



Parental perceived built environment measures and active play in Washington DC metropolitan children

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ABSTRACT

Objective. Previous research identified associations between perceived built environment and adult physical activity; however, fewer studies have explored associations in children. The Built Environment and Active Play (BEAP) Study examined relationships between children's active play and parental perceptions of home neighborhood built environments within the Washington, DC metropolitan area (DMV).

Methods. With this cross-sectional study, a questionnaire was administered in 2014 to parents of children (7–12 years old) residing in the DMV. Data were collected on children's active play, home built environment parental perceptions, and demographics. Active play response data were dichotomized by whether the child did or did not meet the 60-min/day Physical Activity Guidelines for Americans (PAGAs) recommendation. Perceived home neighborhood built environment data were also dichotomized. Chi-square tests determined differences in parental perceived built environment measures between active and non-active child groups. Logistic regression assessed the association of parental perceived built environment variables with active play while adjusting for demographic variables.

Results. The BEAP Study population ($n = 144$) included a uniquely diverse population of children with 23.7% African Americans and 10.4% Asian Americans. A statistically significant greater proportion of active children's parents agreed with the importance of neighborhood esthetics, active play areas, walkability and safety as compared to the parents of non-active children. Fully adjusted logistic regression models demonstrated that some parental perceived built environment measures (e.g. access to play equipment) were predictors of their children meeting the 60-min/day PAGA recommendation.

Conclusion. Our findings support the important role of home neighborhood built environment perceptions on childhood active play.

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1. Introduction

Physical inactivity is contributing to childhood overweight/obesity in the Washington, DC metropolitan area [Washington, DC; Maryland; Virginia (DMV)]. Among DMV youth, where overweight/obesity prevalence rates range from 29% to 35%, only 16.4–23.8% have achieved the daily minimum Physical Activity Guidelines for Americans (PAGA) recommendation of 60-min of moderate-to-vigorous intensity physical activity (CDC, 2014; DHHS, 2008; NSCH, 2013). Furthermore, among some race and ethnic populations, adolescent girls, and lower socioeconomic groups, physical inactivity is disproportionately higher (Hedley et al., 2004; Skinner and Skelton, 2014).

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Research revealing the relationship between the built environment and childhood recreational physical activity is still evolving. Some evidence has shown that children and adolescents with greater physical activity reside in activity friendly neighborhoods with greater access to recreational facilities, parks and trails (Babey et al., 2008; Cohen et al., 2006; Frank et al., 2007; Gordon-Larsen et al., 2006; Grow et al., 2008; Sallis et al., 2012). For example in a nationally representative cohort of adolescents, it was found that the odds of achieving moderate-to-vigorous activity increased with increasing number of recreational facilities (Gordon-Larsen et al., 2006). In the Atlanta, Georgia region, the odds of walking among a sample of youth were two and a half times greater when there was a close recreational space within a one mile distance of the home (Frank et al., 2007). Yet, while the availability of some built environment structural components, such as recreational facilities, have identified a positive association with childhood physical activity, other studies have either not demonstrated this relationship

or found negative associations with other built environment infrastructural components (e.g. traffic speed) or conditions (e.g. crime) (Adkins et al., 2004; Davison and Lawson, 2006; McGrath et al., 2015). Specifically, a very recent study concluded that children do not benefit to the same extent as adolescents from built environment features, such as parks, playgrounds, and amenities that encourage walking or neighborhood play (McGrath et al., 2015). These negative research findings may be due to quality or perceived access and safety of the neighborhood built environment features, as well as other social or cultural subjectivities that have yet to be captured.

Some studies have identified an association between perceived built environment measures and physical activity in adults (Foster and Giles-Corti, 2008; Su et al., 2014). Yet, fewer studies have explored this association in youth. Among the small number of studies, adolescents who were more physically active also held positive perceptions of certain built environment characteristics (de Farias Junior et al., 2011; Duncan et al., 2012; Mota et al., 2005). However, the relation of these environmental characteristics with physical activity level varied by gender, age and socioeconomic status (Carver et al., 2008; de Farias Junior et al., 2011; Mota et al., 2011; Santos et al., 2009). A dearth of research has explored the relationship between parental built environment perceptions and youth activity (Carver et al., 2010; Kerr et al., 2006; Moore et al., 2014; O'Connor et al., 2014). One study sampling parents and children of the Seattle and San Diego metropolitan areas found that there were various aspects of parent perception (e.g. neighborhood esthetics) that positively correlated with children's active play overall, in the home neighborhood and in public recreation spaces (Tappe et al., 2013). However, a limitation noted by the researchers indicated that most of the study's children were from relatively affluent families and that the study sample lacked racial and ethnic diversity.

Therefore, an objective of the current Built Environment and Active Play (BEAP) Study is to examine the relationships between children's active play and parental perceptions of the home neighborhood built environment within the DMV, an area with a unique population of racial and ethnic diversity. As an illustration of the DMV's unique diversity, the most recent census data revealed that with a population just slightly below six million and a median household income of \$90,149, there were a racial/ethnic composition of 47% White, 25% Black, 15% Hispanic and 9% Asian (CensusReporter, 2013). Additionally, among the foreign-born population, the most common places of birth were Latin American (40%), Asia (36%) and Africa (14%) (CensusReporter, 2013).

2. Methods

2.1. Study subjects and setting

Data were collected in September–December 2014 using a stratified sampling strategy in order to ensure adequate inclusion of diverse built environments. The BEAP Study questionnaire was administered to the parents and/or guardians of 2000 children between the ages of 7–12 years residing within the geographic borders of nine DMV counties and cities. These DMV areas included: Washington, DC (District of Columbia); Fairfax County, VA; Arlington County, VA; Loudon County, VA; Fairfax City, VA; Alexandria City, VA; Montgomery County, MD; Prince George's County, MD; and Frederick County, MD. The BEAP Study area consisted of 2901 block groups with varying population densities and land area sizes. Street Smart Walk Scores® were used as a tool for the stratified sampling by randomly selecting street location(s) using latitude and longitude coordinates within the block groups of each of the DMV areas (Roberts et al., 2015). The assigned median Street Smart Walk Score® of the one to three randomly selected location(s) was used to classify and stratify each block group into one of five built environment strata using the classification scheme developed by Walk Score®: (1) Walker's Paradise (90–100 score); (2) Very Walkable (70–89 score); (3) Somewhat Walkable (50–69); (4) Car-Dependent (25–49); and (5) Car-Dependent (0–24)

(StreetSmartWalkScore, 2007). Finally, a total of 2000 DMV addresses representing the five built environment strata were purchased from Alesco Data Group, a direct marketing services company. The number of purchased addresses per strata were proportional to the population of households with children as estimated by the U.S. Census Bureau (Census, 2013).

Potential study participants were mailed the BEAP Study questionnaire, a \$10 gift card, and a postage-paid self-addressed envelope with instructions to return the completed questionnaire by a specified date. Participants also had the option of completing an identical online version of the BEAP Study questionnaire via Qualtrics.com with a provided secure and encrypted web address and unique access code. The BEAP Study questionnaire, which was adapted from a survey used the Neighborhood Impact on Kids project and that underwent several iterations of reliability and validity testing, included various questions on child active play, home and neighborhood built environment features and parental rules (NIK, 2013a; NIK, 2013b; Roberts et al., 2015). Demographic data (e.g. gender, ethnicity/race) including parent reported child weight, height and pre-existing health conditions were also collected through the use of the BEAP Study questionnaire. A response rate of 10% was obtained. Incomplete questionnaires were deleted from analysis since most of the incomplete portions would have contained demographic data, which resulted in 144 (72 girls and 72 boys) responses entered into the analysis. Implicit informed consent was obtained through the return of the completed BEAP Study questionnaire.

2.2. Home neighborhood built environment variables

Parental perceptions of the home and neighborhood built environment were assessed using six questions/statement requests (Tables 2–3). The first three statement requests, “Please mark the answer that best applies to you and your child's neighborhood.”; “My child can walk or bike to the closest local park or playground (alone or with someone) because:...””; and “It is difficult for my child to be active in our home neighborhood because:...” collectively contained 44 subpart-responses in the form of statements or justifications (e.g. because there are sidewalks; because other children walk or bike) based on a four-point Likert scale of agreement. Each individual subpart-response was dichotomized into “agree” and “disagree” responses. These 44 subparts covered several home and neighborhood built environment components such as esthetics (e.g. litter), active play areas (e.g. parks), walkability (e.g. infrastructure and distance) and safety (e.g. crime). For the BEAP Study participants, home was defined based on the “home in which you and your child live” as well as the confirmed address to which the questionnaire was mail delivered. Home neighborhood was further defined as the area “within walking distance” or a “10–15 minute walk from your home”. The fourth, “Have you been the victim of a crime in your neighborhood?”, and fifth question, “Do you know someone who has been the victim of a crime in your neighborhood?”, elicited yes/no responses. Finally, the last question, “About how long would it take you to walk from your/your child's home to each of the nearest places listed below?” contained 17 subpart-destinations (e.g. indoor recreation or exercise facility) with responses ranging from 1–5, 6–10, 11–20, 21–30 and over 30 min. Again, each individual subpart-destination response was then dichotomized into “1–10 min” and “over 10 min”.

2.3. Active play variables

For the BEAP Study, physical activity has been characterized as active play. Active play was defined for study participants as “participating in vigorous-intensity or moderate-intensity activities for fun and enjoyment in an official (e.g. team sports) or unofficial capacity (e.g. neighborhood game of basketball)” (Roberts et al., 2015). Active play was estimated by aggregating data on active play frequency and duration.

Using parent reported responses to two types of questions (1) “For the past seven days, how many minutes per day has your child participated in active play?”; (2) “Over a typical or usual week, how many days has your child participated in active play for a total of at least 60-minutes per day?”, child active play was assessed. These questions were merged and dichotomized into active and non-active groups based on whether the child met or did not meet the 60-min/day PAGA recommendation for either of the two active play questions.

2.4. Statistical analysis

Statistical analyses were carried out using R 3.1.2 and STATA/MP 14.0. Chi-square (χ^2) was used to determine the differences in parental perceived built environment measures between active and non-active child groups. Using univariate logistic regression, the association of each parental perceived built environment variable with active play (e.g. meeting the 60-min/day PAGA recommendation) was examined. The parental perceived built environment variables that were found to be statistically significant (p -value < 0.05) through the univariate analyses were then each individually and independently regressed on active play while controlling for the demographic variables of child age, sex and race (Models A–C). Additionally, all the parental perceived built environment variables from Models A–C were further analyzed using a multivariable logistic regression analysis in a final model (Model D) adjusted for child age, sex, and race.

3. Results

Our study population included 144 children with an average age of 9.7 years ($SD = 1.6$). Children were predominantly White (56.3%), African American (23.7%), or Asian American (10.4%) and based on parent reported weights and heights over 25% were overweight/obese. Among the entire study sample, approximately 13.9% of the children were physically active participants who met the 60-min/day PAGA recommendation. Group differences, such as with gender (active participants: 60% males vs. 40% females) and ethnicity/race (active participants: 70.6% White vs. 17.7% African American vs. 5.9% Asian American vs. 5.3% Hispanic/Latino), in physical activity were also evident in this sample (Table 1).

Differences in parental perceived built environment measures by active and non-active child groups are provided in Table 2. There were a statistically significant (p -value < 0.05) greater proportion of active children's parents that agreed with the importance of neighborhood esthetics, active play areas, walkability (e.g. infrastructure and distance) and safety as compared to the parents of non-active children. For example, a greater proportion of active children's parents agreed with physical activity promoting built environment measures representing their neighborhood walkability and safety, which stated that “There are sidewalks on most streets” and “My child can walk or bike to the closest park or playground because the route has good lighting when it's dark outside”. When parents were asked to estimate the time it would take for them to walk from their home to the nearest destinations, a statistically significant greater proportion of active children's parents perceived or experienced a shorter amount of time for walking to a variety of destinations, such as a friend's/relative's house, trails/paths, public open space, outdoor swimming pool, or winter recreation area (Table 3). Specifically, more parents of active children perceived the distance to these destinations as a 10-min or less walk from their home compared to the parents of non-active children.

Univariate logistic regression found that some parental perceived built environment measures were predictors of their children meeting the 60-min/day PAGA recommendation. Through multivariable logistic regression models, all of these parental perceived built environments were further regressed on active play while controlling for child age, sex, and race (Table 4). With Model A, we estimated a statistically significant higher relative odds of children meeting the 60-min/day PAGA

Table 1
BEAP Study child participant demographics.

Parameter	Total N (%)	Active n (%)	Non-active n (%)
Gender			
Male	72 (50.0)	12 (60.0)	59 (48.0)
Female	72 (50.0)	8 (40.0)	64 (52.0)
Ethnicity/race			
Hispanic/Latino	7 (4.9)	1 (5.3)	6 (5.0)
African American	32 (23.7)	3 (17.7)	29 (24.8)
American Indian/Alaska Native	1 (0.7)	0	1 (0.9)
Asian American	14 (10.4)	1 (5.9)	13 (11.1)
White	76 (56.3)	12 (70.6)	63 (53.9)
Other	12 (8.9)	1 (5.9)	11 (9.4)
Highest grade completed			
1st Grade	14 (9.8)	4 (20.0)	10 (8.2)
2nd Grade	24 (16.8)	1 (5.0)	23 (18.9)
3rd Grade	21 (14.7)	4 (20.0)	17 (13.9)
4th Grade	24 (16.8)	3 (15.0)	20 (16.4)
5th Grade	34 (23.8)	5 (25.0)	29 (23.8)
6th Grade	17 (11.9)	2 (10.0)	15 (12.3)
>6th Grade	9 (6.3)	1 (5.0)	8 (6.6)
Annual household income			
≤\$30,000	6 (4.4)	1 (6.3)	5 (4.2)
\$30,001–\$50,000	14 (10.3)	1 (6.3)	13 (10.9)
\$50,001–\$75,000	12 (8.8)	0	12 (10.1)
\$75,001–\$100,000	20 (14.7)	1 (6.3)	18 (15.13)
\$100,001–\$150,000	27 (19.9)	6 (37.5)	21 (17.7)
\$150,001–\$250,000	29 (21.3)	3 (18.8)	26 (21.9)
\$250,001–\$500,000	13 (9.6)	3 (18.8)	10 (8.4)
>\$500,000	3 (2.2)	0	3 (2.5)
Doctor diagnosed illness			
Anxiety	9 (6.5)	0	9 (7.6)
Asthma	25 (17.6)	5 (25.0)	20 (16.5)
ADHD/ADD	17 (12.0)	1 (5.0)	16 (13.2)
Depression	2 (1.4)	0	2 (1.7)
High blood pressure	1 (0.7)	0	1 (0.8)
High cholesterol	3 (2.1)	0	3 (2.5)
Overweight/obese	11 (7.9)	0	11 (9.2)
Child weight status^a			
Underweight	12 (13.3)	0	12 (15.4)
Healthy weight	55 (61.1)	7 (58.3)	48 (61.5)
Overweight	12 (13.3)	4 (33.3)	8 (10.3)
Obese	11 (12.2)	1 (8.3)	10 (12.8)
Born in United States			
Yes	134 (95.0)	20 (100.0)	113 (94.2)
No	7 (5.0)	0	7 (5.8)
County residence			
Montgomery County	38 (27.1)	6 (30.0)	32 (26.9)
Fairfax County	39 (27.9)	7 (35.0)	32 (26.9)
Loudoun County	19 (13.6)	4 (20.0)	15 (12.6)
Prince George's County	20 (14.3)	0	20 (16.8)
Frederick County	10 (7.1)	1 (5.0)	9 (7.6)
Washington, DC	14 (10.0)	2 (10.0)	11 (9.2)

^a Calculated based on parent reported child weight and height.

recommendation when parents disagreed with the statement: “There is lot of litter on the streets.” compared to parents who agreed. The execution of this regression model successfully converged with a log likelihood of -81.39 and the likelihood ratio chi-square of 13.33 (p -value = 0.038) indicated that this model as a whole fit significantly better than an empty model or one with no predictors. Additionally in Model B, relative higher odds of children meeting the PAGA recommendation were found for parents who disagreed with the statement: “It is difficult for my child to be active in our home neighborhood because there is no play equipment (e.g. basketball hoop).” compared to parents who agreed. Again, this model successfully converged with a log likelihood of -80.07 and the likelihood ratio chi-square of the model was 13.07 (p -value = 0.042). For parental distance estimations, there was a statistically significant lower relative odds of children fulfilling the 60-min/day recommendation when parents perceived the closest bus or Metro train stop to be 6–10 versus 1–5 min in Model C. This regression model displayed a log likelihood of -79.31 and a likelihood ratio chi-square of 15.58 (p -value = 0.049). With Model D, which was composed of all three built environment variables from Models A–C

Table 2

Differences in parental perceived built environment measures by active and non-active child groups.

Built environment measure	Active agree (%)	Non-active agree (%)	χ^2	p-Value
Many streets in my neighborhood are hilly.	55.0	50.4	0.14	0.704
There are not any dead end streets.	15.0	24.8	0.92	0.338
Sidewalks are on most streets.	84.7	63.3	6.76	0.009*
Usually sidewalks are separated from the road/traffic by parked cars.	60.2	40.0	3.88	0.049*
Trees are along the streets.	95.0	87.7	0.91	0.334
My child can look at many interesting things while walking.	82.0	63.3	4.79	0.029*
There are many natural things for my child to see.	85.0	85.2	<0.01	0.977
Many buildings/homes are present for my child to see.	100	80.6	3.97	0.046*
The traffic makes it difficult or unsafe for my child to walk.	30.0	39.2	0.61	0.434
The speed of traffic on most streets is usually 30 mph or less.	80.0	70.8	0.72	0.397
Most motorists drive faster than the posted speed limits.	89.3	76.7	3.57	0.059
Streets have good lighting at night.	60.0	53.7	0.28	0.597
Walkers and bikers can be easily seen by people in their homes.	75.0	71.3	0.12	0.734
Busy streets have crosswalks and signals.	94.4	68.0	5.38	0.020*
There is a high crime rate.	33.3	14.4	4.04	0.044*
The streets have a lot of litter.	7.0	18.6	3.83	0.050*
Many families look like us in our neighborhood.	58.8	72.5	1.35	0.246
You have been the victim of a crime in your neighborhood.	38.9	16.8	4.88	0.027*
You know someone who has been the victim of a crime in your neighborhood.	55.6	51.4	0.11	0.741
I'm afraid of my child being taken or hurt by...				
... a stranger when he/she is outside without me.	43.9	60.5	3.80	0.051
... a known "bad" person (adult or child) in my neighborhood.	21.1	16.3	0.27	0.604
It is likely that my child can be taken or hurt by a stranger...				
... in my neighborhood.	10.0	20.5	1.23	0.268
... in my yard, driveway, or common area.	10.0	11.4	0.03	0.856
My child can walk or bike to the closest park or playground because...				
...there are sidewalks or bike lanes.	80.0	74.6	0.27	0.603
...the route is simple.	90.0	80.3	1.07	0.300
...the route has good lighting when it's dark outside.	61.1	36.6	3.94	0.047*
...there are no dangerous crossings.	55.0	47.1	0.43	0.513
...my child does not get too hot and sweaty.	63.6	46.4	3.95	0.047*
...other children walk or bike.	90.0	75.2	2.14	0.143
...it is considered cool to walk or bike.	75.6	57.0	4.49	0.034*
...my child does not have much stuff to carry.	80.7	63.3	4.02	0.045*
...it is easier than me driving there on the way to something else.	50.0	42.5	0.36	0.549
...it involves very little planning ahead.	80.0	65.8	1.58	0.209
...there are areas to leave a bike safely.	70.0	57.0	1.19	0.275
...there are no stray dogs.	60.0	67.8	0.47	0.495
...it is not too far.	90.0	82.4	0.73	0.394
...my child would not have to walk/bike through high crime or unsafe areas.	80.0	75.2	0.22	0.642
It is difficult for my child to be active in our home neighborhood because...				
...there is no choice of activities.	5.0	20.0	2.63	0.105
...there is no play equipment (e.g. basketball hoop).	8.5	24.5	5.15	0.023*
...there is no adult supervision.	10.5	27.1	2.41	0.120
...there are no other children there.	0	28.9	7.69	0.006*
...it is not safe because of crime.	5.0	7.4	0.15	0.694
...it is not safe because of traffic.	20.0	21.7	0.03	0.866
...it does not have good lighting.	20.0	30.0	0.84	0.360

* Statistically significant (p -value < 0.05).**Table 3**

Differences in parental perceived walking time by active and non-active child groups.

Destinations within 1–10 min walk of home	Active (%)	Non-active (%)	χ^2	p-Value
Friend's or relative's house	95.0	69.8	5.55	0.018*
Public playground	85.0	67.2	2.57	0.109
Biking/hiking/walking trails and paths	82.4	54.4	4.75	0.029*
Basketball court	78.9	64.1	1.61	0.205
Public open space that is not a park	76.6	52.2	5.44	0.020*
Public park	75.0	53.8	3.11	0.080
Bus or Metro stop	64.7	56.9	0.37	0.543
Outdoor swimming pool	63.6	37.9	4.93	0.026*
Other playing fields/court (e.g. tennis, softball)	63.2	53.9	0.56	0.452
School ground during non-school hours	55.0	44.8	0.71	0.399
Convenience/corner store	30.0	30.0	0	1.00
Fast food restaurant	26.3	21.9	0.18	0.672
Indoor recreation or exercise facility (e.g. YMCA)	12.5	11.4	0.16	0.901
Beach, lake river or creek	12.5	15.2	0.08	0.782
Library	12.5	10.4	0.06	0.802
Ski or other winter recreation area	10.0	0	8.09	0.004*
Indoor swimming pool	0	1.1	1.74	0.187

* Statistically significant (p -value < 0.05).

adjusted for child age, sex, and race, the odds ratios and significance for the variables from Models A and B were attenuated. However, with Model D there was still a statistically significant lower relative odds of children fulfilling the PAGA recommendation when parents perceived the closest bus or Metro train stop to be longer than 5 min. Model D successfully converged with a log likelihood of -74.28 and the likelihood ratio chi-square of the model was 22.75 (p -value = 0.012). Finally, for all regression models, there were statistically significant lower relative odds of female children fulfilling the 60-min/day recommendation.

4. Discussion

The BEAP Study presents the cross-sectional analysis of data collected from the parents of children between the ages of 7–12 years residing in the DMV, an area that maintains a mosaic of built environments with an unmatched population of race, ethnicity, income, education, and nativity diversity. Our findings demonstrated that the parents of more active children compared with non-active children reported a greater presence and convenience of built environment amenities and facilities that supported active play in their neighborhoods. Furthermore, logistic regression analysis showed that the odds of children meeting a daily 60-min of physical activity were higher when their parents perceived the home environments more favorably and promoting of physical activity.

The findings from this study are consistent with current research that suggests that built environment amenities and facilities or the perception of those built environment features are contributors to childhood physical activity (Collins et al., 2012; Davison and Lawson, 2006; Kneeshaw-Price et al., 2013). For example, our findings were similar to another research study on children's physical activity and parental home neighborhood built environment perceptions, which found that closer proximity to a play area was significantly associated with greater odds of children achieving 60+ min/day, 5+ days/week of activity (Tappe et al., 2013). Separately, the BEAP Study findings pointedly highlighted the parental importance of neighborhood esthetics and the "cool factor" of their child engaging in physical activity or the idea of promoting less car dependence (e.g. "...it is considered cool [for my child] to walk or bike."). Additionally, the BEAP Study findings on the negative association between perceived parental neighborhood barriers, such as a lack of sidewalks or crosswalks and signals on busy streets, and children's physical activity were also very consistent with the conclusions of other research studies (Budd et al., 2015; D'Haese

Table 4
Logistic regression of parental perceived built environment measures and demographics on children meeting the 60-min/day PAGA recommendation.

Model A predictors ^a	Odds ratio	95% CI		p-Value
		Lower	Upper	
There is a lot of litter on the streets (Agree)				
Disagree	3.43	0.989	11.87	0.052 [^]
Child's age (Years)	1.06	0.831	1.35	0.636
Child's gender (Male)				
Female	0.323	0.150	0.696	0.004 [*]
Child's race (African American)				
Asian American	1.00	0.241	4.19	0.996
White	1.70	0.656	4.42	0.274
Other	1.20	0.127	1.72	0.126
Model B predictors ^a	Odds ratio	95% CI Lower	Upper	p-Value
There is no play equipment for my child (Agree)				
Disagree	2.86	0.958	8.59	0.060
Child's Age (Years)	1.13	0.882	1.44	0.342
Child's Gender (Male)				
Female	0.375	0.175	0.807	0.012 [*]
Child's race (African American)				
Asian American	0.990	0.235	4.18	0.989
White	1.40	0.527	3.70	0.501
Other	0.681	0.148	1.42	0.090
Model C predictors ^a	Odds ratio	95% CI Lower	Upper	p-Value
Closest bus or train stop (1–5 min)				
6–10 min	0.207	0.057	0.754	0.017 [*]
Over 10 min	0.712	0.285	1.78	0.467
Child's age (Years)	1.12	0.877	1.43	0.361
Child's gender (Male)				
Female	0.363	0.168	0.787	0.010 [*]
Child's race (African American)				
Asian American	0.888	0.202	3.89	0.875
White	1.89	0.672	5.33	0.227
Other	1.07	0.211	5.37	0.939
Model D predictors ^a	Odds ratio	95% CI Lower	Upper	p-Value
There is a lot of litter on the streets (Agree)				
Disagree	3.16	0.832	11.98	0.091
There is no play equipment for my child (Agree)				
Disagree	2.67	0.829	8.58	0.100
Closest bus or train stop (1–5 min)				
6–10 min	0.214	0.057	0.808	0.023 [*]
Over 10 min	0.597	0.230	1.55	0.291
Child's age (Years)	1.10	0.851	1.43	0.456
Child's gender (Male)				
Female	0.348	0.154	0.784	0.011 [*]
Child's race (African American)				
Asian American	0.904	0.197	4.16	0.897
White	1.72	0.579	5.11	0.328
Other	1.32	0.241	7.22	0.749

[^] Statistically significant (p-value = 0.05).

^{*} Statistically significant (p-value < 0.05).

^a Within each of the multivariable logistic regression models the odds ratios reported for each independent variable are adjusted as they account for the other variable in the model.

et al., 2015; Muthuri et al., 2015). However, our research identified an unexpected albeit interesting conclusion with regard to neighborhood safety. Even though a greater proportion of active children's parents agreed with physical activity promoting built environment measures representing their neighborhood safety, a significantly higher percentage of active children's parents reported a high crime rate and being the victim of a crime in their neighborhood. This conclusion can be interpreted several ways. One interpretation may be that these parents are frequently outdoors within their environments and therefore with more opportunity to become victims of crimes. Or, these parents employ precautionary measures so that neighborhood crime does not become a deterrent or barrier to their children's physical activity.

With the BEAP Study demonstrating higher physical activity rates among male participants, our data also reinforced previous research findings by supporting the interpretation of children's physical activity gender differences (Cooper et al., 2015; Corder et al., 2011; Owen et al., 2009; Tappe et al., 2013). One theory for this disparity may be due to varying behavior expectations for boys and girls, which may also be moderated by age and/or household income level (Edwardson et al., 2013; Mota et al., 2011). Racial and ethnic disparities in active play levels were also evident in our study population, another phenomenon shared by other researchers (Belcher et al., 2010; Sallis et al., 2000). Results from the BEAP Study reveal that parental perceptions of neighborhood access to parks and playgrounds with play equipment, neighborhood safety and structure as well as esthetics could have a meaningful impact on children's active play levels.

These findings represent a valuable contribution to the built environment and childhood physical activity research. One novel aspect of this study is the exceptionally diverse population of children with respect to race and ethnicity. Prior similar studies have been performed in Seattle, Washington and San Diego, California areas where more than 80% of the study samples consisted of White children (Saelens et al., 2012; Tappe et al., 2013). While contributing to the built environment and physical activity research field, the BEAP Study was able to focus on children's active play levels as well as incorporate the influence of parental neighborhood perceptions. Although there are definite benefits to collecting objective built environment measures, the impact of parental neighborhood perceptions on parental choices, decisions, and rules affecting their children's physical activity levels should not be overlooked. Despite these research strengths, there are possible limitations to consider, such as the study's small sample size. Even though this small sample size resulted from a low response rate, the BEAP Study population was still fairly representative of the overall DMV population with respect to race and ethnicity and the composition of the 144 participants was demographically representative of all potential study participants in all the geographic areas of the study (CensusReporter, 2013). Interestingly, the study sample reported a slightly lower overweight/obesity rate compared to all DMV youths (25.5% vs. 29–35%), however, this study population was also considerably less active (13.9% vs. 16.4–23.8%) (CDC, 2014; DHHS, 2008; NSCH, 2013). Another possible limitation was the collection and use of subjective parent-reported physical activity and perceived neighborhood data. Even though all attempts were made to question recent activity (e.g. active play in past seven days), these data may have been compromised by recall and response bias. Furthermore, the cross-sectional design of this study precluded the establishment of causality. Future prospective studies with the collection of both subjective and objective built environment and physical activity data could enhance the understanding of the relationship between home neighborhood built environments and childhood active play among this diverse population while also gaining insight on achieving the permanency of continued physical activity engagement among children.

5. Conclusions

Findings from the BEAP Study demonstrated that the parents of more active children reported a greater presence of built environment amenities and facilities that supported active play in their neighborhoods compared to parents of less active children. However, future research is essential to understand this relationship in more depth.

Competing interests

The authors have declared that no competing interests exist.

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