristics to obesity outcomes at age 4 (Kitsantas & Gaffney, 2010). Obese children were more likely to be born to mothers who were of Hispanic origin, had a low socioeconomic status, and were themselves overweight compared to mothers of children with a normal BMI (Kitsantas & Gaffney, 2010). These findings are consistent with other data that make associations between weight status and race or ethnicity, socioeconomic status, and maternal weight (Freedman et al., 2016; Han et al., 2010; Kitsantas & Gaffney, 2010; Pan et al., 2016).

Nutrition & Physical Activity Guidelines

The 2015-2020 Dietary Guidelines, developed by the U.S. Department of Health and Human Services (HHS) and the U.S. Department of Agriculture (USDA), encourage healthy eating behaviors among individuals aged 2 and older across all demographics, and are used to inform nutritional policies and programs (HHS & USA, 2015). These broad goals include maintaining healthy eating habits across the lifespan, eating a variety of nutrient-dense foods in appropriate quantities, and limiting consumption of added sugars, fats, and sodium (HHS & USA, 2015).

Generally, these recommendations can be achieved through eating a variety of fruits, vegetables, grains (focus on whole grains), low-fat or fat-free dairy products, some oils, and protein such as lean meats, eggs, legumes, nuts, seeds, and soy (HHS & USA, 2015). Additional resources and specific dietary information put out by HHS and the USDA can

help guide individuals to meet healthy nutritional intake. The Guidelines also focus on the importance of different sectors and settings working together to support good eating habits (HHS & USA, 2015). This includes family-focused programs that identify and modify dietary habits, teach skills for preparing healthy meals, and provide access to resources such as MyPlate that help individuals make healthy food choices (HHS & USA, 2015).

While these Guidelines have not previously focused on children younger than 2 years of age, there has been recent recognition of the emerging need to focus on early child nutrition as it relates to future health outcomes (USDA CNPP, n.d.). This has caused Congress to mandate the expansion of the Guidelines to include pregnant women and infants up to 24 months in the 2020-2025 update (USDA CNPP, n.d.). These recommendations will focus on milk feeding, complementary foods, exposure to foods and food acceptance, maternal diet during and after pregnancy, and parental feeding practices (USDA CNPP, n.d.).

In addition to eating a healthy diet, exercise is also crucial for achieving good overall health. The 2008 Physical Activity Guidelines developed by HHS provide recommendations for regular daily activity (HHS, 2008). This includes 60 minutes of daily physical activity for 6-17 year olds through a variety of aerobic, muscle-strengthening, and bone-strengthening activities (HHS, 2008). For most adults 18 and older, at least 150 minutes of moderate-intensity physical activity, such as brisk walking or gardening, or 75 minutes of vigorous-intensity physical activity, such as jogging or dancing, is recommended weekly (HHS, 2008). While there are no physical activity guidelines for children younger than 6 years of age, HHS does recognize the necessity of movement for infants and young children

for healthy development (HHS, 2008). As such, focus in this age group should be on developmentally appropriate activities that support healthy growth (HHS, 2008).

The Guidelines also encourage individuals to set physical activity goals that can be achieved through different types of activities, including leisure, recreation, and active games (HHS, 2008). Specific examples are provided through HHS. Similar to the Dietary Guidelines, the Physical Activity Guidelines focus on the life course approach to maintaining good exercise habits and stress the need for opportunities to be physically active across individual, community, and societal settings (HHS, 2008). Among these settings is the home, with the family as an important driver in creating healthy habits among children (HHS, 2008).

From these guidelines, an expert committee headed by the American Medical Association, the Health Resources and Service Administration, and the Centers for Disease Control and Prevention, in collaboration with representatives from a broad range of disciplines of health, developed recommendations for childhood obesity prevention based on the best available evidence and information (Barlow & the Expert Committee, 2007). These recommendations are summarized below and serve as general guidelines for all children to maintain a healthy weight.

Dietary Recommendations:

- Limiting consumption of sugar-sweetened beverages (and avoid giving sugar-sweetened beverages to infants less than 12 months)
- Meeting USDA recommendations for a healthy diet by making a variety of foods available in the home
- Eating a nutritious breakfast every morning

- Limiting food consumption at fast food and other restaurants
- Eating family meals
- Limiting portion sizes

Physical Activity Recommendations:

- Engaging in daily physical activity
- Incorporating physical activity into daily routines
- Reducing sedentary behaviors
- Limiting screen time

The American Academy of Pediatrics (AAP) also recognizes the importance of early intervention for childhood obesity prevention starting before age 2. To this end, they make age-specific recommendations for families in line with the Dietary and Physical Activity Guidelines to support the health and wellbeing of infants and children (AAP, n.d.). Among the recommendations include changing the home environment to be more conducive to healthy eating, placing limits on media usage, and increasing opportunities for physical activity (AAP, n.d.). Specific recommendations for parents are discussed later in this paper.

Literature Review

Childhood Obesity Prevention Efforts

The effects of childhood obesity on health are well documented (Ebbeling et al., 2002; Han et al., 2010; Kitsantas & Gaffney, 2010; Must & Strauss, 1999). Interventions to reduce obesity in children have focused largely on increasing physical activity and improving nutritional intake through a variety of prevention strategies in settings where children spend their time (Campbell, Waters, O'Meara, & Summerbell, 2001). However, many of these interventions are aimed at reversing obesity in school-aged children rather than addressing risk factors before weight gain occurs (Ordway et al., 2018; Salvy, de la Haye, Galama, & Goran, 2017). In addition, the evidence-base surrounding prevention strategies remains weak, as few interventions have indicated long-term effectiveness on weight reduction and maintenance (Campbell et al., 2001; Han et al., 2010; Must & Strauss, 1999). Thus, calls for primary prevention as a strategy for reducing obesity prevalence has become an increasingly salient area of focus throughout the literature (Haire-Joshu et al., 2008; Hohman et al., 2017; Ordway et al., 2018; Savage, Birch, Marini, Anzman-Frasca, & Paul, 2016; Stark et al., 2014; Thomson, Tussing-Humphreys, & Goodman, 2014; Wen et al., 2012).

In particular, infancy and early childhood have become well recognized as critical periods for obesity prevention (Anderson & Whitaker, 2009; Pan et al., 2016; Salvy; et al., 2017; Woo Baidal et al., 2016). Several risk factors for obesity can be linked to the period from conception through the first 2 years of life (Salvy et al., 2017; Woo Baidal et al., 2016). ECLS-B data reveal that child characteristics linked to obesity at age 4 include a high birth weight and obesity at age 2 (Kitsantas & Gaffney, 2010). High birth weight, rapid weight

gain during infancy, and high weight in early childhood has been linked to an increased risk of continued weight gain during preschool in several studies (Han et al., 2010; Kitsantas & Gaffney, 2010; Pan et al., 2016). In addition, the probability of adult obesity increases as the child ages, yet changing habits and behaviors relating to weight outcomes becomes increasingly difficult (Guo et al., 2002).

Modifiable risk factors during this period weigh heavily on parents and caregivers (Dietz & Gortmaker, 2001), especially mothers (Han et al., 2010; Woo Baidal et al., 2016). A systematic review of evidence for obesity risk factors found consistent associations between child obesity in later life and maternal factors such as high pre-pregnancy BMI, gestational weight gain, gestational diabetes, and smoking (Woo Baidal et al., 2016). Other maternal behaviors relating to nutrition and physical activity leading to a high infant birth weight and rapid infant weight gain are also consistently associated with an increased risk for subsequent obesity in children (Salvy et al., 2017; Woo Baidal et al., 2016).

Thus, early intervention is particularly important for overweight and obese mothers and children with a high weight at birth and at 2 years of age (Kitsantas & Gaffney, 2010). However, prevention should focus on all children, including those of a healthy weight, to mitigate the potential effects of excess weight gain (Barlow & the Expert Committee, 2007). These efforts should focus on lifestyle factors and behaviors starting at birth that are supportive of healthy dietary and exercise habits (Barlow & the Expert Committee, 2007). This includes maintaining good nutrition during pregnancy (Pan et al., 2016), breastfeeding infants (Dietz & Gortmaker, 2001; Ebbeling et al., 2002; Han et al., 2010; Kitsantas & Gaffney, 2010; Pan et al., 2016; Woo Baidal et al., 2016), healthy feeding practices in older children (Dietz & Gortmaker, 2001; Pan et al., 2016; Woo Baidal et al., 2016), and engaging

in daily physical activity (Dietz & Gortmaker, 2001; Pan et al., 2016). As such, it is critical that parents are engaged in efforts aimed at reducing obesity in children (Dietz & Gortmaker, 2001; Han et al., 2010). A more detailed discussion of recommendations for prevention can be found later in this paper.

Home Visiting Programs

Home visiting as an intervention strategy has been widely used to prevent adverse experiences in early childhood (Duffee et al., 2017; Mercy & Saul, 2009). Infants and children who live at or below the federal poverty level have an increased likelihood of facing adverse experiences, which can have a lifelong impact on development (Duffee et al., 2017). Early adverse experiences that can pose a threat to child development include parental substance abuse, child abuse and neglect, and exposure to violence (Mercy & Saul, 2009). These early childhood experiences have been linked to poor educational and economic achievement, as well as mental and physical health problems (Mercy & Saul, 2009). As a result of these exposures, children are more likely to express emotional and behavioral problems and have increased health risks (Mercy & Saul, 2009) including obesity (Ebbeling et al., 2002; Mercy & Saul, 2009). Consequently, these experiences continue the racial, socioeconomic, and health disparities already felt by these children and families (Mercy & Saul, 2009).

Home visiting programs aim to avert these outcomes by working with parents and caregivers to prevent child maltreatment, promote healthy development, and improve parent skills (Duffee et al., 2017). Often, this is achieved through fostering safe and supportive relationships and environments for children and their families (Mercy & Saul, 2009). Many of these programs begin services to new mothers or to families with children

up to 5 years of age (Salvy et al., 2017), using trained staff to deliver support in the home (Avellar & Supplee, 2013; Duffee et al., 2017). Sessions are typically conducted in the parents' homes over the course of several weeks. Parents learn to foster positive relationships and to safely care for their children, which supports healthy development (Mercy & Saul, 2009). By preventing adverse child experiences in early life, children are less likely to face the consequences associated with adverse exposures (Mercy & Saul, 2009).

Over 500 home visiting programs provide services to 650,000 mothers and their children annually (Salvy et al., 2017). Several of these programs have a substantial evidence-base, supported through randomized control trials that link program participation to important long-term outcomes (Mercy & Saul, 2009; Salvy et al., 2017). These programs, disseminated broadly across the United States and internationally, have shown some favorable results in reducing child maltreatment and injury and improving social and emotional behaviors (Avellar & Supplee, 2013; Duffee et al., 2017; Mercy & Saul, 2009; Salvy et al., 2017). In addition, a few evidence-based models have also shown positive results in other areas such as use of health services, birth weight, breastfeeding, and child development (Avellar & Supplee, 2013).

Many of these models share common elements despite having different target populations, program structure, and outcomes (Avellar & Supplee, 2013; Duffee et al., 2017). Several of their strategies include using structured methods that couple information delivery with engaging activities (Avellar & Supplee, 2013) to improve outcomes for vulnerable families (Duffee et al., 2017). As a result, parents learn about child

development, positive parenting behaviors, and appropriate child and infant interactions that support wellbeing (Avellar & Supplee, 2013; Duffee et al., 2017).

Home Visiting as a Setting for Obesity Prevention

The results of childhood obesity prevention efforts have been mixed (Campbell et al., 2001; Ordway et al., 2018), especially among low-income populations (Salvy et al., 2017). At-risk families often face additional barriers when it comes to obesity prevention due to factors such as food and housing insecurity (Salvy et al., 2017). Thus, previous obesity prevention efforts that address general lifestyle modifications may not be generalizable to this population (Salvy et al., 2017). Still, the prevalence of obesity among low-income and minority populations remains higher than the national average (Freedman et al., 2016; Ogden et al., 2014; Pan et al., 2016). It is estimated that 40% of children who participate in home visiting programs are overweight or obese (Salvy et al., 2017), presenting an important opportunity for prevention in this population.

Home visiting programs have been successful in reaching at-risk populations and addressing issues related to healthy child development (Salvy et al., 2017). However, these programs in their current form do not extensively address nutrition and physical activity (Salvy et al., 2017). Home visiting as a means for addressing childhood obesity is a relatively new area of focus, with many of the related studies having been conducted over the last 10 years (Haire-Joshu et al., 2008; Hohman et al., 2017; Ordway et al., 2018; Savage et al., 2016; Stark et al., 2014; Thomson et al., 2014; Wen et al., 2012). Many of these studies have shown promising results (Haire-Joshu et al., 2008; Hohman et al., 2017; Ordway et al., 2018; Savage et al., 2016; Stark et al., 2014; Thomson et al., 2014; Wen et al., 2012). As such, home visiting for obesity prevention is worth further exploration.

As opposed to efforts in the primary care or outpatient setting, home visiting offers greater flexibility for families who wish to participate in an obesity management program (Spence, Birken, Haines, & Ball, 2015). Families who do have access to a clinic may face a significant burden of receiving long-term treatment in this setting because of the direct and indirect costs associated with doctor's visits and missing work and school (Salvy et al., 2017; Spence et al., 2015). This is especially true for low income and racial and ethnic minority families who are already disproportionately affected by obesity and would benefit the most from a prevention program (Salvy et al., 2017; Spence et al., 2015). Home visiting interventions tend to be more accessible because they are conducted in the home over an extended period of time (Salvy et al., 2017; Spence et al., 2015). This alleviates pressure on families to attend programs outside the home (Salvy et al., 2017; Spence et al., 2015).

Home visiting programs are also better positioned for longer-term follow up, which helps parents maintain their skills (Salvy et al., 2017; Spence et al., 2015). In addition, home visiting gives home visitors the opportunity to observe families in their home environment and address specific barriers and opportunities to achieving optimal nutrition and physical activity (Salvy et al., 2017; Stark et al., 2014; Spence et al., 2015). In the LAUNCH randomized controlled trial, parents who worked with a home visitor to change their home food environment were more likely to consume less calories and increase their fruit and vegetable intake at follow-up despite parents in the pediatric counseling (PC) group receiving information on making behavioral changes (Stark et al., 2014). In this same program, preschool children who received the home visiting program were more likely to have a reduction in BMI by month 6 compared to the PC group (Stark et al., 2014). The type of individualistic approach available via home visiting is important in light of the

various external factors that contribute to poor eating habits and lack of adequate physical activity (Ordway et al., 2018; Savage et al., 2016; Spence et al., 2015).

Another case for expanding home visiting interventions to include components related to childhood obesity is the existing funding for programs that fall under the Maternal, Infant, and Early Childhood Home Visiting (MIECHV) umbrella (Spence et al., 2015). The MIECHV funding stream provides support for the implementation of evidence-based programs to mothers and children aged 0-5 across the United States (Spence et al., 2015), with the aim of improving maternal and child health, child development, child maltreatment (Avellar & Supplee, 2013), and other needs of at-risk families (Duffee et al., 2017). The passage of the Patient Care and Affordable Care Act (ACA) in 2010 allocated \$1.5 billion dollars to states to meet these goals (Avellar & Supplee, 2013; Duffee et al., 2017). This funding also provides an opportunity to evaluate the effectiveness of home visiting for obesity prevention (Salvy et al., 2017).

The feasibility of home visiting to address childhood obesity has been evaluated in a few studies (Karanja et al., 2010; Wen, De Domenico, Elliott, Bindon, & Rissel, 2009). In a pilot of the Healthy Beginnings Trial, the study's high retention rate and positive feedback to the home visiting model demonstrated the acceptance of an early intervention program for childhood obesity prevention among low-income Australian families (Wen et al., 2009). A large-scale randomized controlled trial of the program demonstrated its success in addressing factors related to obesity outcomes (Wen et al., 2012), discussed in greater detail later in this paper. The feasibility of similar programs has been documented for various other cultural and socioeconomic groups as well (Karanja et al., 2010; Ordway et al., 2018; Savage et al., 2016).

Since home visiting services are already widely implemented across the country (Duffee et al., 2017), there may be an opportunity to use the existing framework of such programs and incorporate components related to healthy feeding practices and physical activity (Salvy et al., 2017). It is difficult for families to change habits, particularly in light of external factors such as culture and environment that influence dietary and physical activity behaviors (Barlow & the Expert Committee, 2007). Simply making recommendations to families is not enough to overcome these barriers and has generally not been effective (Barlow & the Expert Committee, 2007). Drawing upon the success of home visiting models and their work with at-risk populations, there may be an opportunity to extend services into a comprehensive system that includes obesity prevention efforts.

Related Studies

Using the evidence base of effective home visiting models, programs that use similar strategies have been proposed for obesity prevention among 0-5 year olds (Savage et al., 2016; Wen et al., 2012). This involves in-home delivery of the program, knowledge and skill acquisition through hands-on learning and practice (Thomson et al., 2014, Wen et al., 2012), and individual goal setting for parents (Salvy et al., 2017). Randomized controlled trials (RCTs) have indicated the positive effects of early intervention home visiting on BMI reduction in infants and preschool aged children (Ordway et al., 2018; Savage et al., 2016; Stark et al., 2014; Thomson et al., 2014; Wen et al., 2012). Several of these interventions have focused on mothers during pregnancy (Haire-Joshu et al., 2008; Ordway et al., 2018; Thomson et al., 2014; Wen et al., 2012) or shortly after birth (Hohman et al., 2017; Savage et al., 2016), as this is a critical time to address the risk factors related to childhood obesity.

Some of these programs specifically aim to reduce BMI among infants and preschool age children (Stark et al., 2014; Wen et al., 2012), while many others focus on obesity risk factors such as infant feeding practices, appropriate introduction of solid foods, active play, and screen time reduction (Ordway et al., 2018; Savage et al., 2016; Wen et al., 2012). Parental behaviors are also often targeted as they relate to their own weight and the influence they have on the weight of their child (Thomson et al., 2014; Wen et al., 2012). By promoting healthy parent behaviors and healthy home environments, these approaches are promising in terms of affecting weight outcomes over the life course (Salvy et al., 2017).

Healthy Beginnings Trial. The Healthy Beginnings Trial, conducted among vulnerable populations in Sydney, Australia, incorporated national guidelines for breastfeeding, the introduction of solid foods, “tummy time”, and playtime into a home visiting model in an attempt to prevent obesity (Wen et al., 2012). Maternal nutrition and physical activity was also addressed. The key messages focused on breastfeeding, delaying the introduction of solids until 6 months, introducing a variety of fruits and vegetables after 6 months, consuming water instead of sugar sweetened beverages, and maintaining an active family.

The intervention began with mothers during the last few weeks of pregnancy and continued post-partum until infants reached 2 years of age. BMI, the primary outcome at the end of the program, was significantly lower in the intervention group than in the control group who received usual community health services only. Secondary outcomes also showed promising results as they relate to obesity prevention. While there were no significant differences between the intervention and the control group for consumption of fruit, consumption of junk food, and playtime, several other measures had more promising

outcomes. At the end of the study, children in the intervention group were significantly more likely to eat at least one serving of vegetables per day and significantly less likely to watch TV while eating. These same children were also significantly less likely to watch TV for more than an hour each day.

In the Health Beginnings Trial, the home visiting intervention was effective at reducing BMI among children. At the end of the two-year study, the mean BMI was significantly lower among infants and children who participated in the intervention compared to those in the control group. In addition to BMI reduction, there was a significant effect on other variables related to maintaining a healthy weight. This included increased vegetable consumption for children and mothers, decreased TV time for children, and increased physical activity for mothers. All of these factors play a role in preventing obesity.

Intervention Nurses Start Infants Growing on Healthy Trajectories (INSIGHT).

The INSIGHT program used a home visiting model to focus on responsive parenting behaviors in addressing the needs of infants beginning shortly after birth (Savage et al., 2016). Instead of explicitly focusing on obesity prevention, the program framed parenting behaviors in terms of feeding, sleeping, and soothing practices. By promoting healthy development among infants in these domains, the program results indicated the possibility of reducing the risk of excessive weight gain during the first year of life. This strategy may be particularly important for parents who may not see obesity prevention as an area of importance.

Mothers were provided with program materials within 2 weeks after giving birth. Home visits began about a week later and continued every 12 weeks for 1 year. Curriculum

components included information about obesity risk factors such as infant feeding, sleep, play, behavior, and growth. In addition to receiving educational materials, parents practiced what they learned with their home visitors.

Results from the INSIGHT RCT indicated that the intervention was associated with slower weight gain among infants in the first 6 months of life, which may be protective against subsequent obesity. This was true among infants who were both breastfed and formula-fed. At 12 months, 5.5% of infants in the intervention group had weight for length $\geq 95^{\text{th}}$ percentile compared to 12.7% of infants in the control group. While there is no formal definition for obesity before 2 years of age, this percentile is consistent with the range for obesity among older children (Ogden et al., 2014).

A separate RCT of the INSIGHT program used the same intervention strategies to examine the diets of 9 month olds and how their eating patterns correlated to weight status (Hohman et al., 2017). Dietary patterns were classified into categories based on whether the infants were breastfed or formula fed plus if the infants consumed a variety of fruits and vegetables or not. Infants in the intervention were more likely to consume high quantities of fruits and vegetables and had lower BMIs at age 2 than infants in the control group. Those in the intervention group also had healthier diets overall, regardless of whether they were breastfed or bottle-fed, than infants in the control group. This indicates the possible benefits of a parenting intervention on healthy eating behaviors among all infants, particularly among those who are not breastfed.

Incorporation into existing evidence-based programs. In addition to stand-alone trials of home visiting programs targeting obesity, a few studies have examined how

obesity prevention can be incorporated into existing home visiting programs (Haire-Joshu et al., 2008; Ordway et al., 2018; Thomson et al., 2014).

Minding the Baby. The Minding the Baby (MTB) program presents a comprehensive approach to supporting the health and development of mothers and children from vulnerable populations (Ordway et al., 2018). This home visiting model has a strong evidence base for strengthening parenting behaviors and parent-child interactions. Although the program does not specifically aim to prevent obesity, modifiable risk factors for obesity are addressed as they relate to rapid infant weight gain, breastfeeding, early introduction of solid foods, TV watching, and poor diet that includes sugar sweetened beverages.

Families who participate in the program receive home visiting services starting before birth, which continue weekly until the child reaches 1 year of age. The services then become biweekly for the second year of life. Mothers are taught to recognize their child's hunger cues and ways to interact with their child during feedings. Home visitors also employ a socioecological approach to understanding feeding practices, working with mothers to address nutrition and food choices in a culturally sensitive manner. This focusing on primary prevention might be protective against excess weight gain in children.

In a randomized controlled trial of MTB, children in the intervention group were significantly more likely to have a normal BMI at age 2 than children in the control group whose mothers received standard clinical care. Just 3.3% of children in the intervention group were obese compared to 19.7% of children in the control group. It is noteworthy that the population for this study was largely Hispanic, a group that typically has a higher than average rate of obesity.

Parents as Teachers. The Parents as Teachers (PAT) program has been explored as a venue for expanding obesity prevention efforts (Haire-Joshu et al., 2008; Thomson et al., 2014). PAT is an evidence-based home visiting program with a broad national reach. The PAT model focuses on increasing parent knowledge on child development, improving parent behaviors to prevent child abuse, and increasing school readiness (Thomson et al., 2014). Using the same strategies and format embodied by PAT, the High 5 for Preschool Kids (H5-Kids) program was created to address the food environment of preschool aged children to determine its impact on food preferences (Haire-Joshu et al., 2008). The program included components related to parent knowledge about nutrition, feeding practices, modeling behaviors in relation to fruit and vegetable consumption, and availability of healthy foods in the home. Materials covered all program components, but were specific to each family's needs.

Parents who received the H5-Kids intervention compared to the standard PAT program showed an increase in nutrition knowledge, fruit and vegetable availability in the home, and fruit and vegetable intake. Among normal weight children receiving the intervention, fruit and vegetable consumption increased. Consumption did not increase in overweight children, suggesting that food preferences are already established by the time a child reaches the 2-5 year range. When parents increased their fruit and vegetable knowledge and consumption, their children were more likely to increase their consumption as well. In addition, children were more likely to consume fruits and vegetables when they were available in the home. Parents in the intervention group demonstrated that small behavior changes were possible as a result participation in the H5-Kids home visiting program.

Implications. Despite many of these studies being conducted among specific population groups that might otherwise limit their generalizability, the research shows that early home visiting interventions can be successfully implemented with families having a variety of racial and ethnic and socioeconomic backgrounds (Haire-Joshu et al., 2008; Ordway et al., 2018; Savage et al., 2016; Stark et al., 2014; Thomson et al., 2014; Wen et al., 2012). Of particular importance is their ability to target low-income or minority groups who are most at risk for the consequences of obesity (Haire-Joshu et al., 2008; Ordway et al., 2018; Thomson et al., 2014; Wen et al., 2012).

Results from studies beginning even at 2-4 months after birth have had mixed outcomes (Savage et al., 2016), suggesting the importance of targeting behaviors as development is occurring. Intervening with preschool aged children presents an added barrier specific to development at this age whereby children are less likely to try new foods (Stark et al., 2014). In addition, positive effects of an early intervention may not be sustained without ongoing efforts (Wen et al., 2015). It is not only important to intervene early to influence healthy weight trajectories, but it is also necessary to ensure that healthy habits are maintained.

These studies indicate the importance of early intervention and addressing multiple risk factors for weight management. Programs that focus on the entire family and on changing the home environment are more likely to be influential if they can be modified to meet family situations and needs (Salvy et al., 2017). The results from these RCTs suggest that it is feasible to incorporate obesity prevention efforts into existing evidence-based home visiting programs. Several of such programs exist to meet the different needs of

families, and including small components surrounding healthy behaviors may go a long way in addressing the factors leading to obesity outcomes.

Purpose & Methods

This project examined the extent to which childhood obesity is addressed, either through nutritional or physical activity components, among various home visiting programs. Information on obesity prevention efforts was obtained from representatives of home visiting models and is summarized in Table 1. This summary is based on information provided from program contacts and thus may not cover what is actually being done in practice or the full extent of obesity prevention efforts carried out by these programs.

The aim of this project is to compare these programs' efforts to expert recommendations for childhood obesity prevention as well as physical activity and nutrition guidelines for the 0-5 age group. From this review, gaps are identified between expert recommendations and program practices, as well as gaps in research and link to practice. Finally, broad recommendations are made for incorporating obesity prevention components into home visiting curriculum and what parents can do to promote a healthy weight in their children.

To select the home visiting models for inclusion in this review, a list of evidence-based programs was obtained through the California Evidence-Based Clearinghouse for Child Welfare (CEBC) and the Maternal, Infant, and Early Childhood Home Visiting (MIECHV). Programs on these lists meet certain criteria for evidence of effectiveness. The ones selected for inclusion in this review focus on children aged 0-5 (some including pregnant women), have a strong evidence base, and are broadly disseminated across the United States. A total of 10 programs were selected and contacted via email asking for curriculum materials or information on childhood obesity prevention efforts, including:

- Child First

- Early Head State-Home Visiting (EHS-HV)
- Family Connects
- Healthy Families America (HFA)
- Home Instruction for Parents of Preschool Youngsters (HIPPY)
- Nurse Family Partnership (NFP)
- Parent-Child Home Program (PCHP)
- Parents as Teachers (PAT)
- Play and Learning Strategies (PALS)
- SafeCare

HIPPY and PALS did not respond to our inquiry. Thus, a total of 8 programs were included in the review.

A literature review was also conducted for the purpose of this project. The review examined home visiting childhood obesity prevention efforts to determine the feasibility and impact of such programs, as well as expert recommendations on nutrition and physical activity behaviors to prevent childhood obesity.

Findings

Based on the information received from programs on what they do for childhood obesity prevention, I was able to identify overarching topics covered by the programs related to healthy weight management. A full summary of program efforts can be found in Table 1.

Table 1. An overview of obesity prevention efforts among evidence-based home visiting programs.

Program	Ages served	Obesity prevention efforts
Child First	Pregnant women, children ages 0-5	<ul style="list-style-type: none"> • Home visitor requests information regarding weight on child health form at baseline and at the end of the program
Early Head Start-Home Visiting (EHS-HV)	Pregnant women, children ages 0-3	<ul style="list-style-type: none"> • Home visitors can provide comprehensive services as needed, including components related to healthy nutrition and physical activity (emphasis on active and outdoor play) (Early Head Start National Resource Center, n.d.) • Connect families to resources and community services, including: <ul style="list-style-type: none"> ○ Special Supplemental Nutrition Programs for Women, Infants, and Children ○ Breastfeeding programs ○ Information on nearby parks ○ Well-Visit Planner • Education for expectant mothers on breastfeeding and maternal nutrition • Support for cognitive development includes recommendations for limiting screen time • More information on these components and resources can be found online: https://eclkc.ohs.acf.hhs.gov/nutrition
Family Connects	Children ages 0-1	<ul style="list-style-type: none"> • Nurse home visitors can connect families with resources and provide referrals for programs or services related to nutrition/obesity prevention if desired by the family <ul style="list-style-type: none"> ○ Nurses are also in a position to identify risk/need while covering domains related to maternal health, infant health, and health care plans
Healthy Families America (HFA)	Pregnant women, children ages 0-5	<ul style="list-style-type: none"> • Integration of COPE (Childhood Obesity Prevention @ Home) nutrition and physical activity components into HFA program (Salvy et al., 2016) • Focuses on modifying the home environment, changing unhealthy maternal behaviors, and suggestions for healthy family behaviors • Connects family to community health resources and social networks such as local parks and free walking groups or cooking

		<p>classes</p> <ul style="list-style-type: none"> • Stresses importance of modeling healthy behaviors • Maternal nutrition components focus on: <ul style="list-style-type: none"> ○ Preparation of nutritious foods (keeping in mind cultural preferences and adapting) ○ Increasing fruit and vegetable intake and limiting consumption of sugar-sweetened beverages and foods high in fat/sugar • Child/infant nutrition includes: <ul style="list-style-type: none"> ○ Breastfeeding during the first 2 years ○ Age-appropriate introduction of solids with focus on nutritional quality ○ Education for caregivers on child hunger/fullness cues, structured eating schedules, non-food soothing techniques, repeat exposure to a variety of healthy foods, and involvement of children in making food choices/meal preparation • Physical activity <ul style="list-style-type: none"> ○ Promotes daily physical activity/active play
Nurse Family Partnership (NFP)	Pregnant women, children ages 0-2	<ul style="list-style-type: none"> • Program focuses on nutrition as it relates to child and maternal health, including: <ul style="list-style-type: none"> ○ Breastfeeding ○ Appropriate introduction of solid foods ○ Healthy food choices/nutrition • Encourage well-child visits
Parent-Child Home Program (PCHP)	Children ages 2-3	<ul style="list-style-type: none"> • Happy and Healthy Curriculum (extension of PCHP) • Uses regular PCHP components to highlight healthy eating or physical activity messages <ul style="list-style-type: none"> ○ Books and educational toys as teachable opportunities ○ Example: playing ‘Head, Shoulders, Knees, and Toes’ and other active activities • Connects good nutrition and exercise to healthy development and school readiness (core program focus) • Early Learning Specialists (home visitors) help families make healthy habits part of the home environment <ul style="list-style-type: none"> ○ Guide sheets given with tips on age appropriate physical play, nutrition guidelines, healthy snacks, and alternatives to screen time ○ Provide resources on where to buy affordable and healthy grocery items, information on SNAP benefits, and safe and accessible places for children to play
Parents as Teachers (PAT)	Pregnant women, children ages 0-5	<ul style="list-style-type: none"> • Program requires comprehensive health screening for children upon entering the program and then yearly, including weight information <ul style="list-style-type: none"> ○ Parent Educator (home visitor) may address health related issues or provide referrals for services (such as a nutritionist) • Obesity prevention topics covered and resources provided during home visits, including:

		<ul style="list-style-type: none"> ○ Breastfeeding ○ Meal planning (healthy food choices/nutrition, portion sizes) ○ Importance of breakfast and packing healthy lunches • Group connections for families to engage in physical activity, interact at local playgrounds, and other community-based activities • Enhanced curriculum available <ul style="list-style-type: none"> ○ High 5 for Preschool Kids focuses on healthy eating for moms and children
SafeCare	Children ages 0-5	<ul style="list-style-type: none"> • Home visitors discuss nutrition and physical activity with parents during the SafeCare health module <ul style="list-style-type: none"> ○ Support breastfeeding and delayed introduction of solid foods ○ Provide suggestions for introducing a variety of fruits and vegetables ○ Promote well visits with pediatrician ○ MyPlate activity for parents (USDA guidelines for optimal nutrition) ○ Encourage regular mealtimes and give suggestions healthy snacks ○ Focus on tummy time, stretching, and movement for infants and active play for older children • Parent-child/infant interaction modules help parents plan age-appropriate daily and play activities for their children <ul style="list-style-type: none"> ○ Parents encouraged to model positive behaviors (healthy eating & physical activity) ○ Focus on giving choices and avoid forced feeding ○ Allow children to help with meal and snack preparation

Of the 8 home visiting programs that responded to our inquiry, 6 reported having child and/or maternal nutritional components integrated into their programs. EHS-HV, HFA, NFP, PAT, and SafeCare recognize the importance of breastfeeding practices within their curriculum. PCHP begins with children aged 2, so this component would likely not be included for their program demographic. In addition, HFA, NFP, and SafeCare promote the delayed introduction of solid foods until it is appropriate for the child.

Related to maternal nutrition, HFA and SafeCare also stress the importance of modeling healthy food behaviors. Other recommendations for modifying dietary habits and the home environment are addressed by HFA, PCHP, PAT, and SafeCare. This includes information on following nutrition guidelines, preparing healthy foods and snacks,

increasing fruit and vegetable intake, meal planning, portion sizes, and eating a healthy breakfast.

Five out of the 8 programs (EHS-HV, HFA, PCHP, PAT, and SafeCare) also address physical activity in some capacity for both families and children. These programs promote daily activity messages through active play and structured or unstructured activities that involve age-appropriate movement. EHS-HV and PCHP are the only programs that reported having recommendations for limiting screen time.

Another important component of many of these programs in addressing childhood obesity is connecting families to a variety of services and community resources related to nutrition and physical activity. This includes recommendations for breastfeeding programs, information on local parks and playgrounds, information on where to buy affordable grocery items, connecting mothers to WIC services, and promoting participation in community-based activities such as walking groups or cooking classes. In addition, home visitors can recommend specific obesity prevention services or referral to a nutritionist if they perceive as need. EHS-HV, Family Connects, HFA, PCHP, and PAT all mention providing a connection to resources for obesity prevention.

Finally, health screenings or recommendations for well visits to pediatricians are included as obesity prevention efforts by Child First, EHS-HV, Family Connects, NFP, PAT, and SafeCare. While this may be thought to identify risk factors for obesity, nutrition and physical activity may or may not be addressed in this domain. Thus, it is uncertain how this component specifically promotes healthy weight management.

Discussion

Gaps & Opportunities

Despite what many home visiting programs report doing as far as childhood obesity prevention, several practice gaps exist. The first has to do with the information that programs provided outlining their efforts. The information received was based solely on what program contacts chose to report. With the exception of SafeCare and EHS-HV, most of the programs did not provide actual curriculum materials for me to be able to verify their efforts. As such, the accuracy of the reported efforts is unknown.

A related second gap has to do with the extent to which home visitors actually cover components related to nutrition and physical activity. Even when these components are included in program curriculum, the degree to which they are translated into practice can vary. This may impact the perceived importance of the messages relayed to parents in terms of maintaining a healthy weight. Fidelity monitoring and reporting would be necessary to ensure that home visitors are delivering these components as intended.

The third gap is whether or not the nutrition and physical activity curriculum components have had any impact in reducing child weight, improving nutrition, or increasing physical activity. Most of the programs examined did not take baseline and post-intervention measurements of food and physical activity behaviors or BMI. In addition, none of the programs with the exception of PAT have conducted studies and reported outcomes on the effects of nutrition and physical activity education as part of home visiting interventions. Home visitors should assess food intake, physical activity behaviors, and weight to determine if any positive changes can be attributed to the program's efforts.

This raises a fourth gap about research studies that have proposed childhood obesity prevention programs within the home visiting framework. Despite the intensive efforts of these research studies to promote child nutrition and physical activity, it is unclear how these programs are translated into practice in a real-world setting. This begs the question about which families would receive extended home visiting services that include components related to obesity prevention or whether these components could be seamlessly integrated into existing services. This is an important consideration about next steps for implementing obesity prevention into everyday practice.

Recommendations

Using expert recommendations for maintaining a healthy weight, home visiting programs can facilitate childhood obesity prevention efforts by addressing these important topics with all parents, regardless of child weight status. Specific points related to feeding and physical activity are discussed below. Many of these integrate well into the framework of many home visiting models as they relate to improving parenting behaviors and child interactions.

For nutrition, home visitors should focus on the following with parents for improving child (and in some cases parent) nutrition:

- Breastfeeding for the first 6 months of life (AAP, n.d.; Barlow & the Expert Committee; Ordway et al., 2018; Wen et al., 2012)
- Calming a fussy infant through means other than feeding (Salvy et al., 2017; Savage et al., 2016)
- Recognizing hunger and satiety cues in infants and children (AAP, n.d.; Ordway et al., 2018; Salvy et al., 2017; Savage et al., 2016)

- Learning age-appropriate portion sizes (AAP, n.d.; Savage et al., 2016)
- Waiting to introduce solid foods until at least 6 months of age (AAP, n.d.; Barlow & the Expert Committee, 2007; Ordway et al., 2018; Savage et al., 2016; Wen et al., 2012)
- Avoiding use of food as a reward (Barlow & Dietz, 1998) or punishment for certain behaviors (AAP, n.d.; Savage et al., 2016)
- Modeling healthy eating behaviors (Barlow & Dietz, 1998; Barlow & the Expert Committee, 2007; Savage et al., 2016), such as fruit and vegetable intake (AAP, n.d.; Salvy et al., 2017)
- Repeating exposure of new foods to infants and children to promote acceptance (Barlow & the Expert Committee, 2007; Salvy et al., 2017; Savage et al., 2016)
- Ensuring children eat a variety of fruits and vegetables (Wen et al., 2012)
- Promoting water intake over juice or other sugar-sweetened beverages (Barlow & the Expert Committee, 2007; Ordway et al., 2018; Wen et al., 2012)
- Maintaining a structured schedule for meals and snacks (Barlow & Dietz, 1998; Salvy et al., 2017)
- Involving children in food selection (Barlow & Dietz, 1998)

Similarly, the following should be discussed with parents to increase physical activity behaviors among children and families:

- Engaging infants in developmentally appropriate structured physical activity, including tummy time (Salvy et al., 2017; Savage et al., 2016; Wen et al., 2012)
- Promoting daily unstructured play time (Barlow & Dietz, 1998; Salvy et al., 2017; Savage et al., 2016)

- Reduce inactivity by limiting screen time and TV watching to no more than 2 hours per day (it is recommended that children under the age of 18 months do not watch any television) (AAP, n.d.; Barlow & Dietz, 1998; Barlow & the Expert Committee, 2007; Ordway et al., 2018; Salvy et al., 2017; Savage et al., 2016; Wen et al., 2012)
- Modeling physical activity behaviors (AAP, n.d.; Barlow & Dietz, 1998; Barlow & the Expert Committee, 2007; Wen et al., 2012)
- Avoid having infants and children be sedentary for more than 60 minutes while awake (Salvy et al., 2017)
- Engaging the entire family in physical activity (Barlow & Dietz, 1998; Barlow & the Expert Committee, 2007; Salvy et al., 2017)
- Incorporating physical activity into daily lifestyle habits and routines (Barlow & Dietz, 1998), such as taking the stairs over the elevator (Salvy et al., 2017)

Home visitors are in a unique position to identify families' capacity to change, barriers, and available resources (Barlow & the Expert Committee, 2007). They can work with families to assess infant and child eating and physical activity behaviors in order to identify opportunities for improvement (Barlow & Dietz, 1998; Barlow & the Expert Committee, 2007). This includes increasing awareness of current behaviors as they relate to nutrition and physical activity, identifying where improvement is needed and modifying that behavior, and maintaining these habits (Barlow & Dietz, 1998).

To do so, home visitors can use motivational interviewing to set goals and discuss families' behaviors in relation to these goals (Barlow & the Expert Committee, 2007). In addition, home visitors can give suggestions for healthy behaviors and connect families with resources to support these actions (Barlow & Dietz, 1998; Barlow & the Expert

Committee, 2007). Taken together, these strategies encompass a system of comprehensive care recommended by the expert committee (Barlow & the Expert Committee, 2007). By focusing on parenting skills in these areas, programs are well positioned to address determinants related to childhood obesity (Barlow & the Expert Committee, 2007).

Conclusion

Childhood obesity continues to be a major concern in the United States (Kitsantas & Gaffney, 2010; Ogden et al., 2014) due to the many complications of excess weight on health outcomes throughout the life course (Han et al., 2010; IOM, 2005; Must & Strauss, 1999; Pan et al., 2016). Previous intervention efforts to prevent childhood obesity have mainly focused on school-age children (Ordway et al., 2018; Salvy, de la Haye, Galama, & Goran, 2017), and have been generally unsuccessful (Campbell et al., 2001; Han et al., 2010; Must & Strauss, 1999). Recent studies have indicated that risk factors for obesity can be identified as early as during conception through the first 2 years of a child's life (Salvy et al., 2017; Woo Baidal et al., 2016). As a result, increasing importance has been placed on early prevention that targets modifiable behaviors relating to healthy eating and physical activity (Anderson & Whitaker, 2009; Pan et al., 2016; Salvy; et al., 2017; Woo Baidal et al., 2016).

In recent years, home visiting has been explored as a promising setting for early obesity prevention (Haire-Joshu et al., 2008; Hohman et al., 2017; Ordway et al., 2018; Salvy et al., 2017; Savage et al., 2016; Stark et al., 2014; Thomson et al., 2014; Wen et al., 2012). This setting has been successful in creating positive parenting behaviors that help support healthy development in children all across the country (Duffee et al., 2017; Salvy et al., 2017). Similarly, parents and the home environment are important driving forces behind eating and physical activity habits in children (Barlow & the Expert Committee, 2007; Dietz & Gortmaker, 2001; Hohman et al., 2017). As such, this may be a logical setting in which to address risk factors related to childhood obesity.

As many evidence-based home visiting programs currently stand, however, they do not adequately support expert recommendations for nutrition and physical activity.

Currently, several gaps exist between what evidence-based home visiting programs include in their curriculum surrounding obesity prevention and how this gets translated into practice. Addressing prevention practices with parents of all children, regardless of weight status, may help change the narrative surrounding childhood obesity. More efforts will need to be undertaken to assess the effects of such programs on uptake of healthy behaviors and weight reduction among children.

References

- American Academy of Pediatrics [AAP]. (n.d.). The case for early obesity prevention. In *HALF Implementation Guide (Healthy Active Living for Families: Right From the Start program)*. Retrieved from <https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/HALF-Implementation-Guide/Pages/The-Case-for-Early-Obesity-Prevention.aspx>
- Anderson, S.E. & Whitaker, R.C. (2009). Prevalence of obesity among US preschool children in different racial and ethnic groups. *Archives of Pediatric and Adolescent Medicine*, *163*(4), 344-348. doi: 10.1001/archpediatrics.2009.18
- Avellar, S.A., & Supplee, L.H. (2013). Effectiveness of home visiting in improving child health and reducing child maltreatment. *Pediatrics*, *132*(Supplement 2), S90-S99. doi: 10.1542/peds.2013-1021G
- Barlow, S.E., & Dietz, W.H. (1998). Obesity evaluation and treatment: Expert committee recommendations. *Pediatrics*, *120*(3). doi: 10.1542/peds.102.3.e29
- Barlow, S.E., & the Expert Committee. (2007). Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report. *Pediatrics*, *120*(Supplement 4), S164–S192. doi: 10.1542/peds.2007-2329C
- Campbell, K., Waters, E., O’Meara, S., & Summerbell, C. (2001). Interventions for preventing obesity in childhood. A systematic review. *Obesity Reviews*, *2*, 149-157. doi: 10.1046/j.1467-789x.2001.00035.x
- Dietz, W.H., & Gortmaker, S.L. (2001). Preventing obesity in children and adolescents. *Annual Review of Public Health*, *22*, 337-353. doi:

10.1146/annurev.publhealth.22.1.337

Duffee, J.H., Mendelsohn, A.L., Kuo, A.A., Legano, L.A., Earls, M.F.; Council on Community Pediatrics, Council on Early Childhood, & Committee on Child Abuse and Neglect. (2017). Early childhood home visiting. *Pediatrics*, *140*(3). doi: 10.1542/peds.2017-2150

Early Head Start National Resource Center. (n.d). *Home visitor's handbook*. Retrieved from <https://eclkc.ohs.acf.hhs.gov/ods/resource/home-visitors-handbook/detail/>

Ebbeling, C.B., Pawlak, D.B., & Ludwig, D.S. (2002). Childhood obesity: Public-health crisis, common sense cure. *Lancet*, *360*, 473–482. doi: 10.1016/S0140-6736(02)09678-2

Finkelstein, E.A., Trogon, J.G., Cohen, J.W., & Dietz, W. (2009). Annual medical spending attributable to obesity: Payer-and service-specific estimates. *Health Affairs*, *28*, 822-831. doi: 10.1377/hlthaff.28.5.w822

Freedman, D.S., Sharma, A.J., Hamner, H.C., Pan, L., Panzera, A., Smith, R.B., & Blanck, H.M. (2016). Trends in weight-for-length among infants in WIC from 2000 to 2014. *Pediatrics*, *139*(1), e20162034. doi: 10.1542/peds.2016-2034

Fryar, C.D., Carroll, M.D., & Ogden, C.L. (2016, July). Prevalence of overweight and obesity among children and adolescents aged 2-19 years: United States, 1963-1965 through 2013-2014. Retrieved from https://www.cdc.gov/nchs/data/hestat/obesity_child_13_14/obesity_child_13_14.pdf

Guo, S.S., Wu, W., Chumlea, W.M., & Roche, A.F. (2002). Predicting overweight and obesity in adulthood from body mass index values in childhood and adolescence. *The American Journal of Clinical Nutrition*, *76*, 653-658. doi: 10.1093/ajcn/76.3.653

- Haire-Joshu, D., Elliott, M.B., Caito, N.M., Hessler, K., Nanney, M.S., Hale, N., Boehmer, T.K., Kreuter, M., & Brownson, R.C. (2008). High 5 for Kids: The impact of a home visiting program on fruit and vegetable intake of parents and their preschool children. *Preventive Medicine, 47*, 77-82. doi: 10.1016/j.ypmed.2008.03.016
- Hales, C.M., Carroll, M.D., Fryar, C.D., & Ogden, C.L. (2017, October). Prevalence of obesity among adults and youth: United States, 2015-2016. Retrieved from <https://www.cdc.gov/nchs/data/databriefs/db288.pdf>
- Han, J.C., Lawlor, D.A., & Kimm S.Y.S. (2010). Childhood obesity. *Lancet, 375*, 1737-1748. doi: 10.1016/S0140-6736(10)60171-7
- Hohman, E.E., Paul, I.M., Birch, L.L., & Savage, J.S. (2017). INSIGHT responsive parenting intervention is associated with healthier patterns of dietary exposure in infants. *Obesity, 25*(1), 185-191. doi: 10.1002/oby.21705
- Institute of Medicine [IOM]. (2005). Preventing childhood obesity: Health in the balance. Washington, DC: The National Academies Press. doi: 10.17226/11015
- Karanja, N., Lutz, T., Ritenbaugh, C., Maupome, G., Jones, J., Becker, T., & Aickin, M. (2010). The TOTS community intervention to prevent overweight in American Indian toddlers beginning at birth: A feasibility and efficacy study. *Journal of Community Health, 35*, 667-675. doi: 10.1007/s10900-010-9270-5
- Kitsantas, P., & Gaffney, K.F. (2010). Risk profiles for overweight/obesity among preschoolers. *Early Human Development, 86*, 563-568. doi: 10.1016/j.earlhumdev.2010.07.006
- Mercy, J.A., & Saul, J. (2009). Creating a healthier future through early interventions for children. *JAMA, 301*(21), 2262-2264. doi: 10.1001/jama.2009.803

- Must, A., & Strauss, R.S. (1999). Risks and consequences of childhood and adolescent obesity. *International Journal of Obesity and Related Metabolic Disorders*, 23(Supplement 2), S2–S11. doi: 10.1038/sj.ijo.0800852
- Ogden C.L., Carroll M.D., Kit B.K., & Flegal K.M. (2014). Prevalence of childhood and adult obesity in the United States, 2011-2012. *JAMA*, 311(8), 806–814. doi:10.1001/jama.2014.732
- Ordway, M.R., Sadler, L.S., Holland, M.L., Slade, A., Close, N., & Mayes, L.C. (2018). A home visiting parenting program and child obesity: A randomized trial. *Pediatrics*, 141(2). doi: 10.1542/peds.2017-1076
- Pan, L., Freedman, D.S., Sharma, A.J., Castellanos-Brown, K., Park, S., Smith, R.B., & Blanck, H.M. (2016). Trends in obesity among participants aged 2–4 years in the special supplemental nutrition program for women, infants, and children - United States, 2000-2014. *MMWR*, 65(45), 1256-1260. doi: 10.15585/mmwr.mm6545a2
- Salvy, S.-J., de la Haye, K., Galama, T., & Goran, M.I. (2017). Home visitation programs: An untapped opportunity for the delivery of early childhood obesity prevention. *Obesity Reviews*, 18, 149–163. doi:10.1111/obr.12482
- Savage, J.S., Birch, L.L., Marini, M., Anzman-Frasca, S., & Paul, I.M. (2016). Effect of the INSIGHT responsive parenting intervention on rapid infant weight gain and overweight status at age 1 year: A randomized clinical trial. *JAMA Pediatrics*, 170(8), 742–749. doi: 10.1001/jamapediatrics.2016.0445
- Segal, L.M., Rayburn, J., & Martín, A. (2016, September). *The state of obesity: Better policies for a healthier America 2016*. Retrieved from <http://healthyamericans.org/assets/files/TFAH-2016-ObesityReport-FINAL.pdf>

- Skinner, A.C., Ravanbakht, S.N., Skelton, J.A., Perrin, E.A., & Armstrong, S.C. (2018). Prevalence of obesity and severe obesity in US children, 1999-2016. *Pediatrics*, *141*(3), e20173459. doi: 10.1542/peds.2017-3459
- Spence, N.D., Birken, C., Haines, J., & Ball, G.D.F. (2015). Back to the future - A case for home visits for managing severe paediatric obesity. *Acta Paediatrica*, *104*, 547-549. doi: 10.1111/apa.12982
- Stark, L.J., Clifford, L.M., Towner, E.K., Filigno, S.S., Zion, C., Bolling, C., & Rausch, J. (2014). A pilot randomized controlled trial of a behavioral family-based intervention with and without home visits to decrease obesity in preschoolers. *Journal of Pediatric Psychology*, *39*(9), 1001-1012. doi: 10.1093/jpepsy/jsu059
- Thompson, J.L., Tussing-Humphreys, L.M., & Goodman, M.H. (2014). Delta Healthy Sprouts: A randomized comparative effectiveness trial to promote material weight control and reduce childhood obesity in the Mississippi Delta. *Contemporary Clinical Trials*, *38*, 82-91. doi: 10.1016/j.cct.2014.03.004
- U.S. Department of Agriculture, Center for Nutrition Policy and Promotion [USDA CNPP] (n.d.). *Pregnancy and birth to 24 months project*. Retrieved from <https://www.cnpp.usda.gov/birthto24months>
- U.S. Department of Health and Human Services [HHS]. (2008). *2008 physical activity guidelines for Americans*. Retrieved from <http://www.health.gov/paguidelines>
- U.S. Department of Health and Human Services and U.S. Department of Agriculture [HHS & USDA]. (2015). *2015 – 2020 dietary guidelines for Americans*. Retrieved from <https://health.gov/dietaryguidelines/2015/guidelines/>
- Wen, L.M., Baur, L.A., Simpson, J.M., Rissel, C., Wardle, K., & Flood, V.M. (2012). Effectiveness

of home based early intervention on children's BMI at age 2: Randomised controlled trial. *BMJ*, 344. doi: 10.1136/bmj.e3732

Wen, L.M., Baur, L.A., Simpson, J.M., Xu, H., Hayes, A.L., Hardy, L.L., Williams, M., & Rissel, C. (2015). Sustainability of effects of an early childhood obesity prevention trial over time: A further 3-year follow-up of the Healthy Beginnings Trial. *JAMA Pediatrics*, 169(6), 543-551. doi: 10.1001/jamapediatrics.2015.0258

Wen, L.M., De Domenico, M., Elliott, D., Bindon, J., & Rissel, C. (2009). Evaluation of a feasibility study addressing risk factors for childhood obesity through home visits. *Journal of Paediatrics and Child Health*, 45(10), 577-581. doi: 10.1111/j.1440-1754.2009.01568.x

Woo Baidal, J.A., Locks, L.M., Cheng, E.R., Blake-Lamb, T.L., Perkins, M.E., & Taveras, E.M. (2016). Risk factors for childhood obesity in the first 1,000 days. *American Journal of Preventive Medicine*, 50(6), 761-779. doi: 10.1016/j.amepre.2015.11.012