

Preventing Childhood Obesity and Its Long-term Effects

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Abstract

Childhood obesity affects nearly one in every five children and adolescents in the U.S. This epidemic has led to the development of chronic illnesses in adulthood, such as metabolic disorders, cardiovascular disease, sleep apnea, osteoarthritis, and asthma. This literature review examined intervention programs and their effectiveness in reducing childhood obesity. The application of health behavior theories and their impact on altering children's behavior was also explored. This paper presents an analysis that describes the success of multiple childhood obesity intervention programs in addition to effective prevention strategies. The findings associated the effectiveness of programs with the socioeconomic status of children, and suggested more substantial state or regional policies to increase physical activity in schools. The most successful childhood obesity intervention programs were implemented using close relationships, community resources, and a holistic approach.

Keywords: childhood obesity, health behaviors, program effectiveness

Introduction

Childhood obesity affects nearly one in every five children and adolescents (Palacios et al., 2023). Another 15% of children are considered overweight and have the potential to become obese (Osorio et al., 2020). Obesity is a chronic disease that results from a person's body mass index (BMI) at or above the 95th percentile for their age group (Health Policy Institute, 2019). This health issue affects a person's weight status and increases the risk of other chronic illnesses. The relationship between childhood obesity and pediatric diabetes in the United States is well established (Osorio et al., 2020). However, obesity also increases the risk of other conditions including metabolic disorders, cardiovascular disease, sleep apnea, osteoarthritis, and asthma

(Qorbani et al., 2020). Many chronic illnesses are rooted in childhood and account for 60% of the global mortality (Beyer et al., 2018).

A child diagnosed with obesity is 6.2 times more likely to become obese as an adult (Luesse et al., 2018). Type II diabetes is one of the most common diseases associated with obesity. There are 215,000 children younger than 20 in the United States with diabetes (Scott, 2013). Diabetes is the sixth leading cause of death, with 45% of new cases occurring in children (Scott, 2013). This prevalence highlights a clear need for prevention and intervention. The longer a child is obese during development, the higher the probability of the child remaining obese in adulthood and developing further health issues (Health Policy Institute, 2019). Obese children report having higher blood pressure, which is believed to increase their susceptibility to many diseases (Qorbani et al., 2020), some of which can be life-altering or even lead to death. Although obesity is not a direct cause of death, it is a risk factor for four of the ten leading causes of death in the U.S. (Health Policy Institute, 2019). More than 300,000 premature deaths per year in the U.S. are associated with obesity and physical inactivity (Health Policy Institute, 2019).

Healthy People 2030 has made addressing childhood obesity a key component of future program development. Within the Healthy People sections, preventive care, nutrition and healthy eating, and child and adolescent development there are objectives intended to address the prevalence of childhood obesity. The goal is to implement intensive behavioral programs that use more than one strategy to effectively reduce obesity (ODPHP, 2020). Solely addressing one aspect of children's weight status has not been successful in reducing the diseases' prominence. While physical aspects such as food and environment play a role, genetics, health behaviors, and family influence should also be considered (Osorio et al., 2020). While one of Healthy People

2030 goals is to reduce the children's obesity rate (NWS-04), there is also a focus on improving developmental screenings (MICH-17), increasing school policies and education (H-D01 and AH-R06), and increasing student participation in physical education (ECBP-01) (ODPHP, 2020).

Multiple intervention strategies should be implemented to decrease the prevalence of childhood obesity. Children's health behaviors are influenced by genetics, environment, relationships, and lifestyle (Health Policy Institute, 2019). While programs have been introduced, a lack of sustainability seems to prevent the nation's goals from being archived (Black & Hager, 2013). However, with consistent attendance, the school environment is one of the most promising venues for children's behavioral changes (Wieland et al., 2020). A school is an environment intended to educate groups of people. School-aged children are between the ages of 6-12 and are still developing behaviors and beliefs. This makes them an ideal population to address, as prevention is the most impactful. Childhood obesity is a highly prominent disease that can result in a multitude of health complications in adulthood if not addressed.

Theories

Theories are an essential aspect of scientific research, and can therefore be effective in altering people's health behaviors. Most obesity research uses behavior change theories and focuses solely on the individual (Pettman et al., 2014). These theories can be productive, but when examining childhood obesity, there are more extrinsic factors than internal ones. As a result, various health theories have been used in combination to prevent childhood obesity. The social-ecological model, social cognitive theory, and extended parallel process model have all been applied to reduce childhood obesity.

The Social Cognitive Theory

The social cognitive theory (SCT) is one of the foundational health behavior theories. This is an ideal theory for children's health behavior, emphasizing the interaction of personal, behavioral, and environmental factors (Luesse et al., 2018). This theory uses many constructs, including personal factors, self-efficacy, social environment, and access to food, to assess a population. In a study on the challenges and facilitators of a healthy food environment, the researchers focused on children's home environments and parents' confidence in food decisions. Parents are usually the primary providers of a child's food supply and vital contributors to a child's food environment. One unique aspect of this study was their education program. Parents received text messages about healthy nutritional facts and tips. These texts increased the parent's behavioral capability for providing fruits and vegetables to their children (Luesse et al., 2018). Families were eager to learn and share healthy eating strategies to improve their children's health (Luesse et al., 2018). SCT focuses on the influence of interpersonal relationships on the target population. Children rely on their interactions with others to learn; therefore, SCT is one of the more promising theories when applied to behavior.

The Social Ecological Model

The social-ecological model of health and wellness is a well-researched model that emphasizes the importance of multilevel interventions. This includes individuals, families, policies, and other community strategies that enhance social support and promote a safe environment for change (Palacios et al., 2023). In the 2007 study by LiveWell Kids, researchers used the social-ecological model, focusing on growth at the personal level, to reduce childhood obesity. They addressed nutritional education, healthier food choices, classroom exercises,

walking programs, safety education, and mindful activities (Palacios et al., 2023). This program also included parent volunteering and education classes to improve children's at-home spaces. They also focused on creating healthier environments by building gardens and promoting community exercise activities. These interventions focus on developing a child's self-efficacy while providing material to parents and the surrounding community. Using this multilevel approach, researchers were able to ensure that at-risk students were provided with the opportunity to alter their behavior. This study used children's BMI to compare the impact before and after program completion. The LiveWell Kids initiative resulted in a decrease in obesity across all grade levels and demographic groups (Palacios et al., 2023). It can be challenging to alter health behaviors when working with children due to their developing minds.

The social-ecological model provides an intervention strategy that works to alter a child's environment and behavior. This well-researched model exemplifies a more effective multilevel approach for addressing childhood obesity (Palacios et al., 2023).

The Eat Well Be Active (EWBA) program, based in Australia, also utilizes the social-ecological model. This program included a range of actions throughout Australia to improve children's weight status. EWBA is a community-based program that stretches over five years and focuses on increasing healthy eating and physical activity to improve individuals' abilities (Pettman et al., 2014). This intervention was conducted in various settings to alter personal behaviors and overcome environmental barriers. EWBA was conducted in a metropolitan suburb and a rural community in South Australia. The social-ecological model was used with a focus on capacity building and community development (Pettman et al., 2014). These factors were developed using community consultation, peer education, policy, infrastructure changes, and

involvement of other communities (Pettman et al., 2014). EWBA has been used in schools, homes, recreational spaces, and other environments that children are exposed to daily. Of the 44 primary schools invited, 35 were followed (Pettman et al., 2014). No significant changes were found in weight or BMI; however, these improvements were more significant than in communities without intervention (Pettman et al., 2014). EWBA's impact was positive and increased community participation and awareness of childhood obesity. Although EWBA was not as successful in reducing the obesity rate, it addressed multiple diverse communities. Both EWBA and LiveWell Kids successfully achieved participation across all levels of the social-ecological model. This utilization of the social-ecological model has successfully altered general health behaviors and has the potential to trickle down to children's individual behaviors (Palacios et al., 2023).

The Extended Parallel Process Model

The extended parallel process model (EPPM) alters people's behavior by exploiting their fear as a form of persuasion (Batchelder & Matusitz, 2014). When people believe they are in danger of something or engaging in activities that may lead to severe consequences, they consciously try to avoid these actions or find a way to solve the problem. This model is similar to the health belief model (HBM) but differs in that it focuses solely on a person's fear. For EPPM to work, a health program must be able to use health threats as a form of motivation for behavioral change (Batchelder & Matusitz, 2014). Michelle Obama's 'Let's Move' campaign utilized this method to change children's health behaviors related to food and activity. They used four main constructs of the EPPM: perceived susceptibility, perceived severity, response efficacy, and self-efficacy. An example of how they use fear factors as motivation is teaching about the

severity of diseases linked to obesity. This includes teaching about the risk of other chronic illnesses, as well as the potential loss of limbs and death. Through television appearances, public speaking events, and other aspects of the media, Obama shares her healthy living message with a significant audience (Batchelder & Matusitz, 2014). The Let's Move campaign utilized television programs, including Sesame Street, The Biggest Loser, and Ellen (Batchelder & Matusitz, 2014). These programs allowed her to campaign for its objectives on a variety of social networks. This allowed information to be shared and educated more children in a more modern manner. Obama starts by introducing fear factors and then moves to address the needs and concerns of her audience. In doing so, she was able to lessen the public's fear while still using it as a motivation. Obama also continues to share online resources to which her audience can obtain reliable and helpful information in one place. While there is no direct data on the success of the Let's Move campaign, it is clear that the program has the foundations for success and addresses children's health in a modern and unique way. The only shortcoming of the EPPM is that further research is needed on more controversial topics. The EPPM is a well-established model for health issues related to germs and hand washing, which are known as negative health behaviors (Batchelder & Matusitz, 2014). Obesity is a more controversial topic, as it raises questions about personal and governmental responsibility (Batchelder & Matusitz, 2014). The Let's Move campaign challenges the boundaries of EPPM and allows health professionals to understand its use in reducing childhood obesity.

Intrapersonal Factors

Intrapersonal factors can significantly influence a person's health behaviors. When looking at school-aged children, these behaviors are even more impactful, as they are still

developing. Intrapersonal factors include age, gender, motivation, and personal intelligence. Instilling motivation for a healthy lifestyle is vital for improving these behaviors (Börnhorst et al., 2023). Most chronic conditions stem from childhood (Wijesundera et al., 2023); therefore, positive behaviors are important for early development. One study examined changing children's behavior and replacing negative behaviors with physical activity and healthy eating. Increasing physical activity by as little as 15 minutes daily over six years reduced the risk of an overweight or obese classification by 1.5 percentage points (Börnhorst et al., 2023). This study focused on following children throughout their development, starting in 2007/08 and following up in 2020/21 (Börnhorst et al., 2023). This study focused on children's screen time, sports membership, transportation, activity levels, sleep, sugar-sweetened beverages, and mealtime distractions (Börnhorst et al., 2023). Addressing these factors aims to prevent poor health behaviors and to replace them with positive ones. These factors focus on the individual and proper motivation for a child. When children adhere to all six behavioral interventions compared to no intervention, the overweight or obese classification risk is reduced by 10-26% (Börnhorst et al., 2023). However, almost none of the children were able to maintain all behavioral guidelines. The most effective interventions included reducing an individual's screen time or introducing moderate to vigorous physical activity into a child's lifestyle (Börnhorst et al., 2023). This study also shows that when focusing only on behavioral interventions, the risk of overweight and obesity remains high at 25.4% (Börnhorst et al., 2023). Intrapersonal interventions are not as effective because of children's lack of knowledge and control over their own well-being.

Personal choice also has an internal influence on health behaviors. However, the children's ability to participate in personal choices is constantly debated. In a qualitative study, it

was found there are three forms of choice (freedom, responsibility, and impacted by context) that work together to affect a child's health behavior (Porter, 2013). Regarding freedom of choice, every child has the right to make decisions about themselves. However, some laws and regulations are in place to protect children. These include laws such as wearing a seatbelt, having a helmet, and using a life jacket. This study found that restricting children's food choices for the sake of healthier options (school lunch menus, health education) is beneficial for personal behavior due to a lack of capability and understanding (Porter, 2013). This individual intervention only works for young children. In another obesity program targeting adults, there would be direct interference with personal choice and, therefore, would not be as successful. Adults are more informed about their health and health choices in ways children are not. As a result, school-aged children's personal choices can be influenced and altered to promote healthier or safer behaviors.

Interpersonal Factors

The interactions a child shares with their family, teachers, and other friends significantly impact the child's behaviors and understanding. Positive parental perceptions of health, body weight, and self-image are associated with improved compliance with pediatric lifestyle modification programs (Dhuper et al., 2021). As parents are the primary providers of food for school-aged children, they heavily influence food choices and health patterns. One study found that a lower maternal BMI was correlated with a better perception of one's weight, body image, and the health of their child (Dhuper et al., 2021). Another study focused on improving caregivers' education as a means of improving a child's diet. Parents already recognize their essential role in modeling positive food behaviors (Luesse et al., 2018) but still struggle to make

healthy behavior a habit. Despite demonstrating behavioral capability/competence in providing and preparing fruits and vegetables, parents felt that other social barriers made it difficult to encourage eating these healthier options (Luesse et al., 2018).

Most programs that focus on decreasing obesity and increasing physical activity occur in schools. Many schools have dietary programs and physical education requirements that focus on teaching healthy behaviors. One study found that an additional 60 minutes per week of physical education lowered children's BMI and z-scores by 9.6% of the standard deviation (Cawley et al., 2013). Another study, the Adolescent Trial for Cardiovascular Health (CATCH), found that focusing on nutrition education, morning activity and exercise, and healthier school meals decreased the obesity and overweight prevalence (Palacios et al., 2023). The CATCH program was able to decrease obesity prevalence in the city of Redondo Beach from 13.5% to 5.7% (Palacios et al., 2023). Teachers and the community fully embraced this program, contributing to its success. These studies support the idea that children's interactions with their teachers and peers at school help shape health behaviors and introduce behaviors that differ from those in their home environment.

In the new age of technology, another interpersonal factor that affects children is what the media presents. The increasing presence of screens can negatively impact a child's development, particularly with regard to exercise and physical activity. In one study looking to shift children's screen times, children older than six were recommended to only have one hour of screen time per day (Börnhorst et al., 2023). Adhering to screen time and physical activity recommendations were the strategies with the most considerable risk difference and the largest group of children needing behavior change (Börnhorst et al., 2023). High screen times are

associated with unhealthy food choices and distracted eating (Börnhorst et al., 2023), contributing to weight gain.

Organization, Community, Environmental, and Policy Section

Research shows that by addressing communities, organizations, environments, and policies, the rates of childhood obesity have significantly decreased. Public schools show the most promise as they have more consistent attendance due to federal mandates (Wieland et al., 2020). School interventions take place at the organizational level. The organizational level focuses on providing services, standards, and rules for group members to influence their health behavior. As school-aged children have little control over their diet and lifestyle choices, it is essential to utilize education programs in an organization that students can easily access.

Once again, the 2007 program LiveWell Kids is an excellent example. This multi-level intervention program focused on improving childhood nutrition, activity, and health behaviors related to weight, spanning kindergarten to eighth-grade students (Palacios et al., 2023). Throughout the program, education evolved from simple nutrition and gardening lessons to creating healthier meal options, morning exercises, active breaks, a walking bus program, bicycle safety, and mindfulness programs. This program decreased the obesity and overweight population from 30.7% to 17.0% while teaching long-lasting health behaviors (Palacios et al., 2023).

After-school programs are another form of intervention that is an effective community resource. A community-based intervention focuses on altering the behavior of those who share common geography, culture, conditions, and interests. Within communities, especially those of minorities and low-income families, these programs help address social and environmental

challenges that in-school programs can overlook. One specific program tested is Club Fit, an intuitive program designed to promote physical activity in collaboration with the Boys and Girls Club after-school program and Rochester Healthy Community Partnership (Wieland et al., 2020). They created a community-based program that utilized healthy diets, physical activity, training, challenges and self-monitoring, a peer-coaching program, and social media to alter school-aged children's behaviors. This program significantly improved participants' self-efficacy and motivation to be physically active from the baseline assessment to six months of the program (Wieland et al., 2020). Overall, the preliminary results of this program showed promising results, demonstrating that improving self-efficacy and motivation are predictors of improved physical fitness (Wieland et al., 2020).

Another effective community-based program that utilizes a participatory research approach is Kids N Fitness (KNF). This program was a 6-week intervention in an after-school program. KNF ran in partnership with a local University in the Los Angeles area. The KNF holds weekly sessions led by registered nurses, trained community health workers, and physical education specialists to react to structure-activity and nutrition for elementary students and their parents (Wright et al., 2013). This program uses wellness activities, health counseling, education on health promotion, educational newsletters, and wellness policies to improve health outcomes post-intervention (Wright et al., 2013). Significant changes were observed with a decrease in the body mass index z-score at the 12-month follow-up (Wright et al., 2013). This program effectively altered health behaviors but acknowledged a need for policy and environmental support (Wright et al., 2013).

One of the most vital aspects of young children's health, but often out of their control, is their environment. This is important when examining a child's food and environment.

Walkability, cleanliness, safety, and access to healthy food stores directly influence a child's health behaviors (Jiang et al., 2023). In a 2020 comparative study, researchers found that while parents had a general concern about their child's health environment (i.e., playgrounds and playing on the road), the children themselves expressed fear of outdoor environments, with dog bites, cars, and harm from neighbors all listed as main concerns (Duck et al., 2020). When children fear their environment, it can significantly hinder their ability to make positive health decisions. However, the power to choose an environment for development falls within the hands of the child's guardian.

A prospective study of a neighborhood's access to healthy food and walkability showed the impact of a child's environment. This study examined children's development and weight status over five years and its correlation with relocating families. This is particularly important, as a mover can experience a dramatic shift in food access and availability (Jiang et al., 2023). This study found that children with higher walkability correlated with a healthier BMI. However, if they moved to an area with decreased access to healthy food, they found a somewhat higher increase in obesity (Jiang et al., 2023). The environment in which a child was placed significantly altered their health behaviors, especially regarding their safety and food access. While these studies did not look to change these behaviors, they highlighted a space for further programs to address.

At the policy level, federal campaigns are far and few on this subject. However, the few that exist significantly affect developmental health behaviors. As policies look to change local,

state, and federal laws, they can considerably impact behavioral change. Most public schools now have to adhere to school-based nutritional interventions to improve the quality of food served in schools. Some states have also reduced access to soft drinks in schools, have required calories to be prominently displayed, and have significantly altered their menus to promote healthier food behaviors (Batchelder & Matusitz, 2014). In a comparative study of two large U.S. counties, Los Angeles and Cook County, dramatic changes occurred once these school districts applied new regulations and recommendations. These changes resulted in a reduction in calories, sugar, and sodium in the menus. Between both areas, approximately 688,197 students were exposed to this new balanced diet (Cummings et al., 2014). Although these counties differ in geography and population, they have both successfully changed the obesity outcomes of their students. This suggests that local and federal mandates are beneficial for changing health outcomes and should continue to be implemented, particularly in healthier food environments (Cummings et al., 2014).

States are often involved in health regulations. State mandates are in place for public schools' physical education, allotting a specific amount of time for physical activity per week. While organizations such as the Centers for Disease Control (CDC) advocate increasing the time requirement, there is some pushback among states due to limited research (Cawley et al., 2013). However, in a study focusing on the impact of school physical education courses and the effect it has on a child's BMI, increased duration of physical education led to greater overall participation by boys in structured physical activity, physical activity increases during free time, and aerobic exercise. It was found that an additional hour of P.E during the week would lower BMI by 0.5

units (Cawley et al., 2013). These policies promote healthy behaviors from a young age and act as a form of prevention for obesity and obesity-linked diseases later in life.

Suggestions For Intervention

There are numerous examples of interventions that address childhood obesity. However, there are also gaps in the research that need to be addressed. While family intervention is one of the most prominent and promising strategies, most of the research takes place in middle-class communities (Palacios et al., 2023). Although programs are effective in these environments, they only address children's weight status if they are in the middle class. This can be damaging in U.S. prevention initiatives, as children of lower socioeconomic status are 1.6 times more likely to become obese (Duck et al., 2020). Home interventions also need to acknowledge the impact of cultural and educational status on one's health. As African Americans, Hispanics, Asian Americans, Pacific Islanders, and American Indians are all at a higher risk of obesity and type II diabetes, researchers need to address the differences in ethnicity (Scott, 2013). In one study that examined Spanish and English-speaking households, parents expressed a need for more tailored and personalized nutrition messages rather than generic facts (Luesse et al., 2018). They also exposed a gap in meal preparations, particularly with picky eaters, and navigated these factors to promote healthy behaviors (Luesse et al., 2018). Definitions of snacking and meals also differed depending on the participant's ethnic and cultural environment (Luesse et al., 2018). This study also noted that, while they did have a range of Latino and African-American families, participants with poor literacy or who were undocumented were not represented in the sample (Luesse et al., 2018).

Schools and community programs have also highlighted research areas that require further exploration. Schools need more substantial policy compliance depending on the region or state. (Cawley et al., 2013). Community participation can also lead to differences in program success. People in lower-income communities may need to work more and limit their ability to volunteer in these programs (Palacios et al., 2023). Without strong community participation, health programs may not be as effective.

Attendance and gender are also common limitations of these program interventions. In interventions, such as Club Fit, attendance was correlated with decreased BMI z-scores (Wieland et al., 2020). The lack of consistent attendance prevents the program from completing its intended changes. It was predicted that the low attendance rate would be correlated with a lack of immediate results (Wieland et al., 2020). Gender is also a component that has created gaps in the research. By not considering differences in male and female development, gender health inequalities can be further exploited (Wright et al., 2012). In a study using six different behavioral interventions, the intervention that focused on screen time was more effective for girls. However, when looking at the results, sports club membership and mealtime distractions altering the behaviors were more effective in boys (Börnhorst et al., 2023). This shows how gender can affect children's motivation and requires consideration during program planning.

Location and access also play significant roles in the risk of obesity in children. Using the U.S. Census, researchers have found that neighborhoods with less walkability, less access to healthy grocery stores, lower income, and more diverse ethnic areas are all linked to a higher risk of childhood obesity and are hotspots for childhood obesity (Osorio et al., 2020). In these hotspots, the prevalence of obesity and type II diabetes was 1.4 and 1.8 times higher than in non-

hotspots (Osorio et al., 2020). Using the Census helps health professionals determine social and environmental factors that may affect a child's health. However, depending on the area of research, the coloration of other racial, ethnic, and regional groups may be limited (Wright et al., 2012). As most research is based on urban and suburban environments, more data needs to be collected in rural areas to compare the impact of population density.

Overall, there are many measurements of childhood obesity, including weight tracking and nutrition planning. In the United States, there is a strong focus on preventing childhood obesity and its long-term effects. The most successful intervention programs include interpersonal and community components that focus not only on improving a child's health status but also on permanently altering their health behavior. More information on the sustainability and long-term effects of altering a child's activity level, diet, sleep, and screen time is needed (Börnhorst et al., 2023; Black & Hager, 2013). By addressing the gaps found by researchers, health professionals can continue to reduce the risk of childhood obesity and prevent diseases linked to this condition.

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