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Research Paper

Park attributes that encourage park visitation among adolescents: A conjoint analysis

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HIGHLIGHTS

- Slides were the most important attribute for park visitation among adolescents.
- Absence of rubbish/graffiti was the second most important attribute for visitation.
- Swings and walking paths were the third and fourth most important attributes.
- Identifying important park attributes will help to maximise park visitation.

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ABSTRACT

Parks provide opportunities for people of all ages to engage in physical activity, connect socially with family and friends, and have contact with nature. Despite these benefits, park visitation among adolescents is particularly low; however, little is known about what attributes would attract adolescents to visit parks. This study examined the relative importance of park features that might influence their decision to visit a park. Adolescents were recruited in 2014–5 from four secondary schools located in Melbourne, Australia. Participants completed an adaptive choice based conjoint (ACBC) task during one school class-lesson. This methodology makes it possible to identify the relative importance of individual park features. Ten park attributes were included in the survey and part-worth utility and importance scores were estimated for each attribute with Hierarchical Bayes analyses using Sawtooth Software. Participants (n = 92) had a mean age of 14.7 years (SD = 1.0) and 57% were female. Importance scores showed that playground slides (particularly long steep slides) were the most important attribute for park visitation (16.1%; 95% CI = 15.0, 17.2), followed by an absence of rubbish/graffiti (13.0%; 95% CI = 11.2, 14.8), and the presence of swings (12.4%; 95% CI = 11.4, 13.3), walking/cycling paths (12.1%; 95% CI = 11.0, 13.2) and BMX tracks/skate bowls (10.6%; 95% CI = 9.3, 11.9). These findings can assist those involved in designing parks to identify attributes that should be prioritised to ensure visitation by adolescents is maximised. The novel methodology utilised may be transferable to other studies of the built environment among other population groups.

1. Introduction

Parks are an important public resource that provide opportunities for people of all ages to engage in physical activity, connect socially with family and friends, and have contact with nature. Despite the benefits associated with park visitation, parks are generally under-utilised and, research within Australia and internationally shows that park visitation among adolescents is particularly low (Floyd et al., 2011; Lindberg & Schipperijn, 2015). For example, a recent observational study of park visitors in Melbourne, Australia, showed that only seven percent of all park visitors were teens (aged 13–20 years), with the majority of park users being younger children and adults (Veitch et al., 2015).

It is plausible that the features and amenities in parks may not appeal to adolescents, discouraging visitation. Indeed, it is a

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common perception among parents and children that amenities in neighbourhood parks are typically better suited to younger children (Veitch, Bagley, Ball, & Salmon, 2006; Veitch, Salmon, & Ball, 2007). However, little is known about what features/amenities would attract adolescents to visit parks. Most studies examining the importance of specific park features for visitation and park-based physical activity have been conducted with adults (Kaczynski, Potwarka, & Saelens, 2008) and children (Timperio et al., 2008; Veitch et al., 2007), and these findings may or may not be relevant to adolescents.

Further, parks provide a setting where adolescents can participate in physical activity. Few adolescents participate in enough physical activity to meet current recommendations of 60 min of moderate- to vigorous-intensity physical activity every day (Hallal et al., 2012). Longitudinal studies have shown that a steep decline in physical activity occurs between childhood and adolescence (Nelson, Gordon-Larsen, Song, & Popkin, 2006), with continued declines across the lifespan (Telama, Yang, Laakso, & Viikari, 1997). Importantly, adolescents have been shown to be engage in moderate- to vigorous-intensity physical activity when using playgrounds in parks (Oreskovic et al., 2015). Thus, creating and enhancing opportunities for adolescents to be active at parks is critical.

One of the few studies to examine adolescents' perceptions on park features (Veitch et al., 2016) used photography imagery to identify characteristics of parks that are perceived to be important for park visitation and park-based physical activity. That study found physically challenging play equipment is likely to encourage adolescents to visit parks whereas rules, rubbish, graffiti, and skate bowls may discourage visitation. Although these findings will help to inform future research aiming to better understand what park features are important for adolescents, the relative importance of different park features is still unknown (Cohen et al., 2006).

Parks receive significant investment for modifications and redevelopment, particularly from local authorities. To ensure that park renewal and development stimulates park visitation to optimal levels it is important to understand which park features are most likely to attract visitors from all age groups. While natural experiment study designs can determine the impact of changes to specific park attributes on park visitation (Veitch, Ball, Crawford, Abbott, & Salmon, 2012; Veitch et al., 2014), they are costly, time-consuming and difficult to conduct as control of the environmental change is outside of the researcher's control (Craig et al., 2012; Hunter et al., 2015). Virtual experiments in a 'laboratory' setting based on conjoint analyses can be an alternative to natural experiments for identifying which park features to prioritise in park design. Conjoint analysis is a quantitative market research technique that examines the joint effects of park characteristics as they are presented to participants in different combinations, rather than in isolation. This makes it possible to identify the relative importance of individual features and therefore better understand what features should be prioritised in the design and management of parks to facilitate and encourage use of these spaces. Conjoint analysis has successfully been used previously to examine the park preferences of older adults (Alves, Aspinall, Thompson, & Sugiyama, 2008), street preferences for children's cycling for transport (Ghekiere, Deforche et al., 2015; Ghekiere, Van Cauwenberg et al., 2015), adults cycling (Mertens et al., 2015), and walking among older adults (Van Cauwenberg et al., 2016); however, it has not been applied among adolescents to examine preferences for park features.

The aim of this study was to examine the relative importance of selected environmental attributes (park features) that might influence adolescents' decision to visit a park using an experimental design, based on an adaptive choice-based conjoint analysis approach. Identifying the relative importance of park features will inform which features should be prioritised in the design of parks to facilitate and encourage active and social use of these spaces by this age group. Parks were defined as publically accessible urban green spaces.

2. Methods

This was a cross-sectional study in which adolescents completed a web-based survey constructed using Sawtooth SSI Web (v 8.4.6) (www.sawtoothsoftware.com.au). All data were collected between November 2014 and February 2015. The study was approved by the Human Ethics Advisory Group (H167_2013) and approval to conduct research in schools was granted from the Department of Education and Training.

2.1. Participants

Purposive sampling was used to ensure that adolescents from a range of socio-economic status (SES) backgrounds were represented. All suburbs in Victoria were categorised into low-, middle- or high-disadvantage tertiles, using the Australian Bureau of Statistics' Socio Economic Index for Areas (SEIFA). The SEIFA is an area-based measure of socio-economic disadvantage, constructed from the population census (Australian Bureau of Statistics, 2013). The 10 closest suburbs within 40 km of the University were chosen from each of the SEIFA tertiles and each week three secondary schools from each tertile were selected and sent an invitation to participate in the study. After three unsuccessful attempts to make contact with the Principal at a school no further attempts were made and the next closest school to the University within the tertile was contacted.

Overall, 35 schools were contacted and invited to participate before gaining consent from four schools (11% response rate). The four schools included one school from low SES (33% response rate), one from mid SES (17% response rate) and two schools from high SES (8% response rate) areas. The main reasons for non-participation were no response from the school Principal after three attempts, lack of time, and schools being inundated with requests to participate in research studies. Once a school was recruited, the Principal or a delegated staff member selected two classes of year 8–10 students (aged 13–16 years) to complete the study protocol during a school period. The classes were chosen based on availability of the teacher and convenience in regards to the timetable Student packs with study information and parental consent forms were sent home via the students in the selected classes; active parental consent was required. Written parental consent was obtained for 92 of 196 students (46.9%; ranging from 45% in low SES, 75% in mid SES, to 25% in high SES areas).

2.2. Protocol and measures

The web-based survey was completed using tablets during one school class-lesson and the task took approximately 15–20 min to complete. In the first section of the survey, participants were asked to complete the following survey items for descriptive purposes: demographics (age and sex); usual frequency (daily, 2–3 times/week, once/week; 2–3 times/month, once/month, <once/month, not visited in past 3 months) and duration (<30 min, 30–59 min, 1 < 2 h, 2 < 3 h, 3 < 4 h, 4 + h) of park visitation in the past three months; usual accompaniment to parks (alone, adult family members, siblings, friends, organised group, dog, other); time taken to walk from home to the nearest park and to the park they visit most often (1–5 min, 6–10 min, 11–20 min, 21–30 min, 31 + min, don't know); and dog ownership (yes, no).

In the second section of the survey, participants completed an Adaptive Choice-Based Conjoint (ACBC) task. ACBC analysis is a

Table 1
Ten park attributes included in the adaptive choice based conjoint (ACBC) task.

Attribute	Attribute level
Slide	Giant slide Medium Slide No Slide
Swings	360° swing Traditional swing No swing
Flying fox	Flying fox No Flying fox
Table Tennis Table	Table tennis table No table tennis table
Climbing equipment	Spiderweb No climbing equipment
BMX track/Skate bowl	BMX track Skate bowl No skate bowl or BMX track
Basketball area	Basketball area No basketball area
Walking Paths	Tree-lined path Path with no trees No path
Aesthetics	Picturesque (green grass/shady trees) Not picturesque (patchy grass/few trees)
Maintenance/incivilities	Rubbish/graffiti No rubbish/graffiti

quantitative market research technique that makes it possible to identify the relative importance of each characteristic by examining the joint effects of park characteristics as they are presented to participants in different combinations, rather than in isolation (Aspinall et al., 2010). Participants identify their preferences through a series of adaptive choice-based conjoint tasks. An ACBC survey is an interactive experience, customized to the preferences and opinions of each individual (Orme, 2014).

The 10 park attributes included in the survey were identified from a previous study by Veitch et al. (2016) that was conducted with a different sample of adolescents recruited from the same four schools. The findings from that study showed that these 10 attributes were perceived by adolescents to influence (positive or negative) their willingness to visit parks. For the current study, each attribute was presented with two (i.e. present or absent) or three levels (i.e. optimal level, medium level, not present) and included: slides (giant slide, medium slide, no slide); swings (360° swing, traditional swing, no swing); flying fox (flying fox, no flying fox); table tennis table (table tennis table, no table tennis table); climbing equipment (spiderweb, no climbing equipment); BMX track/skate bowl.

(BMX track, skate bowl, no BMX track or skate track); basketball area (basketball area, no basketball area); walking paths (tree-lined path, path with no trees, no path); aesthetics (picturesque: green grass/shady trees, not picturesque: patchy grass/few trees); and maintenance/incivilities (rubbish/graffiti, no rubbish/graffiti) (see Table 1). In all ACBC tasks, a written description of the attributes was presented (not images); however, before commencing the tasks, a research assistant gave a verbal description of what was meant for each attribute and level and showed images to exemplify. Participants could view these images if desired whilst completing the task.

Firstly, respondents answered a 'build your own' item where they were required to select their preferred level for each of the 10 attributes. Secondly, respondents were presented with a series of six screening questions. In these questions, descriptions of four possible parks with various combinations of attributes and levels of attributes (randomly selected by the software program) were presented. Respondents were asked to indicate how likely (i.e. likely to visit vs. unlikely to visit) they would be to visit each of the four parks. Based on these screening questions, the program identified particular attributes in parks that were 'avoided' by the participant (i.e. indicated as unlikely to visit). The program presented these 'avoided' attributes to respondents and respondents were asked to indicate if any of the listed attributes/levels would be 'totally unacceptable' or an 'absolute requirement' and to mark the one attribute that was most unacceptable and the one attribute that was most important to them. This process enabled the program to customise the remaining tasks to focus on the attributes that best met each individual's needs. Finally, respondents were shown a series of 15 choice tasks that included a description of two possible parks with different combinations of park attributes that had been identified in the previous sections as 'possibilities' (i.e. attribute levels had not been marked as unacceptable). Any attributes that were the same in both parks, were 'greyed out' so that it was easier for the participant to focus on the differences between the two parks. For these choice tasks, respondents selected the park they would be most likely to visit.

2.3. Data analyses

Descriptive characteristics of the sample were calculated using SPSS Statistics 22. Data obtained from the ACBC survey were analysed using Sawtooth Software SSI Web version 8.4.6. ACBC analyses yield two types of parameters: part-worth utilities and average relative importance scores (Orme, 2014). A part-worth utility of an attribute level (i.e. giant slide, medium slide, no slide) represents the preference for that attribute level, with a higher value indicating a greater preference for that level within the park attribute. For ease of interpretation, these part-worth utilities were zero-centered. For example, if the attribute levels for slides, 'giant slide', 'medium slide', 'no slide' had part-worth utility values of 8, 2, and -10 respectively, this means that a 'giant slide' is the most preferred level and 'no slide' is the least preferred level. Relative importance scores reflect the maximum effect each attribute has on choice (with greater importance scores reflecting greater effects on choice). Importance scores are presented as a percentage and are directly related to the environmental attribute ranges (i.e. the difference between the least and most favorable environmental attribute level) that were used in the experiment.

Individual part-worth utility and importance scores were estimated with Hierarchical Bayes analyses, which is considered the best method for choice-based conjoint analyses (Orme, 2014). Preliminary iterations were run until convergence was reached; 40,000 draws were used per respondent. For each part-worth utility and importance score, standard errors and 95% confidence intervals were calculated manually in Microsoft Excel 2013 to determine significant differences between levels of each attribute (for part-worth utilities) and different attributes (for importance scores). The overall fit of the conjoint model was interpreted with Root LikeliHood (RLH) values. RLH values range from zero to 1, with a higher value indicating a better fit of the model (Orme, 2014). Statistical significance was set at 0.05.

3. Results

Table 2 presents the sample's characteristics. The participants (n = 92) had a mean age of 14.7 years (SD = 1.0) and 57% were female. Almost 23% attended a school located in a high SES area, 42% in a mid SES area and 35% in a low SES area. Twenty-five percent of participants were regular park visitors reporting that they had visited a park at least once per week over the past three months, 40%

Table 2
Characteristics of participants (n = 92).

	Overall
Age, mean (SD)	14.7 (1.0)
Sex (%)	
Female	57.6
School attended (%)	
Low SES	34.7
Mid SES	42.4
High SES	22.8
Usual frequency of park visitation in the past 3 months (%)	
Daily	4.3
2–3 times per week	10.9
Once per week	9.8
2–3 times per month	22.8
≤Once per month	34.8
Have not visited a park in the past 3 months	17.4
Usual duration of park visit in the past 3 months (%)	
<30 min	22.8
30–59 min	17.4
1 to <2 h	33.7
2 or more hours	8.7
Have not visited a park in the past 3 months	17.4
Usual accompaniment (%)[a]	
Alone	7.6
Adult family members	27.2
Siblings	35.9
Friends	47.8
Organised group	5.4
Dog	18.5
Other	4.3
Time taken to walk from home to nearest park (%)	
1–5 min	44.6
6–10 min	29.3
11–20 min	15.2
21 + min	4.4
Don't know	6.5
Time taken to walk from home to park visited most often (%)	
1–5 min	29.3
6–10 min	29.3
11–20 min	17.4
21 + min	18.5
Don't know	5.4
Dog ownership (%)	41.3
Participated in organised sport outside school hours in past year (%)	37.0
Days physically active for 60 min in a typical week, mean (SD)	4.43 (1.93)
Days physically active for 60 min in the past 7 days, mean (SD)	4.52 (4.52)

[a] Multiple responses allowed.

reported that they usually visited the park for one hour or less, and 48% usually visited parks with friends. Forty-five percent of participants could walk to their nearest park in five minutes or less, 29% could walk to the park they usually visit in five minutes or less and 41% owned a dog.

3.1. Part-worth utilities

Within each park attribute, part-worth utilities significantly increased in the expected direction (Fig. 1). For example, having no slide had a significantly lower preference (−73.08; 95% CI = −78.9, −67.2) than a medium slide (−5.74; 95% CI = −13.9, 2.4) which again had a significantly lower preference than a giant slide (78.82; 95% CI = 70.9, 86.8). This implies that a giant slide was preferred over a medium slide which in turn was preferred over having no slide. Similarly, having no walking path had a significantly lower preference (−46.34; 95% CI = −52.3,−40.4) than a path with no trees (-7.94; 95% CI = −16.3, 0.4) which again was lower than a tree-lined path (54.29; 95% CI = 45.5, 63.1). This implies that a tree-lined path was preferred over a path with no trees which in turn was preferred over having no path.

3.2. Importance

Slides were the most important attribute for park visitation (16.1%; 95% CI = 15.0, 17.2) (Fig. 2). This was followed, by absence of rubbish/graffiti (13.0%; 95% CI = 11.2, 14.8), presence of swings (12.4%; 95% CI = 11.4, 13.3), presence of walking paths (12.1%; 95% CI = 11.0, 13.2) and presence of BMX tracks/skate bowl (10.6%; 95% CI = 9.3, 11.9), which did not significantly differ from each other. These were followed by aesthetics (9.7%; 95% CI = 8.5, 10.9) which was significantly lower than rubbish/graffiti, swings and walking paths but not BMX tracks; and basketball rings (8.6%; 95% CI = 7.5, 9.7) which was significantly lower than rubbish/graffiti, swings, walking paths and BMX tracks but not significantly lower than aesthetics. The importance of climbing equipment (6.6%; 95% CI = 5.8, 7.4) and flying foxes (6.3%; 95% CI = 5. 6, 7.0) was significantly lower than basketball rings and aesthetics, but did not differ in importance from each other. Presence of table tennis tables was the least important attribute of a park within our sample of adolescents (4.7%; 95% CI = 4.1, 5.3).

4. Discussion

The aim of this study was to examine the relative importance of park attributes that may influence adolescents' preference to visit a park. To our knowledge this is the first time that ACBC analysis has been performed to examine the relative importance of park features among this important age group. There is a dearth of research on what specific park attributes are associated with park visitation among adolescents. Furthermore, identifying which attributes have higher importance compared to other attributes is necessary to better understand what to prioritise in park design in order to make park settings more inviting for youth to visit. Additionally, actual changes to the environment are long-lasting and without prior knowledge of what features are important to include in a park refurbishment, they may have sub-optimal or unanticipated negative effects on park visitation.

This study found that the presence of slides was the most important attribute. This was followed by the absence of rubbish/graffiti, and the presence of swings and a tree-lined path.

Slides, and a giant (very long and steep) slide in particular, were rated as the most important attribute. Our previous research has shown that children desire challenging and adventurous play equipment (Veitch et al., 2006, 2007) and among adolescents, steep slides were identified as a feature that would make them want to visit and be active in a park (Veitch et al., 2016). Play equipment in parks is typically designed to cater for younger children and more challenging equipment that provides 'excitement' and a physical challenge is rarely provided (Veitch et al., 2007). Playgrounds have been shown to be associated with moderate- to vigorous-intensity physical activity among adolescents (Oreskovic et al., 2015) and adolescents observed in parks are most likely to be observed using playgrounds (Reed & Hooker, 2012), thus confirming that parks are spaces that promote physical activity among adolescents. It is important that park playgrounds are designed to cater for all age groups, particularly adolescents who are often undergoing substantial declines in physical activity as they age.

A pleasant environment without graffiti or litter was the second most highly rated attribute. It is possible that the presence of graffiti and litter is associated with a perceived unsafe environment, for example, people engaging in socially undesirable behaviours, which may be a deterrent to park visitation (Veitch et al., 2006).

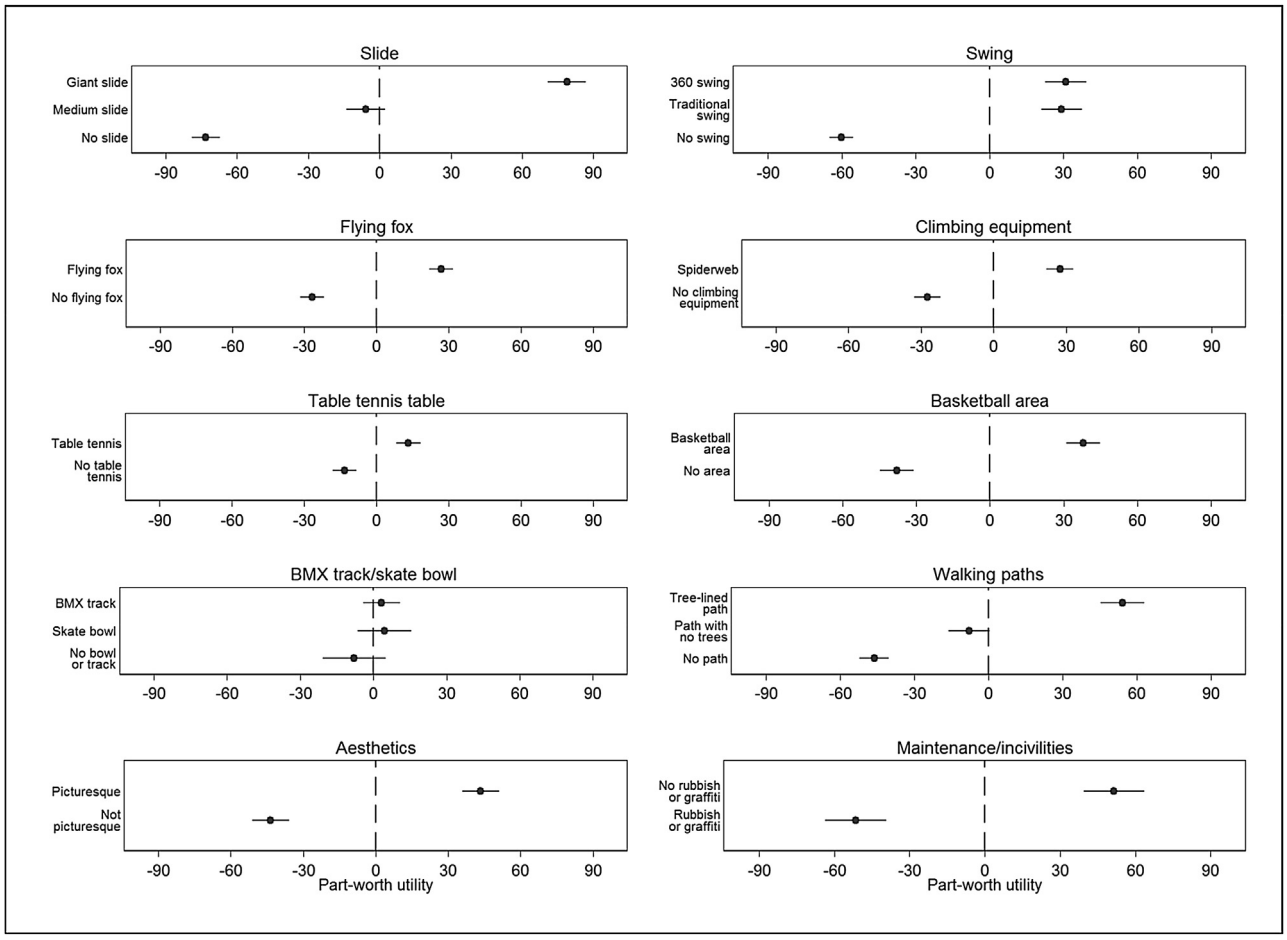

Fig. 1. Part-worth utilities of the park attribute levels for each park attribute (95% CI).
*Part-worth utilities should be compared within one attribute and not across attributes. A higher part-worth utility signifies a stronger preference for that attribute level.
CI = Confidence interval.

Park aesthetics (i.e. a picturesque setting with trees and landscaping) were also considered relatively important with a ranking of six out of the 10 attributes. This is consistent with previous research, for example, in a study by Edwards, Hooper, Knuiman, Foster, and Giles-Corti (2015) the presence of more trees in the park was associated with higher park use for physical activity among adolescents. In addition, perceived park quality which included measures of amenities, maintenance, aesthetics and safety was positively associated with park visitation among adolescents (Ries et al., 2009).

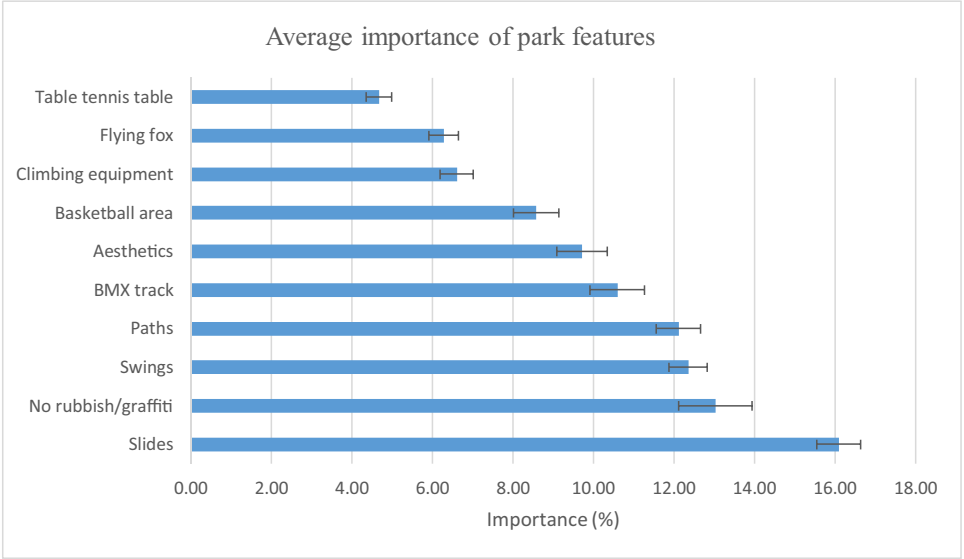

Fig. 2. Average importance of park attributes.

Basketball courts have previously been shown to be a popular park feature among adolescents (Baran et al., 2014; Lindberg & Schipperijn, 2015) and associated with higher levels of objectively measured non-school physical activity among adolescent girls (Cohen et al., 2006); however, in the current study the presence of basketball courts was ranked 7th out of 10 attributes. In addition, climbing equipment, flying foxes and table tennis tables were ranked 8th to 10th respectively, suggesting that certain play/sports features in parks may not be appealing to adolescents. It appears important that parks are well maintained and possess a combination of appealing facilities and aesthetics that encourage adolescents to visit and be physically active.

4.1. Limitations/strengths

This study was novel in the use of ACBC analysis and demonstrated that this methodology is an effective way of examining the relative importance of individual environmental park attributes to increase park visitation among this population group. It is important to acknowledge that park planning involves the consideration of multiple factors and is not solely based on the inclusion of individual attributes. Our results are constrained by the fact that the sample size was relatively small and it was not possible to explore differences by sex or SES or for other sub-groups such as park users and non-users. The findings may have been influenced by participants' previous park experiences and we acknowledge that young people living in different places may have different preferences. However, a strength of the study was the inclusion of adolescents attending schools located in a range of SES areas as park use by adolescents has been shown to vary by SES (Edwards et al., 2015). In addition, in the ACBC tasks, the attributes were described with a written description and it is possible that different findings could have resulted if images rather than written descriptions of attributes were used as participants may have interpreted the descriptions differently from each other.

Another limitation of this research is that the findings have not been validated by testing people's behaviour in response to actual changes in their neighbourhood environment; however, natural experiments are costly, time-consuming and due to time constraints they are difficult to conduct. Further, participants were only able to rate 10 pre-selected attributes with two or three levels and it is possible that other attributes (i.e. sports ovals, park size) may be more/less important than the attributes included. However, these attributes were selected based on findings from a previous study with adolescents attending the same school (Veitch et al., 2016). In addition, the relatively low response rates of schools and students may have impacted the representativeness of those included in the study. Future studies should also consider examining the perceptions of adolescents living in rural areas as park features have been shown to differ in urban versus rural parks (Veitch, Salmon, Ball, Crawford, & Timperio, 2013). Finally, this study only examined the relative importance of selected park features that might influence adolescents' decision to visit a park therefore future studies should consider examining the relative importance of park features for encouraging park-based physical activity.

5. Conclusions

Due to the physical and mental health benefits of visiting parks and the low levels of park visitation observed among adolescents, it is critical that urban planners and policy makers consider park features that encourage youth visitation when redeveloping parks or building new parks. This study found that the presence of slides (particularly long steep slides) was the most important park attribute, followed by the absence of rubbish/graffiti, and the presence of swings and a walking path. These findings may be limited by the small sample size; however, this study clearly shows ACBC is a feasible approach to examine the relative importance of park features that may influence adolescents' preference to visit a park. The novel methodology utilised in this study may also be transferable to other studies of the built environment among other population groups. Future studies should consider using this methodology among more diverse and representative samples to examine the relative importance of park features for particular sub-groups (i.e. males vs females, those living in neighbourhoods of varying level of disadvantage, users vs non-users of parks). Experimental studies such as natural experiments should also be considered to examine whether adolescents' park visitation increases by improving the built features in parks.

Competing interests

The author's declare that there are no competing interests.

Author contributions

JV, JS and AT conceived and planned the study. BD, JvC and AG provided expert input into the design and analysis. SB assisted with the study design. JV drafted the manuscript and all authors contributed critical feedback on drafts.

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References

Alves, S., Aspinall, P., Thompson, C. W., & Sugiyama, T. (2008). Preferences of older people for environmental attributes of local parks. *Facilities*, *26*(11/12), 433–453.

Aspinall, P. A., Thompson, C. W., Alves, S., Sugiyama, T., Brice, R., & Vickers, A. (2010). Preference and relative importance for environmental attributes of neighbourhood open space in older people. *Environment and Planning B-Planning & Design*, *37*(6), 1022–1039.

Australian Bureau of Statistics (2013). Socio-Economic Indexes for Areas (SEIFA) 2011, Australia Canberra, Australia: Retrieved from www.abs.gov.au/ausstats/abs@.nsf/mf/2033.0.55.001.

Baran, P. K., Smith, W. R., Moore, R. C., Floyd, M. F., Bocarro, J. N., Cosco, N. G., & Danninger, T. M. (2014). Park use among youth and adults: Examination of individual, social, and urban form factors. *Environment and Behavior*, *46*(6), 768–800.

Cohen, D. A., Ashwood, S., Scott, M., Overton, A., Evenson, K. R., Staten, L., . . . & Catellier, D. (2006). Public parks and physical activity among adolescent girls. *Pediatrics*, *118*(5), 1381–1389.

Craig, P., Cooper, C., Gunnell, D., Haw, S., Lawson, K., Macintyre, S., . . . & Thompson, S. (2012). Using natural experiments to evaluate population health interventions: New medical research council guidance. *Journal of Epidemiology and Community Health*, *66*(12), 1182–1186.

Edwards, N., Hooper, P., Knuiman, M., Foster, S., & Giles-Corti, B. (2015). Associations between park features and adolescent park use for physical activity. *International Journal of Behavioral Nutrition and Physical Activity*, *12*(1), 21.

Floyd, M. F., Bocarro, J. N., Smith, W. R., Baran, P. K., Moore, R. C., Cosco, N. G., . . . & Fang, K. (2011). Park-based physical activity among children and adolescents. *American Journal of Preventive Medicine*, *41*(3), 258–265.

Ghekiere, A., Deforche, B., Mertens, L., De Bourdeaudhuij, I., Clarys, P., de Geus, B., . . . & Van Cauwenberg, J. (2015). Creating cycling-friendly environments for

children: Which micro-scale factors are most important? An experimental study using manipulated photographs. *Public Library of Science*, *10*(12), e0143302.
Ghekiere, A., Van Cauwenberg, J., Mertens, L., Clarys, P., de Geus, B., Cardon, G., . . . & Deforche, B. (2015). Assessing cycling-friendly environments for children: Are micro-environmental factors equally important across different street settings? *International Journal of Behavioral Nutrition and Physical Activity*, *12*, 54.
Hallal, P. C., Andersen, L. B., Bull, F. C., Guthold, R., Haskell, W., Ekelund, U., & Lancet Physical Activity Series Working, G. (2012). Global physical activity levels: Surveillance progress, pitfalls, and prospects. *Lancet*, *380*(9838), 247–257.
Hunter, R. F., Christian, H., Veitch, J., Astell-Burt, T., Hipp, J. A., & Schipperijn, J. (2015). The impact of interventions to promote physical activity in urban green space: A systematic review and recommendations for future research. *Social Science and Medicine*, *124*, 246–256.
Kaczynski, A., Potwarka, L., & Saelens, B. (2008). Association of park size, distance, and features with physical activity in neighbourhood parks. *American Journal of Public Health*, *98*(8), 1451–1456.
Lindberg, M., & Schipperijn, J. (2015). Active use of urban park facilities—Expectations versus reality. *Urban Forestry & Urban Greening*, *14*, 909–918.
Mertens, L., Van Cauwenberg, J., Ghekiere, A., Van Holle, V., De Bourdeaudhuij, I., Deforche, B., . . . & Van Dyck, D. (2015). Does the effect of micro-environmental factors on a street's appeal for adults' bicycle transport vary across different macro-environments? An experimental study. *Public Library of Science*, *10*(8), e0136715.
Nelson, M. C., Gordon-Larsen, P., Song, Y., & Popkin, B. M. (2006). Built and social environments associations with adolescent overweight and activity. *American Journal of Preventive Medicine*, *31*(2), 109–117.
Oreskovic, N. M., Perrin, J. M., Robinson, A. I., Locascio, J. J., Blossom, J., Chen, M. L., . . . & Goodman, E. (2015). Adolescents' use of the built environment for physical activity. *BMC Public Health*, *15*, 251.
Orme, B. (2014). *Getting started with conjoint analysis: Strategies for product design and pricing research*. Manhattan Beach, CA: Research Publishers.
Reed, J. A., & Hooker, S. P. (2012). Where are youth physically active? A descriptive examination of 45 parks in a southeastern community. *Childhood Obesity (Print)*, *8*(2), 124–131.
Ries, A. V., Voorhees, C. C., Roche, K. M., Gittelsohn, J., Yan, A. F., & Astone, N. M. (2009). A quantitative examination of park characteristics related to park use and physical activity among urban youth. *Journal of Adolescent Health*, *45*(3 Suppl), S64–70.
Telama, R., Yang, X., Laakso, L., & Viikari, J. (1997). Physical activity in childhood and adolescence as predictor of physical activity in young adulthood. *American Journal of Preventive Medicine*, *13*(4), 317–323.
Timperio, A., Giles-Corti, B., Crawford, D., Andrianopoulos, N., Ball, K., Salmon, J., & Hume, C. (2008). Features of public open spaces and physical activity among children: Findings from the CLAN study. *Preventive Medicine*, *47*, 514–518.
Van Cauwenberg, J., De Bourdeaudhuij, I., Clarys, P., Nasar, J., Salmon, J., Goubert, L., & Deforche, B. (2016). Street characteristics preferred for transportation walking among older adults: A choice-based conjoint analysis with manipulated photographs. *International Journal of Behavioral Nutrition and Physical Activity*, *13*(1), 6.
Veitch, J., Bagley, S., Ball, K., & Salmon, J. (2006). Where do children usually play? A qualitative study of parents' perceptions of influences on children's active free-play. *Health & Place*, *12*(4), 383–393.
Veitch, J., Salmon, J., & Ball, K. (2007). Children's perceptions of the use of public open spaces for active free-play. *Children's Geographies*, *5*(4), 409–422.
Veitch, J., Ball, K., Crawford, D., Abbott, G. R., & Salmon, J. (2012). Park improvements and park activity: A natural experiment. *American Journal of Preventive Medicine*, *42*(6), 616–619.
Veitch, J., Salmon, J., Ball, K., Crawford, D., & Timperio, A. (2013). Do features of public open spaces vary between urban and rural areas? *Preventive Medicine*, *56*(2), 107–111.
Veitch, J., Salmon, J., Carver, A., Timperio, A., Crawford, D., Fletcher, E., & Giles-Corti, B. (2014). A natural experiment to examine the impact of park renewal on park-use and park-based physical activity in a disadvantaged neighbourhood: The REVAMP study methods. *BMC Public Health*, *14*, 600.
Veitch, J., Carver, A., Abbott, G., Giles-Corti, B., Timperio, A., & Salmon, J. (2015). How active are people in metropolitan parks? An observational study of park visitation in Australia. *BMC Public Health*, *15*, 610.
Veitch, J., Salmon, J., Parker, K., Bangay, S., Deforche, B., & Timperio, A. (2016). Adolescents' ratings of features of parks that encourage park visitation and physical activity. *International Journal of Behavioral Nutrition and Physical Activity*, *13*, 73.