

Health-equity issues related to childhood obesity: a scoping review

Clemencia M. Vargas, DDS, PhD¹; Elsie M. Stines, DNP, CRNP²; Herta S. Granado, BS¹

1 University of Maryland School of Dentistry

2 University of Maryland, School of Nursing

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Correspondence

Dr. Clemencia M. Vargas, University of Maryland School of Dentistry. Tel.: 410 706 2678; Fax: 410 706 4031; e-mail: cvargas@umaryland.edu. Clemencia M. Vargas and Herta S. Granado are with the University of Maryland School of Dentistry. Elsie M. Stines is with the University of Maryland, School of Nursing.

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Abstract

Purpose: The purpose of this scoping review was to determine the health-equity issues that relate to childhood obesity.

Methods: Health-equity issues related to childhood obesity were identified by analyzing food environment, natural and built environment, and social environment. The authors searched Medline, PubMed, and Web of Science, using the keywords “children” and “obesity.” Specific terms for each environment were added: “food desert,” “advertising,” “insecurity,” “price,” “processing,” “trade,” and “school” for food environment; “urban design,” “land use,” “transportation mode,” “public facilities,” and “market access” for natural and built environment; and “financial capacity/poverty,” “living conditions,” “transport access,” “remoteness,” “social support,” “social cohesion,” “working practices,” “eating habits,” “time,” and “social norms” for social environment. Inclusion criteria were studies or reports with populations under age 12, conducted in the United States, and published in English in 2005 or later.

Results: The final search yielded 39 references (16 for food environment, 11 for built environment, and 12 for social environment). Most food-environment elements were associated with obesity, except food insecurity and food deserts. A natural and built environment that hinders access to physical activity resources and access to healthy foods increased the risk of childhood obesity. Similarly, a negative social environment was associated with childhood obesity. More research is needed on the effects of food production, living conditions, time for shopping, and exercise, as related to childhood obesity.

Conclusions: Most elements of food, natural and built, and social-environments were associated with weight in children under age 12, except food insecurity and food deserts.

Introduction

Although the prevalence of childhood obesity has not increased in the past decade, this issue remains a relevant public health problem because of its long-term impact on the population’s health and on the cost of health care (1). The prevalence of obesity among children age 2–5 decreased from 13.9 percent (95 percent confidence interval [CI] 10.7–17.7 percent) in 2003–2004 to 9.4 percent (95 percent CI 6.8–12.6 percent) in 2013–2014, while among children age 6–11 it has leveled off since 2007–2008 (19.6 percent [95 percent CI 17.1–22.4 percent] in 2007–2008 to 17.4 percent [95 percent CI 13.8–21.4 percent] in 2013–2014) (1).

Childhood obesity tends to be more prevalent among children who are socially disadvantaged, such as children from families with low incomes or those who are racial/ethnic minorities (1). The consequences of the current disparities in childhood obesity will last for years to come, as obese children are likely to become obese adults (2,3), and the consequences will manifest themselves in future generations (4). Obese adults will be more likely to present with chronic conditions, such as diabetes, hypertension, and depression (5). Unfortunately, these chronic conditions will continue to present a high economic burden for society. For example, the cost of medical care for diabetes in the United States has been

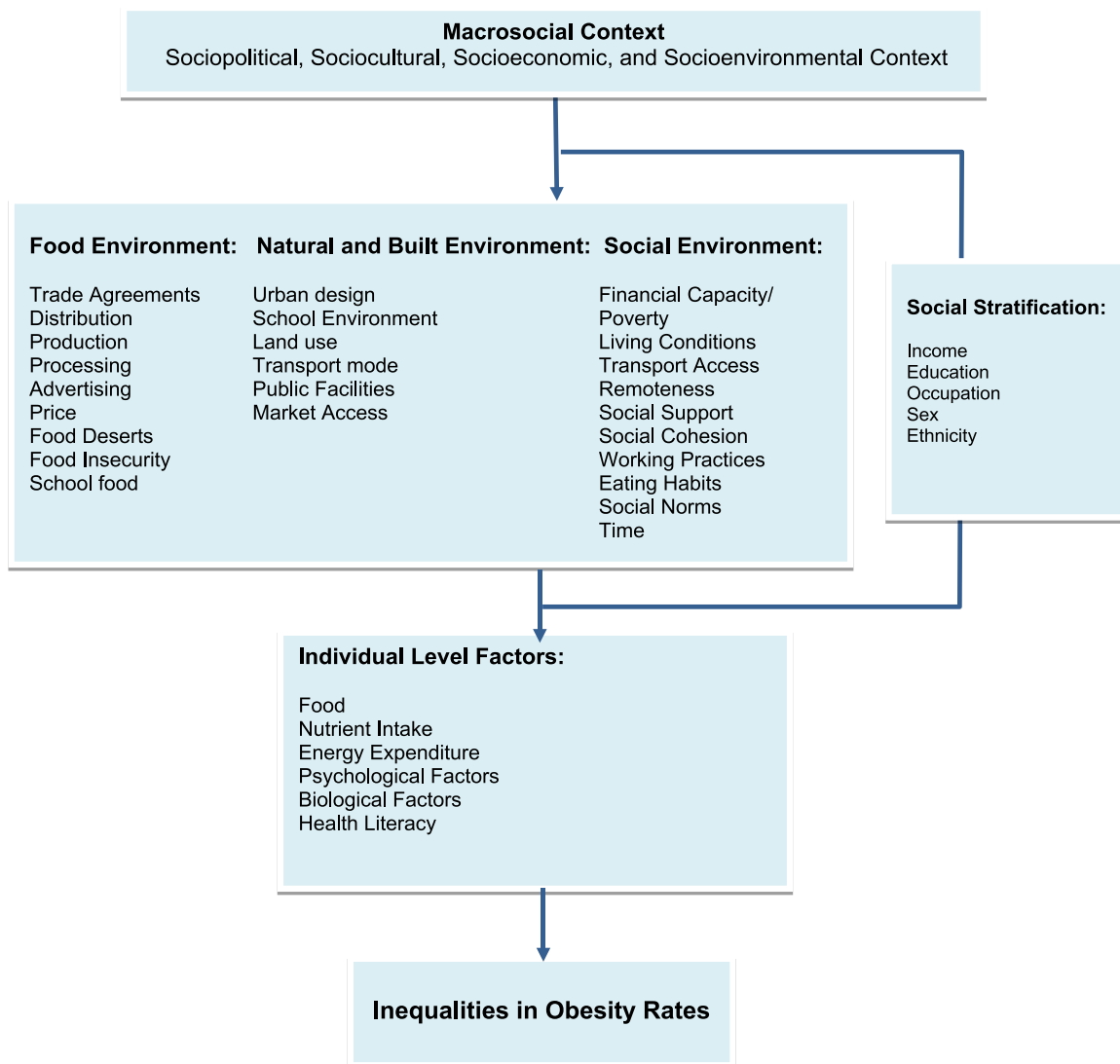


Figure 1 Conceptual framework of the social determinants of inequalities in obesity.

estimated at \$190 billion per year among adults and \$14 billion for lifetime direct increment health costs for the 10-year-old obese child in the United States (6).

Thus, due to the significant role that healthy-equity issues play, it is important to target this topic as a critical area of research to identify and hopefully minimize the disparities that exist in childhood obesity. With this aim in mind, this scoping review of the literature summarizes findings and identifies the gaps in research regarding health-equity issues related to childhood obesity, including how to decrease the effect of health-equity issues related to childhood obesity. As defined in *Healthy People 2020*, health equity is the “attainment of the highest level of health for all people.” (7) Therefore, achieving health equity requires eliminating health disparities – understood as the unavoidable and unjust differences related to social position – by aiming to improve

the health of disadvantaged groups (8). In this scoping review, we concentrate on the social determinants of obesity (7) that are the sources of disparities in obesity among children in the United States. Actually, body weight is one of the paths that links the social determinants of health to health outcomes (9).

Healthy People 2020 reports that obesity prevention must be a shared priority of health professionals and that collaboration is necessary (7). Oral health professionals are in an excellent position to recognize children who are at risk of developing obesity and provide recommendations. Additionally, oral health care professionals can help address childhood obesity policy by engaging in discussions about topics such as coverage for obesity-related services, availability of healthy food choices in communities and schools, opportunities for exercise, and advertising to children.

For this study, we used the conceptual framework proposed by Friel, Chopra, and Satcher (10) to explain the association between social determinants of health and obesity (Figure 1). The model posits that macrosocial-level processes, which include sociopolitical, sociocultural, socioeconomic, and socio-environmental contexts, determine an individual's food, natural and built, and social environments. These environments are modified by social stratification characteristics and then affect individual-level factors that result in inequalities in obesity. We will concentrate on the environments that are between the macrosocial context and the individual-level factors. The *food environment* includes elements that specifically influence individuals' food choices and food availability; the *natural and built environment* is comprised of community design factors that may also contribute to levels of physical activity and access to food. Finally, the *social environment* includes elements associated with the resources and limitations associated with a family's or an individual's socioeconomic position (10). By focusing on these three broader environments posited by the conceptual framework, we are better able to break down and assess how issues within these categories individually affect the prevalence of childhood obesity.

Methods

For this study, we used the scoping-review methodology. A scoping study or review tends to address broader topics than a systematic review and includes different types of study designs. Scoping reviews do not include analysis of the quality of the studies owing to the fact that multiple study designs would not be comparable and also because the objective is not to answer a narrow question (11).

This scoping review follows the five-stage methodology proposed by Levac *et al.* (12) as a later development of the methodology for scoping reviews proposed by Arksey and O'Malley (11).

1. In stage 1, the research question was refined in cooperation with the Healthy Futures Conference committee to make it appropriate for a scoping review. The research question had two parts: *What are the health-equity issues that relate to disparities in childhood (under age 12) obesity? How could oral health professionals and parents decrease the effect of disparities on childhood obesity?* We identified the health-equity issues from the food environment, natural and built environment, and social environment presented by Friel *et al.* (10).

2. Stage 2 included discussions and preliminary literature searches to define the breadth and comprehensiveness of the scoping review and the definition of inclusion and exclusion criteria. Inclusion criteria were studies or reports that included children under age 12, conducted in the United States, articles written in English, and published after January 2005. The depth of the coverage of a scoping review is determined by the objective (11). Since the specific objective of this study is to

determine the health-equity issues that relate to childhood obesity, we gave preference to published systematic reviews over individual reports for highly researched topics. The selection of potential studies and documents to be included was conducted iteratively by two of the researchers (CV and ES) using RefWorks. The authors searched Medline, PubMed, and Web of Science, using children and obesity or overweight as the main keywords and adding specific keywords for each element. For food-environment elements, we conducted individual searches, adding "food desert," "advertising," "insecurity," "price," "processing," "trade," and "school." For natural and built environment elements, we conducted individual searches, adding "urban design," "land use," "transportation mode," "public facilities," and "market access." For social environment elements, we conducted individual searches adding "financial capacity/poverty," "living conditions," "transport access," "remoteness," "social support," "social cohesion," "working practices," "eating habits," "time," and "social norms."

3. In stage 3, we reviewed the list of references independently and collectively. After several iterations, we agreed on the studies and documents to be included.

4. In stage 4, we designed a chart to be populated with information extracted from the selected studies and documents. At this stage, the list of articles was enhanced by including references cited in some of the selected articles (snowball technique) and excluding references that were too specific.

5. Stage 5 included summarizing and performing a qualitative thematic analysis to ascertain the results of the scoping review and to determine their implications. The inclusion of systematic reviews allowed us to reach saturation with few articles; that is, no new information was found after analyzing the systematic reviews.

Results

The initial search based on titles and abstracts yielded 152 references for food environment, 144 for natural and built environment, and 55 for social environment. After reviewing the articles, we selected 36 references that included 16 for food environment, 9 for natural and built environment, and 11 for social environment. We added references using the snowball technique: 4 for food environment, 4 for natural and built environment, and 5 for social environment; references that were included in literature reviews and were thus redundant were eliminated (4, 2, and 4 for each environment, respectively). The final count of references was 16 for food environment, 11 for natural and built environment, and 12 for social environment, for a final total of 39 references (Figure 2).

Food environment

The food environment includes elements that affect food choices and food availability to feed a child. The majority of

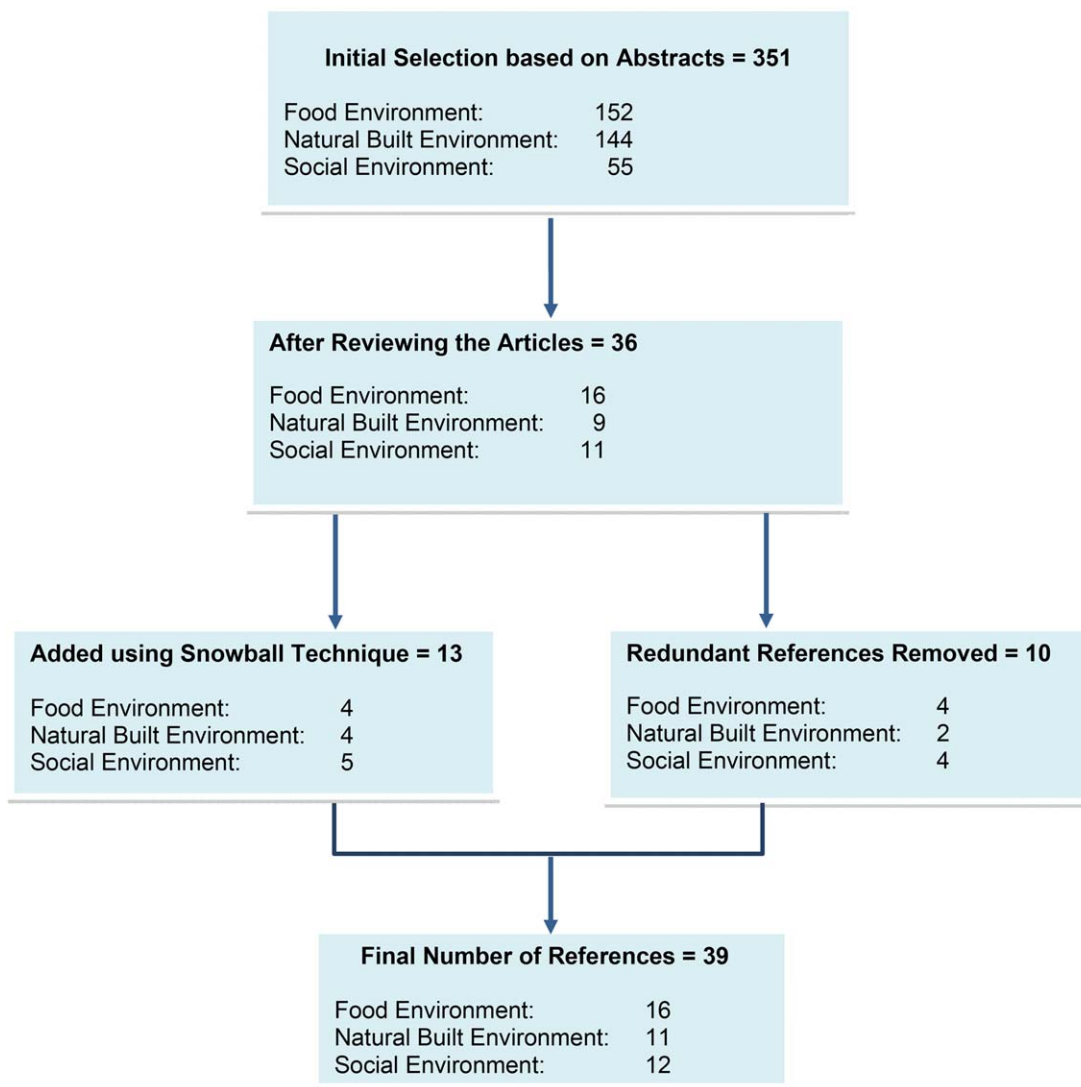


Figure 2 Selection of references process.

food-environment elements included in the studies were positively associated with childhood obesity; however, there was no agreement regarding the association between childhood obesity and both food deserts and food insecurity.

Trade agreements, an element within the food environment, affect the food environment mostly at an international level. Thow and Hawkes (13) reported that trade liberalization between Central American countries and other countries, especially the United States, has resulted in increased availability and low prices of meat, processed foods (usually energy-dense and high in fats), salt, and sugar. Consumption of these products has been reported to be associated with an increase in childhood obesity and chronic diseases. Similar findings about changes in food environment were reported for Mexico by Clark *et al.* Specifically, the enactment of the North American Free Trade Agreement in 1994 resulted in an

increased availability of soft drinks, refined and processed foods, and meats, which contributed to a rise in the obesity epidemic in the Mexican population (14).

Food advertisement is another significant element in the food environment given that the food industry is a strong client of the marketing industry. After an extensive literature review and discussions among experts, the Institute of Medicine reported in “Food Marketing to Children and Youth: Threat or Opportunity” that advertisements affect children’s preference and selection of food and beverages. Moreover, the report finds that advertisements generally do not follow recommendations for healthy diets (15). This discordance between health-based recommendations and marketing places the health of children and adolescents at risk (15).

Price of food is an additional influence on children’s diet quality. High prices result in lower consumption of fruits,

vegetables, and milk (16). In contrast, the authors also found that differences in prices did not affect sugar-sweetened beverage (SSB) and fast food consumption. A market-basket study in California found not only that access to healthier food was limited in neighborhoods where most residents have low incomes but also that the cost of an average Thrifty Food Plan market basket (foods to meet the basic recommendation of the *1995 Dietary Guidelines for Americans*) was lower than the healthier food basket (17). Not surprisingly, the body mass index (BMI) of elementary-school children increased more between kindergarten and fifth grade in areas with a high fruit and vegetables price index than in lower-price index-areas, even after adjusting for individual and family characteristics and cost of living in the area (18).

Access to and availability of healthy foods could also play a role in the food environment. Food deserts are those areas in which residents do not have access to healthy foods. A food audit in Nashville, TN, confirmed that available foods in stores depended on the socioeconomic characteristics of the neighborhood; the same store could be present across diverse communities, but the foods stocked varied according to the neighborhood. Such neighborhoods where most residents had low incomes or were racial/ethnic minorities had more tobacco and alcohol and practically no fruits and vegetables (19). Nonetheless, despite the lack of healthy foods, a study in Detroit found no association between BMI and residing in a food desert (20). Furthermore, Lee (21) analyzed data from the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K) and found that differences in access to healthy foods did not explain differences in obesity among US children.

Several literature reviews found no direct association between household food insecurity and obesity among children in the United States (22-24). However, most studies showed that food insecurity and obesity co-existed, that is, they are present simultaneously, but there is no statistically significant association between them (22,23). To account for the possibility of unequal distribution of food among household members in food-insecure homes, some studies specifically identified food-insecure children to test the association between child food insecurity and obesity; these studies also found that there was not an association between child food insecurity and obesity (22).

School food environment also plays a crucial role in shaping a child's health, owing to the large amount of time children spend at school. This particular food environment includes foods provided as subsidized breakfast and/or lunch as well as "competitive foods," or those foods that are sold to students on school premises outside of the federally funded meal programs. Since many children consume two meals at school, it is possible that the school food environment affects obesity; multiple studies have investigated this association. One such national study reported that subsidized school-breakfast participation compared to nonparticipation was

associated with lower BMI, but participation in school lunch was not associated with any of several measures of weight (25). However, the content of the food provided in subsidized school lunches has been associated with obesity; serving elementary school students low-nutrient and/or energy dense foods, such as potatoes and dessert, more than once a week was associated with higher likelihood of obesity (26). The few studies that have analyzed the effect of competitive foods on obesity found that increased availability augmented the risk of obesity (27).

The study of the association between food environment and obesity is relatively new; initial reports were presented in the 1990s. According to Gordon-Larsen, the studies providing findings regarding the association between obesity and food environment are subject to multiple limitations: lack of longitudinal data, reliable environment measures, lack of complex multilevel statistical approaches, lack of paths to link individual diet and obesity, and lack of rigorous evaluation (28). Addressing these limitations in future research will help further understanding of the complex association between the food environment and childhood obesity (28).

Natural and built environment

The natural and built environment of a child's neighborhood includes the community design characteristics that contribute to, or deter from, physical activity and access to food. This environment must facilitate availability and access to both healthy foods and physical activity in order to promote good health. Deficits in access to either of these elements often contribute to a rise in the prevalence of childhood obesity.

The built environment strongly influences the quality of the food environment in terms of accessibility. Bader *et al.* found that access to food markets or presence of food deserts must include measures of personal vehicle ownership, public transit systems, and neighborhood safety (29). For instance, distance to a supermarket has a different meaning for a family who owns a car or has access to mass transit than for a family with neither of those resources. Consequently, adjusting for vehicle ownership and neighborhood safety increased disparities in access to markets, and adjusting for public transit and traffic safety reduced those disparities (29). Food access in low-income Midwest rural counties was not limited by proximity to grocery stores because parents traveled to an urban center to acquire healthy foods (30), but, conversely, Rahman *et al.* found that easy access to convenience stores was associated with obesity (31).

Higher levels of physical activity have been associated with lower BMI (32) and, residents in areas with resources for physical activity have a lower prevalence of obesity (33). After extensive literature reviews, several researchers concluded that a physical environment providing children with recreational facilities in the community and schools, as well as a safe

transportation infrastructure (walkability, safe intersections, and public transportation) results in more physically active children (31,34,35), even in rural areas (30). Similarly, high density/speed traffic and adverse local conditions (crime and poverty) precluded children's participation in physical activities (34). Moreover, Lovasi *et al.* found that for preschool children from families with low incomes in New York City, neighborhood crime was associated with higher prevalence of obesity, while street tree density was associated with lower prevalence of obesity (36). However, this study did not find an association between access to parks and transportation infrastructure and obesity. The authors explained that in low-income and high-crime areas, what can be amenities, such as parks and walking trails, in other neighborhoods are instead risks for children (36). Active transportation to school, or walking to school, is another source of regular physical activity for children. Children from families with low incomes are more likely to walk to school than children from families with high incomes given that they are more likely to live near school, and it is less likely for their family to own a vehicle (37).

In addition, an increase in media interaction (TVs, computers, cell phones, audio, games) and limited options for outdoor activities have resulted in an increase of "screen time" among children in general and in African-American and Hispanic children in particular. Children and adolescents age 8–18 who are racial/ethnic minorities have 50 percent more screen time per day than non-Hispanic white children and adolescents (8.5 versus 13 hours) (38). It has been well documented that reducing the amount of time dedicated to screen-related sedentary activities results in BMI reductions (32).

Social environment

The factors that play into childhood obesity extend beyond the physical environment. The social environment, which includes those elements associated with a child's socioeconomic position that shape both the types of relationships and living conditions a child may have, also contributes significantly.

To start with, poverty undoubtedly influences the food choices of families. Lower financial capacity measured with the Economic Hardship Index was associated with higher rates of childhood obesity, and racial disparities were observed at every level of economic hardship (39). Moreover, increase in BMI between kindergarten and fifth grade was more accentuated among children from families with incomes below the median income than among children from families with incomes above the median income (18). It is well established that children from families with lower incomes are more likely to consume meat products, fats, sugars, potatoes, and cereals; and less likely to consume fruits and vegetables, compared to this from families with higher

incomes (40). However, Carlson and Frazao reported that families allocate their budgets for food in a similar fashion between healthy and unhealthy foods independent of economic situation; they add that for families with both high and low incomes, the quality of diet could be improved (41). Parents in Philadelphia reported that they would shop for food at places that fit their financial capacity, in their words "where they can stretch their dollar." In the search for best deals, parents would shop in a different location even if this is inconvenient (42). These parents did not shop for groceries at convenience or corner stores that are viewed as very expensive; they only shopped there for snack foods or beverages as an expression of responsible management of their money (42). Thus, efforts made to address childhood obesity must take into consideration the financial capacity of families, and more importantly, the way parents view and cope with their financial situation.

Social cohesion, represented by a shared language, was a protective social environment element against preschoolers' adiposity when they lived among a higher number of people sharing their language (43). The authors explain that sharing the language facilitates access to social networks and the retention of protective cultural values, such as dietary preferences. Kimbro and Denney reported that young children residing in communities with a high proportion of foreign-born residents had lower obesity prevalence (44). Consistently, children between 2 and 4 years of age of highly acculturated Hispanic mothers were more likely to have higher BMI percentiles and to consume more foods that are not necessary for a healthy diet, also known as noncore foods, than children from non-acculturated mothers (45).

Social norms determine ideal body shape and in some situations result in weight stigma. Studies show that children are aware of weight stigma and are affected by it more than adults (46). Weight-related stigma has been associated with overeating; Nolan and Eshleman propose a conceptual model to explain the path from stigma to eating and exercise (46). Children facing stigma because of their weight are more likely to consume more food and less likely to engage in physical activity (46).

Time available to prepare foods at home could make the difference between a wholesome home-cooked dinner and purchased fast-food. US national data for the 1990s show that time preparing meals at home has declined by 10 percent from 1994 to 1999 (40). Analyses from the American Time Use Survey (ATUS) indicate that the proportion of Hispanic mothers engaged in food preparation at home is declining across generations; consistently, first-generation mothers were less likely to buy convenience food or to eat out (47). Also, Hispanic women who worked 8-hour days spent 38 fewer minutes on average on meal preparation than women who did not work. Furthermore, being a single mother or having higher educational attainment were also associated

with less time spent preparing meals (47). Similar findings were found for all mothers who participated in the ATUS; working mothers spent less time grocery shopping, preparing meals, and eating with their children (48). Working practices, particularly those of mothers, are also associated with obesity in children. Datar *et al.* found that BMI and obesity are positively associated with mothers' work hours, so that by fifth grade an increase in a mother's work hours by 20 hours per week while their child is in elementary school is associated with a 3.5 percent higher percentile BMI and an 11 percent increase in the chances of obesity for the child (49).

A review found that eating habits are passed from parents to children, so that children will eat more fruits and vegetables or more low-fat foods if their parents also eat them (40). Parents' behaviors regarding food preferences and intake control are also seen in their children (40). Moreover, parents' feeding practices have been linked to both a child's eating habits and the child's weight. Patrick and Nicklas present three feeding styles: authoritarian (restricting food or forcing a child to eat certain foods), permissive or "nutritional neglect" (child is allowed to eat at will), and authoritative (balanced). Both authoritarian and permissive parental feeding styles have been associated with higher child BMI (40).

A study by Appelhans *et al.* found that having food preparation supplies in a household significantly impacts the frequency with which meals are prepared at home and eaten together as a family (50). Those households with few to no supplies, which were generally found to be socioeconomically disadvantaged, consumed fewer home-prepared and family meals. This further influence food intake for children, such that consumption of sugar sweetened beverages and fast food were negatively associated with frequency of home-prepared dinners and family meals (50). Despite the extensive literature available regarding equity issues in obesity, there was a gap in research regarding housing conditions such as functionality of the kitchen, water supply, sharing kitchen areas, and availability of cooking utensils. There was also a paucity of studies on the association between child obesity and time available for cooking, shopping, and exercise.

Discussion

Decreasing the effect of disparities on childhood obesity

How could oral health professionals and parents and caregivers decrease the effect of disparities on childhood obesity?

The effects of the macrosocial context on the food environment, built and natural environment, and social environment are fundamental factors in the likelihood that an individual will develop obesity. Differences in the macro-environment result in a lack of equity in the distribution of childhood obesity. In this section, we will present different suggestions for

copied with or reducing the effects of equity issues on obesity.

Oral health professionals and their organizations

As members of the health care team, oral health professionals have a role in reducing the effect of health-equity issues on obesity. These are suggested activities that could assist them in that role.

Community

As trusted health professionals, oral health professionals, as well as their organizations, must establish a presence within their local communities by becoming involved in efforts to reduce obesity at a community level. To accomplish this, oral health professionals may take several steps as individual advocates or as members of professional organizations. To begin, they may support school community gardens or agricultural programs with local farmers through either funding, advocacy, or both. Additionally, they may make an impact within the health professions field by promoting healthy eating at local health care facilities. This would involve regulating the types of food available to both employees and patients and ensuring that healthy food options are offered at reasonable and comparable prices to other selections. Furthermore, oral health professionals could have a broader influence by motivating local businesses to exchange unhealthy rewards and prizes for children, such as candies or cookies, for more beneficial options such as stickers, balloons, and pencils. At the infrastructural level, oral health professionals should engage their local governments in developing policies that address equity issues in childhood obesity. First, the construction of safe routes to school is crucial so that children have the opportunity to engage in more physically active transportation methods, such as walking or biking. Next, efforts must be made to redesign communities with healthy lifestyles in mind; for instance, one step to accomplish this would be to repurpose buildings and open land into recreation facilities and parks. Finally, oral health professionals and their organizations should endeavor to encourage government agencies to evaluate the impacts to human health when considering policies and regulations.

School system

In addition to becoming involved at a more general communitywide level, oral health professionals should also directly cooperate with school systems in order to specifically impact obesity among children. As health experts, they should support teachers in building curriculums that include lesson plans on healthy diets and lifestyles, as well as taking part in parent-teacher groups to push for healthier food environments at school. Moreover, oral health professionals should

highlight to school district administrators and local governments the need to reduce, and even eliminate, unhealthy competitive foods sold at school. Additionally, they could learn about the “Safe Routes to School” program in the neighborhoods surrounding their homes and offices so that they may promote it among their patient base and community members. Finally, an effective approach that oral health professionals can take to become directly involved in the school system is to “adopt” schools in socially disadvantaged neighborhoods. This would entail participating in activities planned by the school, such as career day, parent–teacher association educational meetings, and parent health seminars.

Oral health practices and clinics

Last but not least, the most obvious platform through which oral health professionals may have an impact on childhood obesity is in their dental practices and clinics. During routine dental visits, oral health professionals must include conversations and education about healthy diets. However, it is important that in the educational activities emphasis is placed on overall health rather than on weight in order to avoid weight-related stigma and instead encourage children to become self-motivated in making healthier choices. Furthermore, in regard to engaging parents in these conversations, oral health professionals must address consumption of SSBs and other foods high in sugar as a risk factor not only for the development of caries but also for obesity. They must also discuss with parents the mechanisms to gain greater access to healthy foods in the area. In order to drive home these issues, oral health professionals should obtain children’s BMI regularly in their clinics and share results with parents. Employing these steps in oral health care clinics is crucial. Up until now, obesity is seldom discussed between oral health professionals and their patients – rather, the conversation is usually left to primary care health professionals. However, emphasizing education regarding childhood obesity in both settings will reinforce the severity of the issue and will potentially help reduce its prevalence.

Advocacy

Overall, a diet that includes sugars that promote dental caries is also a diet that promotes obesity. Therefore, oral health professional and their organizations have a clear role in the development and support of policies that address the factors that affect the diet consumed by children.

Parents and caregivers

Improving family members’ financial skills was shown to reduce food insecurity in American households with children (51). Therefore, schools and community-based organizations, particularly those serving populations with low incomes,

could provide financial education in order to reduce food insecurity.

Nolan and Eshleman discussed the concept that lapses in self-control take place as a reward following an effort. They extended the concept to suggest that healthy habits could be encouraged by presenting nutrient-dense foods (e.g., fresh fruit and vegetables) as rewarding treats, and active play during recess as a time for students to take a breather from sitting at their desks (46).

Parents and caregivers should limit children’s leisure screen time and instead offer nonsedentary activities (32). For example, parents and caregivers could limit children’s watching television time to 2 hours per day (32). Posing restrictions on screen time would allow for and encourage children to find other ways to play, such as engaging in sports and other outdoor activities. These recommendations require that alternatives for healthy recreation exist in the community. In some communities, residents have joined forces to clean vacant lots and turn them into parks or cleaned and painted previously dangerous alleys to make them walkable (Personal experience in Baltimore City).

Active participation of parents in their children’s school is an effective mechanism to promote a healthy and safe school environment. It also allows the creation of social cohesion and provides social support to confront the consequences of equity issues.

Body weight stigma is one of the elements in the social environment. Stigma is associated with low motivation to exercise, poor food choices, and overeating (46). Therefore, reduction of stigma associated with body weight is an urgent goal in society to reduce equity issues in childhood obesity. Some actions to avoid or reduce weight stigma include: emphasize with children what their body can do, rather than how it looks; parents and caregivers should frame the discussion about weight from a “healthy weight” perspective. Nolan and Eshleman, based on several articles that reject the notion of an obesity epidemic and its deleterious effects, indicates that referring to the increase in BMI as an “epidemic” increases weight related stigma (46).

The conceptual framework (10) used to guide this scoping review of literature to determine the health-equity issues that relate to childhood obesity provided strength to the review. A weakness was the vast topic it attempted to review; this limitation was addressed by prioritizing systematic reviews over single-study reports. This scoping review showed the strong connection between the macrosocial context and the environments that are associated with childhood obesity: food environment, natural and built environment, and social environment.

The only elements that were not found to be consistently associated with obesity were food insecurity (22–24) and food deserts (20) from the food environment. The lack of association indicates a resilient response of the population, despite

the limitations associated with their low income. Individuals residing in food deserts travel to other neighborhoods to shop in stores that offer acceptable food quality and prices (52). Similarly, food insecurity has not been associated with obesity (22-24). Larson and Story posited that factors from the community and household may be impacting the association between food insecurity and obesity (23). For example, receipt of assistance in the form of Supplemental Nutrition Assistance Program benefits or school meals is likely to alleviate food insecurity without increasing obesity, but to increase obesity risk among non-food-insecure children (23).

Other factors that could affect food insecurity, such as social support and housing conditions, need to be studied in more detail. Adequate housing conditions affect families with low incomes in particular; a nonfunctional kitchen, because it lacks a consistent supply of clean water or lacks appliances, is a deterrent for food preparation at home. Besides, the presence of a working refrigerator is a requirement in most climates to preserve fresh fruits and vegetables.

The inconsistency in the association between obesity and both food insecurity and food deserts, which are both linked to poverty, could be related to the decline in or leveling off of obesity among children (1), while there have not been substantial changes in the prevalence of poverty (53). A potential explanation could be methodological limitations. Gordon-Larsen (28), after reviewing the literature on food availability and obesity, concluded that limitations in the research methodology (definitions, statistical techniques, study design, confounding variables) preclude arriving to any conclusion about their association. However, a more plausible explanation for the lack of the expected association between obesity and food insecurity and food deserts could be “community resilience.” Community resilience refers to the ability of certain neighborhoods to “bounce back” in the face of stressors as a result of proactive efforts to strengthen the community (54). Community resilience will result in a community that accesses healthy foods outside its boundaries despite food deserts and makes appropriate use of any available assistance to counteract food insecurity.

Most of the equity issues could be addressed with regulations, but the challenge to achieve change based on the legal system is practically insurmountable (55). Hayne *et al.* contend that proposals to limit advertisement are likely to confront first amendment considerations; regulations to change the built environment need to face contractual barriers, such as terminating contracts early with food providers at schools. Regulations to change the macrosocial context also need the support of voters and other stakeholders. In most cases, there is strong opposition to changes in the environments related to childhood obesity (55). The most powerful barrier is financial limitations to making changes in the environments. Most changes will require budgets that are already limited, particularly for changes in transportation or schools in low-

income areas (55). In order to address the equity issues related to obesity, it will be necessary to muster very strong political will to overcome the barriers. Additionally, increasing the involvement of as many stakeholders as possible could improve the chances of success of any regulation in terms of acceptance, longevity, and impact (55).

The increase in childhood obesity over the past 25 years cannot be explained by genetic or biological changes given the short period of time. Johnson contends that this increase in childhood obesity is the result of “an obesogenic environment that promotes inactivity and overeating” (4). As demonstrated by the literature, this obesogenic environment is determined by macrosocial contextual factors such as changes in sociopolitical, socioeconomic, and socioenvironmental contexts (10). Therefore, this strong social aspect of obesity should be considered when seeking solutions to address the problem.

Conclusion

Most food environment elements were associated with obesity, but there was no agreement about the association between obesity and both food insecurity and food deserts. A deficient natural and built environment that does not facilitate participation in physical activity and limits access to healthy foods increases childhood obesity. Similarly, a negative social environment represented by poverty, unhealthy social norms and eating habits, and limited social cohesion and time was associated with childhood obesity. In order to reduce childhood obesity prevalence, oral health professionals and their organizations should recognize and address obesity equity issues in the community, in schools, and in their workplaces.

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