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Children's active free play in local neighborhoods: a behavioral mapping study

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Abstract

Many Australian children are more sedentary than they should be, and almost one in five are currently overweight or obese. Some children may face difficulties finding opportunities to be active, having poor access to safe public open spaces or having low independent mobility limiting their access to places to play. This study aimed to examine children's access to places in their neighborhood for active free play and how these vary by age, sex and socioeconomic status (SES). Behavioral maps of the local neighborhood were completed by children (8–12 years) from five primary schools across different areas of Melbourne. Children living in low SES outer-urban neighborhoods had to travel greater distances to access local parks compared with those in inner-urban mid and high SES areas. One-third (32%) of children reported an independent mobility range of <100 m from home. In conclusion, for some children opportunities to engage in active free play in the local neighborhood may be limited due to lack of parks in close proximity to home and restricted independent mobility. It is important to collaborate with local governments, urban planners and community groups to improve access to neighborhood parks and to promote a sense of neighborhood safety.

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Introduction

Physical activity in youth is important for children's current and future health [1, 2]. Declining physical activity [3] and rising obesity rates [4] among children provide a strong rationale for the promotion of physical activity in childhood. Children's physical activity consists of structured activities such as organized sport, school physical education and school sport and unstructured activities which may include walking or cycling to school and active free play. Among primary school-aged children, active free play (which may be defined as unstructured physical activity that takes place outdoors in the child's free time) may potentially be a major contributor to overall physical activity levels and it has been suggested that young people's free time should become more of a focus for promoting physical activity [5]. In order to increase the opportunities for children to engage in active free play, it is important to understand where children are playing and the influences on their use of different play spaces.

Ecological models posit that physical activity behavior is influenced by intrapersonal, social and physical environmental factors [6]. Age and gender have been shown to be strong correlates of physical activity among youth, with older children being less active than younger children and girls less active than boys [7, 8]. Children from lower socioeconomic status (SES) areas have also been found to be less active than children of higher SES areas [9, 10]. While intrapersonal and social influences on physical activity have been extensively studied [8], public health researchers are increasingly interested in how characteristics of neighborhood physical environments influence children's and adults'

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physical activity levels [11–13]. However, relatively little research has examined the impact of the physical environment on children's physical activity, particularly their active free play [13].

Neighborhood parks provide a venue for physical activity among young people [14] and access to neighborhood parks can influence children's participation in physical activity [15]. Recent studies have shown positive associations between proximity of parks and playgrounds to the home and children's physical activity. For example, a cross-sectional study of seventh grade boys and girls (n = 177) in the United States of America found that the objectively measured distance to the nearest open play area was inversely related to self-reported outdoor physical activity for boys [16]. Sallis *et al.* [17] showed that parents' reports (n = 247) of the number of play areas within walking distance of the home were positively associated with observed levels of physical activity among pre-school-aged children. Furthermore, Timperio *et al.* [18] demonstrated that children's perception of easy access to parks was cross-sectionally associated with a greater number of walking or cycling trips among 919 Australian youth. A study of 59 children aged 4–7 years also found that those living in a neighborhood with denser housing and a greater proportion of park area had higher levels of physical activity [19].

Access to neighborhood parks and other places for free play may also be affected by children's levels of independent mobility (i.e. a child's ability to walk or cycle to places in the neighborhood unaccompanied by an adult). Despite there being very little scientific evidence, it is argued that over recent years there has been a significant decline in children's independent mobility and that children today are much more restricted than children in previous generations [20, 21]. Children with greater independence have been shown to play more often with their peers both indoors and outdoors [22]; however, there has been little research exploring children's independent mobility around their local neighborhood and whether this is related to use of public play spaces.

The majority of previous studies have involved a quantitative assessment of associations between self-reported aspects of the environment and children's overall physical activity or active transport. Other methodologies, such as behavioral mapping techniques including drawing and photographing the physical environment, have been developed as useful alternatives to survey methods for exploring children's physical environments [23]. For example, a study by Hume *et al.* [24] that involved children freely drawing a map of their home and neighborhood environment found associations between several neighborhood factors and objectively assessed physical activity. In the current study, a mapping technique that required participants to mark places on a map was considered an innovative way to gather information from children about where they play and their access to places in their neighborhood.

In summary, there has been limited research identifying where children play and in particular examining children's access to places in their neighborhood for active free play. While it is established that children who are older, girls and from low SES areas are less active, little is known about how these factors might influence children's access to and use of play spaces in their local neighborhood. The aim of this study was therefore to examine where children engage in physical activity in their free time, their access to local parks and their independent mobility around their neighborhood and to explore how these vary by sex, age and SES. In addition, this study examined associations between access to local parks and independent mobility and use of parks and other public open spaces.

Methods

This research involved the completion of behavioral maps of the local neighborhood and a brief survey of children (aged 8–12 years) from five government primary schools from high, medium and low SES areas of metropolitan and outer-urban Melbourne, Australia. Ethics approval was received from the Deakin University Ethics Committee and the Department of Education and Training, Victoria.

Participants

Two hundred and twelve children completed the mapping and survey activities. Purposive sampling was used to recruit children living in a range of SES areas. Schools were selected from areas of different SES, using the Socio Economic Index for Areas [25]. SES ranking of schools was confirmed using the 'like school' group ranking [26]. This ranking categorizes schools in Victoria, Australia, into nine groups based on the demographic background of their students—for instance, the proportion of students receiving Government education benefits, a means-tested welfare payment [26]. Two schools from low SES (lower tertile of like school groups), two schools from mid SES (middle tertile of like school groups) and one school from high SES (highest tertile of like school groups) were included in the study. The two low SES schools were geographically located in the outer suburbs of the Melbourne metropolitan area, and the mid and high SES schools were more centrally located. Two classes per school (nominated by the Principal) participated in the study; one class from each school was selected from children aged 8–9 years, and one class was selected from children aged 10–12 years. All children in each class participated.

Mapping activity and survey

Mapping techniques have been identified as a useful research method for children [23] and for this study were considered an innovative way of gathering information from children about their use of the local neighborhood. Prior to commencing the study, a map including the area surrounding the school within which the majority of the school population lived was obtained from the local council for that school. Each child was provided with an A3-sized copy of this map, a packet of colored felt pens and a survey that included the instructions: 'mark on the map with an ''X'' in black pen where you live'; 'mark on the map with an ''X'' in purple pen where you have engaged in active play or been physically active in the past week'; 'mark on the map with an ''X'' in blue pen the park/playground you go to the most' and 'mark on the map with an ''X'' in green pen where you ride or walk to in your neighborhood without an adult'.

In addition to marking these places on the map the children were required to write their responses on the survey. For example, the children were asked to 'list the places where you ride or walk to in your neighborhood without an adult'. This ensured that data were collected from all children, including those who lived in an area or usually visited a park that was located outside the area included on the map and were therefore unable to mark all locations on the map. As part of the survey, the children were also asked to record their sex, age and school class. To assist the children recognize and name places in their neighborhood, local landmarks such as the school and local parks were highlighted on the map. Photographs of parks and other public open spaces in the local neighborhood were also mounted on posters for each school and these were displayed for the children while they were completing the activity. For each class, two investigators plus the classroom teacher were in attendance to give assistance to the children where required. Peer interaction did not appear to influence children's completion of their maps. Each child was firstly required to mark their home location on the map and this was not something they could copy from their classmates. After this, they tended to continue to work independently to answer the remainder of the questions.

Data management and analysis

The information provided on the maps and surveys was used to determine the following: where children engage in physical activity in their free time, the distance from the child's home to their closest park, the distance from home to the park the child usually visits, the number of different places the child could walk or cycle to without an adult and the furthest distance the child could walk or cycle to without an adult.

In order to obtain a description of where the children had engaged in active play or been physically

active in the past week, responses were grouped into categories (e.g. yard at home, park/playground) and the total number of children who reported each place category was summed. All distances were calculated using two methods; direct measurement and computer-generated measurement. The maps that the children were given were produced to scale; therefore, in most cases the distances were calculated by simply using a ruler and measuring the actual distance (i.e. direct measurement). In some instances (fewer than 5% of all maps), the distances were calculated using a computerized program 'whereis' (http://www.whereis.com.au/), which calculates the distance between specified locations. This program was only used when direct measurement was difficult, such as when a child lived outside the area shown on the map or when the park a child usually visited was not on the map. All distances were measured by the road network rather than 'as the crow flies'.

Once the child's home location was established, the distance from the child's home to the closest park and to the park they usually visit were measured. No requirements were placed on the closest park (i.e. it did not need to have play equipment or to be a certain size); it was simply the closest park to the child's home. For each child, the total number of different places that they could walk or ride to in their neighborhood independent of an adult was summed. The furthest distance each child goes without an adult was calculated by measuring the distance from home to the place that was marked on the map, or reported on the survey, that was located the greatest distance from home.

When reporting the places they could walk or cycle to independently, a small proportion of children (8%) gave responses such as 'around the block' or 'anywhere'. These responses could not be assigned a specific numeric value, so categories were created, and standard distances were assigned. For example, when calculating the furthest distance a child could go without an adult, the responses 'across the street' or 'in own street' were placed in the lowest category (i.e. <100 m) and the response 'anywhere' was placed in the upper category (i.e. >1000 m).

Double entry verified data entry was performed by a commercial company and the resulting data file was converted to SPSS for Windows for all analyses. Analysis of variance, Scheffé *post hoc* tests, independent *t*-tests and Pearson's chi-square analyses were used to investigate differences in the places where children had been active, distances to local parks and independent mobility in the neighborhood by sex, age and SES groups. Logistic regression models were performed to predict the likelihood of children of using parks/playgrounds or other public open spaces (e.g. sports fields) according to the distance from home to the child's closest park, the distance from home to the park the child usually visits and the number of different places and the furthest distance the child could walk or cycle to without an adult. Models were also adjusted for potential confounders (i.e. sex, age and SES).

Results

Two hundred and twelve children (51% girls) participated in the study, with 49% aged 8–9 years and 51% aged 10–12 years. Thirty-nine percent of children were from low SES areas, 42% from mid SES and 19% from high SES areas.

Places where children have been active

Table I presents the proportion of children reporting being active in particular locations. The most frequently reported place for physical activity was the yard (or garden) at home, followed by the park/playground and a friend's/relative's yard. A significantly higher proportion of girls than boys reported being active in the yard at home, and a higher proportion of boys than girls reported being active in other public open spaces such as a sports field. The only significant difference observed between age groups was that a higher proportion of children aged 10–12 years reported being active in the street/footpath compared with children aged 8–9 years. A number of significant differences by SES were also identified. Children from the low SES area reported being active in

Table I. *Places where children have been active in the past week, overall and by sex, age and SES*

	Total (n = 212) %	Boys (n = 105) %	Girls (n = 107) %	Age 8–9 years (n = 103) %	Age 10–12 years (n = 109) %	Low SES (n = 83) %	Mid SES (n = 88) %	High SES (n = 41) %
Yard at home	48	37	58**	48	48	51	42	54
Park/playground	37	35	39	39	36	25	44	46*
Friend's/relative's yard	26	21	31	20	31	35	22	17*
Other public open space (e.g. sports field, open space, bike path, walking track, river and bush)	25	33	17**	21	28	28	26	17
Street/footpath	18	17	18	12	23*	15	14	32*
Indoor sports center	16	11	20	13	18	5	13	44**

*$P < 0.05$; **$P < 0.01$ (chi-square).

their friend's/relative's yard more often than children from the high SES area; however, a higher proportion of children from the high SES area reported being active at the park/playground than children from the low SES area. More children from the high SES area reported being active on the street/footpath or at an indoor sports center compared with children from the low and mid SES areas.

Access to parks in the local neighborhood

Distance from child's home to closest park

The mean distance that children needed to travel to get from home to their closest park was 590 m [standard deviation (SD) = 963 m) and the range was 50–12060 m. In comparisons by sex, age and SES, the only significant difference observed was between SES areas. As Table II shows, the children from the low SES area were required to travel almost two-and-a-half times the distance of children from the mid and high SES areas to get from home to their closest park.

Distance from home to the park child usually visits

The mean distance that children needed to travel to get from home to the park that they usually visit was 1736 m (SD = 2196 m) and the range was 50–13710 m. As detailed in Table III, the only significant difference that was observed was between SES areas, with the children from the low SES area traveling more than twice the distance of the children in the high SES area to get from home to the park that they usually visit.

Independent mobility around the neighborhood

Number of different places children can walk or cycle to without an adult

The four most frequently reported places that participants walked or cycled to independent of adults were their own street, nearby shops, friend's houses and nearby streets. Twelve percent of participants

Table II. *Mean distance (m) children travel from home to their closest park by sex[a], age[a] and SES[b]*

	Mean (SD) distance from home to closest park (m)	*P* value
Sex		
Boys (*n* = 103)	625 (1262)	0.605
Girls (*n* = 106)	556 (535)	
Age (years)		
8–9 (*n* = 101)	609 (1205)	0.782
10–12 (*n* = 108)	572 (667)	
SES		
Low (*n* = 81)	927 (1445)**·*	<0.001
Mid (*n* = 87)	374 (315)**	
High (*n* = 41)	384 (237)*	

[a]Independent *t*-test.
[b]Analysis of variance Scheffé *post hoc* test. *$P < 0.05$; **$P < 0.01$.

Table III. *Mean distance (m) from home to the park children usually visit by sex[a], age[a] and SES[b]*

	Mean (SD) distance from home to park usually visit (m)	*P* value
Sex		
Boys (*n* = 85)	2035 (2466)	0.073
Girls (*n* = 82)	1425 (1841)	
Age (years)		
8–9 (*n* = 82)	1888 (2200)	0.382
10–12 (*n* = 85)	1589 (2196)	
SES		
Low (*n* = 56)	2273 (3168)*	0.031
Mid (*n* = 71)	1676 (1546)	
High (*n* = 40)	1090 (1113)*	

[a]Independent *t*-test.
[b]Analysis of variance Scheffé *post hoc* test. *$P < 0.05$.

reported that they could not walk or cycle anywhere without an adult and 8% reported that they had unlimited independent mobility. As shown in Table IV, significant differences were observed between all groups. More girls than boys could go to three or more places without an adult. A higher proportion of older children reported that they could go to three or more places without an adult compared with younger children. Compared with those in the high SES area, a higher proportion of children from the low SES area reported that they could go to three or more places without an adult.

Table IV. *Number of different places children can walk or cycle to without an adult by sex, age and SES*

	0–1 place without an adult %	2 places without an adult %	3+ places without an adult %	*P* value[a]
Total	43	21	36	
Sex				
Boys (*n* = 102)	53	17	30	0.021
Girls (*n* = 106)	34	26	41	
Age (years)				
8–9 (*n* = 99)	64	21	15	<0.001
10–12 (*n* = 109)	25	21	54	
SES				
Low (*n* = 79)	37	19	44	0.045
Mid (*n* = 88)	52	17	31	
High (*n* = 41)	37	34	29	

[a]Chi-square.

Furthest distance children can walk or cycle to without an adult

Overall, 32% of children reported traveling <100 m from home without an adult. Significant differences were observed between age and SES groups. As Table V shows, just under half of older children reported they could travel >1000 m compared with only one-quarter of younger children. In addition, a substantially higher proportion of children from the low SES area reported being able to travel >1000 m without an adult compared with children in the mid and high SES areas.

Associations between explanatory variables and use of parks and other public open spaces

Logistic regression models controlling for sex, age and SES revealed no significant associations between use of parks/playgrounds and other public open spaces in the previous week and the distance from home to the child's closest park, the distance from home to the park the child usually visits and the number of different places or the furthest

Table V. *Furthest distance (m) children can walk or cycle to without an adult by sex, age and SES*

	0–100 m %	150–999 m %	1000+ m %	*P* value[a]
Total	32	32	36	
Sex				
Boys (n = 92)	35	35	30	0.279
Girls (n = 91)	29	30	42	
Age (years)				
8–9 (n = 88)	46	31	24	<0.001
10–12 (n = 95)	19	34	47	
SES				
Low (n = 75)	25	21	53	<0.001
Mid (n = 72)	44	38	18	
High (n = 36)	19	44	36	

[a]Chi-square.

distance the child can walk or cycle to without an adult.

Discussion

The primary purpose of this study was to examine where children play and to explore children's access to places in their neighborhood for active free play. The innovative methodology employed enabled data to be gathered directly from a diverse sample of boys and girls, of different ages, and from different SES areas.

For the children in this study, the yard at home was the most frequently reported place for active play and this was followed by the park/playground and their friend's/relative's yard. While there are few studies that have explored where children engage in active play, a study by Tandy [27] of 421 children aged between 5 and 12 years in urban Australia reported similar findings to the current study with more than half the children (59%) reporting that their preferred play space was at home or at a friend's home, 23% at the park and 9% in the street. However, that study did not examine sociodemographic differences in where children play. In the current study, fewer children in the low SES areas reported being active at the park/playground compared with the children from the mid and high SES areas. One explanation for this may be the differences in the distances that the children need to travel to access their local parks. We identified that children from the low SES area needed to travel almost two-and-a-half times the distance to get from home to their closest park compared with children from the mid and high SES areas and more than twice the distance to get from home to the park that they usually visit compared with children from the high SES areas. This may in part be due to the geographic differences between the schools in this sample since the low SES area schools were located in an outer-urban area where there were often greater distances between homes and facilities in the local area, whereas the mid and high SES area schools were located in more inner-urban areas. It is therefore possible that these findings may be due to SES or geographic area or even perhaps a combination of both factors. It is also possible that the variance was due to other factors such as an overall lack of public park infrastructure in the particular low SES outer-urban neighborhood involved in this study and such variances may not be identified in other neighborhoods of similar SES. The findings that there were no significant associations between distance from the child's home to the closest park and distance to the park the child usually visits and the use of parks and other public open spaces in the previous week suggests that other factors apart from distance may be influencing children's use of parks and playgrounds.

Other recent studies in both Australia and the United Kingdom [28, 29] have examined the availability of public open spaces by geographic area across neighborhoods of varying SES. For example, Timperio *et al*. [28] examined the availability of public open spaces that can be used for recreation across neighborhoods in Melbourne and found no differences in availability of open spaces by neighborhood SES once neighborhood population and geographic area were considered. Another study of outdoor play areas in Glasgow, Scotland, showed more play areas in deprived neighborhoods compared with affluent neighborhoods [29]; however, that study also observed that the play areas in the more deprived areas were of a poorer quality. In contrast, a US study examining disparity in access

to recreational facilities among adolescents found that lower SES and high-minority block groups had reduced access to facilities [30]. In addition, research has identified that those living in lower SES areas are more likely to report a lack of safe places for children to play [31]. It is also important to acknowledge that while the current study linked individual residences with access to public open spaces, the sample of children may not be representative of urban populations generally.

Results from the current study also showed that children across all sex, age and SES groups were usually not visiting parks that are located closest to their home. One explanation may be that children are traveling to parks that are more appealing and offer more facilities. In a qualitative study that explored parents' (n = 78) perceptions of the influences on children's active free play, the availability of interesting and challenging play equipment was identified as an important factor that motivates children and parents to visit particular parks [32]. Another possible explanation for children not visiting parks that are closest to their home may be that the closer parks are less accessible for particular reasons, such as a busy road barrier between the park and the child's home. Timperio *et al.* [18] found that the need to cross several roads to reach destinations and a lack of lights or crossings was negatively associated with walking and cycling in the neighborhood among Australian youth. Identifying the reasons why children are not visiting the closest parks may be an important aim of future research, considering that safe access to appropriate environments is likely to influence young children's play and physical activity opportunities.

Children's independent mobility was explored in the current mapping study, with the results showing that 12% of children were not able to walk or cycle anywhere in their neighborhood without adult supervision, and almost one-third of the sample were restricted to traveling <100 m. This may partly explain why for the children in this study, the yard at home was the most frequently reported place to engage in physical activity during their free time. The lack of association found in this study between a child's independent mobility and their use of parks and other public open spaces in the previous week, however, suggests that the parks the children wish to visit may be beyond their range of independent mobility or that they are more likely to visit parks when accompanied by adult. Other studies have shown that children with limited independent mobility spend less time playing outdoors with neighborhood friends [22]. Parental safety concerns have been identified as one of the major reasons why parents restrict their child's independent mobility [21, 32]. In a multilevel study, lower neighborhood safety was significantly associated with less physical activity among youth [11]. An interesting finding of this study was that more girls than boys could go to three or more places without an adult. One potential reason for this could be that parents of boys are more concerned about their child taking risks when walking or cycling independently in their neighborhood [33]. Improving actual and perceived neighborhood safety and increasing children's independent mobility are likely to be important strategies for promoting opportunities for children to engage in active free play in their local neighborhood.

The methodology used in this mapping study was innovative and to my knowledge is the first study that has used this type of mapping technique to examine children's access to places in their neighborhood for active free play. The direct involvement of children in the study and the ability to gather information from them about their own local neighborhood was a strength of this study. However, it is also important to consider the study limitations and to acknowledge that the mapping task was potentially challenging for children aged 8–12 years. The authors recognize that the validity of results is dependent on children being able to understand the task, accurately recall past events and experiences and also clearly report their responses. Unfortunately, it was not feasible to collect validity and reliability data on the measure or have a parent/guardian verify the child's response; however, face validity according to the researchers was positive. Having staff available to assist the children where necessary and being able to cross-check mapping data with written responses on

the survey helped to minimize potential problems. Further, previous studies have also undertaken mapping techniques with children aged 10–15 years [23, 24], suggesting that children are capable of undertaking such tasks. It is an important priority of future research to consider conducting reliability and validity studies of children's mapping. In addition, a small number of participants were unable to complete all mapping questions; however, this was difficult to avoid as the maps could only encompass a pre-defined neighborhood area, and allowing children to also provide these responses by survey overcame this issue. It is also important to recognize that the findings of this study are not able to be generalized across other populations as they only represent the views of groups of children from five primary schools living in metropolitan and outer-urban areas of Melbourne. Finally, and perhaps most importantly, it is acknowledged that all the low SES communities were located in the outer suburbs whereas all the mid and high SES schools were more centrally located. Destinations in inner-urban areas are more likely to be within close proximity compared with destinations in more outer-urban areas. It is possible, therefore, that the finding that the children in the low SES areas needed to travel greater distances to access parks in their neighborhood compared with children in the mid and high SES areas may indicate a relationship between geographic location rather than the SES of the area. In order to explore this issue, it is important that future studies include multilevel research involving neighborhoods from matched geographic locations at each level of SES.

In conclusion, for some children, opportunities to engage in active free play in the local neighborhood may be difficult due to a lack of parks located in close proximity to home particularly in outer-urban areas and limited independent mobility experienced by many children. However, as this study did not find associations between distance to local parks and independent mobility and the use of parks and other public open spaces in the previous week, there are potentially many other factors, such as the closest parks not being appealing or accessible or concerns about safety, that may influence children's use of their local neighborhood open spaces for active free play. Improving access to and quality of neighborhood parks and developing a sense of neighborhood safety that might encourage parents to allow their child greater independent mobility is the joint responsibility of local governments, urban planners and community groups. It is important that these partners are engaged in collaborative efforts to create neighborhoods that support active lifestyles for both children and adults. In addition, it may be important to work with parents and schools to promote children's pedestrian skills and safe navigation of their neighborhood independent of adults. Future population-level research is required on issues surrounding children's access to local parks and other influences on children's active free play including individual, social and environmental factors. It would also be beneficial to conduct further qualitative studies that explore children's perspectives on issues relating to the quality, appeal and use of venues for active free play in the local neighborhood.

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