Chapter 4

The Physical Activity Environment In Homes and Neighborhoods

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Abstract

The home environment is believed to be key in obesity prevention, yet it is unclear how factors in the home and neighborhood influence physical activity. This chapter examines possible interactions and reviews instruments for assessing physical activity and media availability and accessibility in homes and neighborhoods. Items in homes and neighborhoods associated with weight-related behaviors included availability and accessibility of equipment for active and sedentary pursuits, parental perceptions of neighborhood safety, and restrictions on screen-based behaviors. Testing to ensure validity and reliability was limited for several instruments, and given the variety of samples and varying methodology used in instrument development, comparisons between studies were difficult to make. Future work should address this so these instruments can more effectively assess interventions focused on improving home physical activity environments.

The Physical Activity Environment in Homes and Neighborhoods

Data from the 2011-2012 National Health and Nutrition Examination Survey (NHANES) indicate that nearly 35 percent of adults in the United States are obese. Obesity and its comorbidities significantly impact both physical and financial health. In 2009, the overall estimated burden of obesity in the United States accounted for approximately 10 percent of all medical spending [1], greatly impacting quality of life [2-5].
The increase in obesity rates in the United States likely reflects shifting dietary patterns [6,7], sedentary lifestyle patterns [8], and multiple environmental and lifestyle factors that influence weight status [9]. At the macro level, social norms, advertising, agriculture and economic policies have an indirect effect on obesity rates, whereas at the individual level, physical and social environmental and personal factors, like skills and behavior, more directly influence weight-related behaviors. These more direct effects include characteristics of the home, such as parental overweight [10,11], insufficient sleep [12,13], low daily physical activity levels [14-16], infrequent family meals [13,17], high consumption of sugary drinks [18-20], limited intakes of fruits and vegetables [21-23], television viewing times greater than two hours daily [13,17], adverse parental feeding practices [24], parental modeling of behaviors associated with unwanted weight gain [15,25], lack of opportunities for active play in and around homes [26-28], and many others.

Addressing the home environment is therefore key to childhood obesity treatment and prevention. However, the extent to which factors in the home interact to influence obesity, and physical activity, in particular, is unclear, in part because a large number of measures and a wide variety of instruments have been used to assess constructs associated with these [26]. This variability has made published data [26,29-41] difficult to compare. This chapter will describe factors in the home environment associated with physical activity level. In addition, it will describe an array of instruments available to assess the home physical activity and sedentary behavior (i.e., media) environments and identify gaps where further research is needed.

Online searches were performed in Medline, PubMed and CINAHL for articles describing instruments that assess physical activity availability and/or accessibility in the home and neighborhood and media availability and accessibility in the home. The results of these searches are described here.

Physical Activity Availability and Accessibility

Physical activity, independent of sedentary behaviors, contributes to healthier body weights as well as improved blood pressure, better motor skills, and greater self-confidence in children [16,42-48]. There are multiple ways that environmental attributes in the home can affect behaviors related to physical and sedentary activity, including providing opportunities for physical activity, providing cues to (not) engage in activity, and signaling values, support, and modeling of activity by parents or other household members [26]. For instance, having exercise equipment in the home is positively related to physical activity among adolescent girls [49], and obese sixth graders reported less physical activity equipment in the home than their non-obese counterparts (although not statistically significant) [50]. There is also evidence for children and adolescents...
that having physical activity equipment in the home alone is inversely related to television viewing [26]. Of the limited studies available, most focus on adolescents with few studies investigating how the home physical activity environment affects younger children [25].

Among adults, a recent review found numerous factors in the physical environment that predicted physical activity. These included exercise equipment at home, access to and satisfaction with recreation facilities, and community-level influences, such as neighborhood safety, hilly terrain, frequently observing others engaged in physical activity, and having enjoyable scenery [48]. Despite the importance of accessibility, many previous home environment assessments have only focused on availability [51]. Accessibility may help promote “ease of use and cueing of behavior” [41] and is thus an important prompt to engage in specific behaviors (e.g., use available equipment or consume certain foods). A review found that access to facilities and programs was also consistently related to children’s physical activity [46]. In addition, parents’ attitudes towards physical activity and the amount in which they participate are correlated with increased activity in their children [46]. Hence, parental role modeling and transporting of children to activities play a significant role in the physical activity of children between the ages of 4 and 12 years old [52-54].

There is some evidence that the neighborhood environmental characteristics near the home may also determine the extent of physical activity and thus influence body weight [55-57]. Children who reside in urban areas engage in significantly less physical activity than suburban children, and their parents express more anxiety about neighborhood safety, which is correlated with their activity levels [58]. There is also evidence that neighborhood patterns such as traffic safety and walkability may affect obesity outcomes and physical activity levels in adolescents [59-61]. The effect of the neighborhood environment on younger children’s obesity and related behaviors, however, is mixed [25,59]. It may be that certain features of the neighborhood and home physical activity environment have a greater impact on activity levels than others, or that interactions between certain features have not yet been identified [25]. Neighborhood characteristics may also promote or deter adults from engaging in physical activity [62]. A review found lack of facilities for physical activity (e.g., recreation centers) was one of the strongest predictive barriers to physical activity among adults [63]. This indirectly affects other family members, too; if parents do not engage in an activity, they cannot model the behavior for their children.
Home Physical Activity Availability and Accessibility Measures

The use of ecological models of behavior change in studying physical activity only became prominent in the 1990s; hence, the history of physical activity environment measures is relatively brief [64]. A total of nine instruments were found that assessed physical activity availability and accessibility in the home (Table 1). Six inquired about the presence of active toys, such as bicycles, bats, racquets, jump ropes and balls [26,29,31,39-41,65], and three about the presence of home fitness equipment, such as a treadmill, stationary bicycle, cross trainer, stepper or workout video [26,31,41]. Three examined whether the yard was available and adequate for active play [29,40,66], and two evaluated the home’s indoor space for active play [26,37,38].

Associations between equipment and space for active play or exercise and physical activity were mixed, and characteristics of the instruments, including target audience and determination of validity and reliability, varied. For example, research using the Children’s Leisure Activities Study Survey (CLASS) among Australian parents of 5- to 6- and 10- to 12-year olds and the Home Physical Activity Equipment Scale among American parents reported that physical activity equipment availability was positively related to physical activity; however, data on other forms of validity and reliability were limited [26,39,65].

Moreover, data from American parents collected using the Home Self-administered Tool for Environmental assessment of Activity and Diet indicated that child BMI percentile was significantly correlated with the presence of easily accessible, well-maintained adult exercise and child play equipment [31]. In contrast, testing of the Home Environment Survey found that accessibility, but not availability, of equipment and indoor/outdoor space for active play was significantly correlated with child physical activity; however, the sample was limited to parents of overweight and obese 8- to 12-year olds who were mostly white and had at least some college education [29]. The Physical and Nutritional Home Environment Inventory modified a previously validated Outdoor Playtime Checklist for use with parents of Australian preschoolers [28]. There was a limited relationship between the amount of outdoor play equipment and the size of the yard; these were weakly associated with more outdoor play, though data on other forms of reliability and validity were not provided [40]. However, when Plotnikoff and colleagues surveyed eighth grade girls living in Australia and disengaged in physical education class using the Family Nutrition and Physical Activity Screening Tool [67], they found no relationship between physical activity and access to equipment or places for exercise [66].
Recent Advances in Obesity in Children

Table 1: Instruments that assess Physical Activity Availability and/or Accessibility in the Home.

<table>
<thead>
<tr>
<th>Characteristics evaluated</th>
<th>Type of instrument</th>
<th>Evidence</th>
<th>Stability</th>
<th>Reliability</th>
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Neighborhood Physical Activity Availability and Accessibility Measures

Four instruments assessed potential barriers to outdoor physical activity, such as road safety and concerns about strangers, within the external environment [30,32,34,36,39] (Table 2). This included the accessibility of public facilities, such as shops, schools, playgrounds, parks and recreation facilities within the community and/or the presence of extracurricular activities [32,36,65]. In particular, among adults in 11 countries, there were significant positive associations between physical activity prevalence and the presence of nearby shops, sidewalks, bicycle facilities and low-cost recreational facilities [36].

Table 2: Instruments that assess Physical Activity Availability and/or Accessibility in the Neighborhood.

<table>
<thead>
<tr>
<th>Neighborhood Physical Activity Availability and Accessibility in the Neighborhood</th>
<th>Characteristics evaluated</th>
<th>Type of instrument</th>
<th>Evidence</th>
<th>Stability</th>
<th>Reliability</th>
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a park and perceived traffic safety for adolescents in the United States [32]. Data from CLASS found that parents who reported concerns about road safety were more likely to have children in the lowest category of physical activity [39]. Commonly cited barriers to increased outdoor play included concerns about strangers, road safety, and needing to supervise outdoor play. Similarly, data from the Neighborhood Environment for Children Rating Scales found mothers of preschoolers who perceived their neighborhood was less safe had a greater mean body mass index (BMI) and a higher prevalence of obesity than those who felt their neighborhood was safe [30]. Among girls ages 10 to 12, parental belief that their child would need to cross several roads to access play areas and that public transportation was limited and child belief that there were no play areas or sports facilities nearby were correlated with less walking and cycling [34].

**Media Availability and Accessibility**

Although there is evidence that watching certain child-centered television shows can help teach skills like counting [68-71] and sharing [72,73], many children view more television than the 2 hours per day limit recommended by the American Academy of Pediatrics for children ages 2 years and older [74]. This time limit not only includes television viewing but all screen time, defined as time watching television or videos/DVDs, playing video or computer games, and using a computer for purposes other than school work [74,75]. Exposure to too much screen time is associated with the following outcomes in children: shorter attention spans and learning problems [76-78], aggression and misbehavior [79-84], sleep problems and feelings of tiredness [85-87], consumption of less healthy meals and snacks [78,88-100], participating in too little physical activity [81,101-104], and having above-normal weight for age [105-107].

Screen time devoted to watching television, in particular, is positively related to the prevalence of childhood obesity [103,108]. Five to 11-year old children with televisions in their bedrooms watch significantly more television and have significantly higher BMI z-scores than those who do not have a bedroom television [26]. Moreover, parents who restrict television viewing during meals may have children that spend less time watching television [35]. Hence, limiting and setting rules about the use of television in the home and its availability in children's bedrooms may be important variables to consider when assessing home environment attributes related to childhood obesity [26]. Indeed, one study of 10- to 16-year olds found media accessibility had a stronger association with energy balance than the number of media-playing items in the home [109].

**Media Availability and Accessibility Measures**

Though several instruments had items inquiring about sedentary activities, three scales addressed seden-
tary opportunities related to media use or related parental rules and restrictions at home in detail (e.g., access to TVs, computers, electronic games, Internet, etc.) [26,35] (Table 3). Findings with the Home Electronic Equipment Scale showed that the number of televisions and electronics at home was positively related to child’s television viewing time [26] and that activity equipment was inversely related to television viewing time, though the sample was limited to parents of 5- to 11-year olds living in several cities in the United States. Data from the Sedentary Opportunities at Home and Rules and Restrictions Scales found that rules about watching television during meals were not related to physical activity [35]. Girls who preferred watching television and whose fathers reported using computer and electronic games ≥30 minutes per day were also more likely to engage in less physical activity [35]. Overall time spent in media use was not significantly associated with physical activity among 10- to 12-year olds [35]; however, these data were limited to parents of 10- to 12-year olds living in Australia, and validity of the scale items was not reported. Published measures of availability and accessibility of new screen devices such as tablets and smart phones and their associations with obesity-related outcomes are still limited.

Table 3: Instruments that assess Media Availability and/or Accessibility in the Home.

<table>
<thead>
<tr>
<th>Media Environment Scales</th>
<th>Characteristics evaluated</th>
<th>Type of Questionnaire</th>
<th>Audience</th>
<th>Validity</th>
<th>Reliability</th>
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<tr>
<td>Home Electronic Equipment Scale [26]</td>
<td>Availability of television entertainment or information devices in the home and on the child’s television in 3 subscales: 1) Electronic available in the home (televisions, video/DVD recorder, digital television recorder, music players, desktop computer with internet, video game player, and telephone;[non-cell phone]) 2) Electronics available in the child’s bedroom (same as in the home), and the presence of computers in the home 3) Portable electronics (music player, video game player, laptop with internet, laptop without internet, and cell phone)</td>
<td>Open-ended</td>
<td>Open-ended, total items=21</td>
<td>ICC of subscales: 0.71-0.92 (range: 0.26-0.96; n=116); digital TV recorder was not the lowest and removed</td>
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<tr>
<td>Sedentary Opportunities at Home Scale [35]</td>
<td>Availability of items that may encourage or support children’s screen-based behaviors or low levels of activity: pay TV; free-to-air TV (regular free channels and an antenna), video/DVD player, electronic games (e.g., PlayStation, Nintendo, Gameboy), a TV in the child’s bedroom, and number of TVs in the home</td>
<td>Dichotomous &amp; open-ended</td>
<td>Parents of children 10-12 years (n=156) in Australia</td>
<td>Percent agreement of items: 91-99%; Cohen’s Kappa of items: 0.6-0.9; ICC for “the number of TV sets in the home” item: 0.99</td>
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<tr>
<td>Rules and Restrictions Scale [35]</td>
<td>Rules and restrictions parents apply to their children’s screen-based behaviors (e.g., “During meals, I do not allow the TV to be on.” “My child is not allowed to watch TV until his/her homework is done.” “My child must be supervised when playing the PlayStation/Nintendo.” “My child must be supervised when he/she is watching TV.” “My child must be supervised on the Internet.”)</td>
<td>Likert scales</td>
<td>Parents of children 10-12 years (n=156) in Australia</td>
<td>Not reported; ICC of items: 0.71-0.98</td>
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Instrument Quality

As noted above and in Tables 1-3, data on scale validity and reliability were limited or not available for some of the instruments. Respondent burden also varied; though some were brief, two instruments contained more than 100 items [29,41], and one reportedly took over 1 hour to complete [40]. The intended audience also varied; only one instrument was developed for and tested with adults outside of the United States and Australia [36], and only four were tested with parents of preschoolers [27,31,38,40].

Conclusions

Comprehensive instruments that assess social and physical aspects of the home environment as they relate
to nutrition and physical activity can provide great insight into behaviors that may increase obesity risk. Future work to refine existing instruments is needed. First, though several instruments measure physical activity availability, fewer address accessibility. The reported associations between accessibility and child physical activity suggest that factors beyond availability will be important to examine in the future [31]. Second, few of the home environment measures in these instruments were examined in relation to objectively-measured outcomes. Two collected home environment data using direct observation by researchers [27,40] and three measured physical activity using an accelerometer [33,65,66]. The majority, however, utilized self-administered assessments of the home environment and in many cases, used proxy measures of physical activity, neighborhood safety, and television viewing. Although proxy measures reduce costs and the need for home visits, additional research should address ways to ensure the reliability and validity of these measures while still minimizing respondent burden. Third, the samples in which these instruments have been validated thus far are limited; testing with diverse groups of subjects will clarify the effectiveness of these instruments in a broad range of population subgroups and particularly within a family environment, which may include multiple generations and individuals of many backgrounds. In addition, research should evaluate the ability of the instruments to detect changes over time in an intervention setting.

The instruments developed to date have identified multiple factors that may affect physical and sedentary activity opportunities in the home and neighborhood environment. Items associated in at least some samples with weight-related behaviors included availability and accessibility of equipment for active and sedentary pursuits, parental perceptions of neighborhood safety, and restrictions on screen-based behaviors. However, testing to ensure validity and reliability was limited or not reported for several instruments, and given the variety of samples and varying methodology used, comparisons between studies are difficult to make. Future work needs to address these issues so that instruments can be effectively used to assess interventions aimed at building healthy home physical activity environments.

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