Designing outdoor fitness areas for older adults: a conjoint analysis study

Leisure Studies

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/rlst20

Designing outdoor fitness areas for older adults: a conjoint analysis study

Chahana Paudel, Anna Timperio, Jo Salmon, Venurs Loh, Benedicte Deforche & Jenny Veitch

To cite this article: Chahana Paudel, Anna Timperio, Jo Salmon, Venurs Loh, Benedicte Deforche & Jenny Veitch (24 Feb 2024): Designing outdoor fitness areas for older adults: a conjoint analysis study, Leisure Studies, DOI: 10.1080/02614367.2024.2320357

To link to this article: https://doi.org/10.1080/02614367.2024.2320357

LEISURE STUDIES
https://doi.org/10.1080/02614367.2024.2320357

Designing outdoor fitness areas for older adults: a conjoint analysis study

Chahana Paudel[a], Anna Timperio[a], Jo Salmon[a], Venurs Loh[a], Benedicte Deforche[b,c] and Jenny Veitch[a]

[a]Institute for Physical Activity and Nutrition (IPAN), School of Exercise and Nutrition Sciences, Deakin University, Geelong, Australia; [b]Department of Public Health and Primary Care, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium; [c]Department of Movement and Sport Sciences, Faculty of Physical Education and Physiotherapy, Vrije Universiteit Brussel, Brussel, Belgium

ABSTRACT

This study aimed to examine the relative importance of micro-level design features of outdoor fitness areas preferred by older adults and whether preferences varied according to gender, park accompaniment, and mobility status. A series of Adaptive Choice-Based Conjoint (ACBC) tasks were completed by older adults ($n = 372$, 65–93 years, 57% female) in an online survey. Ten different micro-level design features of outdoor fitness areas were examined including surface type, location of fitness equipment, equipment designed for older adults, equipment distribution, shade sails, light fixtures, shady trees, benches, drinking water, and water body near fitness area. Hierarchical Bayes analyses within Sawtooth software were used to identify the relative importance scores and part-worth utilities of the design features. For the overall sample, the three most important features were as follows: surface type (21.5%, 95% CI 20.0, 22.9); equipment specifically designed for older adults (18.7%, 95% CI 17.3, 20.2); and shady trees around the fitness area (14.0%, 95% CI 12.9, 15.0). A few significant differences in the relative ranking of design features were observed by gender and mobility status. This study will help stakeholders in understanding which design features to prioritise when (re)designing outdoor fitness areas for older adults.

ARTICLE HISTORY
Received 17 August 2023
Accepted 13 February 2024

KEYWORDS
Conjoint analysis; outdoor gym; parks; physical activity; senior

1. Introduction

The population and proportion of older adults (≥65 years) worldwide are growing due to an increase in life expectancy and declining fertility rates (Nations, 2020). Globally, the percentage of older adults has increased from 6% in 1990 to 9% in 2019 and is further predicted to rise to 16% in 2050 (Nations, 2020). However, with an increase in life expectancy, there is an increased risk of chronic disease and disability in older adults, resulting in decrements in health and quality of life (He et al., 2016). Encouraging older adults to engage in physical activity will help to prevent developing many health conditions, maintain quality of life and independence for longer, and reduce the cost of healthcare associated with an ageing population (McPhee et al., 2016).

Parks are a valuable community resource and are an important setting to enable physical activity and foster social interaction and recreational opportunities for all age groups. In recent years, the

CONTACT Chahana Paudel cpaudel@deakin.edu.au Institute for Physical Activity and Nutrition (IPAN), Deakin University, 221 Burwood Highway, Burwood VIC 3125, Australia
Supplemental data for this article can be accessed online at https://doi.org/10.1080/02614367.2024.2320357

installation of outdoor fitness areas, also known as fitness zones, outdoor gyms and senior playgrounds, are becoming more common in parks in Australia and internationally (Bettencourt & Neves, 2012; Chow, 2013; Chow et al., 2017; Cranney et al., 2018; Jansson et al., 2022; Marcos-Pardo et al., 2023; Scott et al., 2014; Veitch et al., 2021). These facilities consist of fixed exercise equipment in outdoor settings and are being installed as an inexpensive environmental strategy to increase physical activity among park visitors (Cohen et al., 2012; Lee et al., 2018). Since most older adults are often sedentary during their park visits (Evenson et al., 2016; Joseph & Maddock, 2016), the provision of outdoor fitness equipment could provide important opportunities to engage in moderate- to vigorous-intensity physical activity and functional balance and muscle strengthening activities (Scott et al., 2014). These are important components of international and Australian physical activity guidelines for older adults (Australian Government Department of Health, 2019; World Health Organization, 2020). In a previous qualitative study among older adults, outdoor fitness equipment was frequently mentioned as a feature to encourage physical activity in parks (Veitch et al., 2020). Furthermore, the installation of outdoor fitness equipment can attract new park visitors and increase park use (Cohen et al., 2012). Outdoor fitness equipment can also encourage social interaction, which might be beneficial for the social and mental well-being of older adults and for sustained physical activity participation (Chow, 2013; Levinger et al., 2021; Ng et al., 2021).

Current research on outdoor fitness areas for older adults has mainly focussed on exploring their perceptions of the equipment and usage, quantifying energy expenditure and intensity of exercise when using outdoor fitness equipment, and determining the effectiveness and efficacy of the equipment, training protocols or exercise programmes (Chow, 2013; Chow et al., 2018, 2021; Kim et al., 2018; Levinger et al., 2021, 2022; Sales et al., 2017, 2018; Stride et al., 2017; Veitch et al., 2021). Despite the growing interest in outdoor fitness equipment, limited research has explored older adults' preferences in relation to the micro-level design features of outdoor fitness areas. Micro-level design features refer to the specific design elements that enhance the overall functionality, usability, and aesthetic appeal such as the placement of fitness equipment, type of flooring or surfacing used, and availability of shade and shelter. These features are important as they can impact safety, comfort, and enjoyment and can influence the use of the fitness area for older adults (Chow, 2013; Cohen et al., 2012; Copeland et al., 2017).

In previous qualitative studies, older adults have discussed the need for shade, diverse equipment, placement of equipment on even surfaces, and locating fitness areas near other amenities (Chow, 2013; Copeland et al., 2017; Stride et al., 2017). Furthermore, a few quantitative studies have indicated that placement and location of equipment may be important factors to consider when designing outdoor fitness areas. A recent quasi-experimental pre-post study found a greater increase in park-based physical activity levels when all the fitness equipment was placed in one location, compared with another park where equipment was spaced out along the walking paths (23% compared to 19% increase) (Sami et al., 2020). In addition, a study examining the installation of outdoor fitness equipment in 12 parks in the USA found no increase in the use of outdoor fitness equipment by all age groups when the fitness area was located in less visible and less accessible areas (Cohen et al., 2012). Although these findings provide some evidence of the importance of placement and location of equipment, other features such as the supporting amenities, under-surfacing, and equipment type, have not been explored. In addition, previous studies have not examined the relative importance of these individual design features, which is important for identifying which features to prioritise when (re)designing outdoor fitness areas.

It is also plausible that diverse groups of older adults may have different needs and preferences for the design of outdoor fitness areas. For example, having a fitness area near the playground might be more important for older adults who visit the park with their grandchildren than for those who visit the park alone. Mobility limitations are also important to consider; for example, whether nearby seating is available. It is also possible that preferences for the design of outdoor fitness areas differ by gender and other characteristics. Previous studies have found that the use of outdoor

fitness equipment varied among older males and females (Chow & Wu, 2019; Cranney et al., 2016). To our knowledge, no studies have examined the preferences of different sub-groups (gender, mobility status, park accompaniment) of older adults in relation to the design features of outdoor fitness areas.

This study aimed to investigate the relative importance of micro-level design features of outdoor fitness areas perceived to promote use among older adults in Australia and to explore differences in preference according to gender, mobility status and park accompaniment. The findings will be relevant to park designers and policymakers to determine which design elements should be prioritised for optimal outdoor fitness area (re)design.

2. Methods

An online survey was completed by older adults (≥65 years) from September 2021 to December 2021. Ethical approval for this study was provided by the Deakin University Human Ethics Advisory Group (HEAG-H 110_2021).

2.1. Participants

Several strategies were used to recruit older adults living independently (i.e. not living in a nursing home) anywhere in Australia. Different organisations such as the University of the Third Age, PROBUS, Men's Sheds, neighbourhood centres, and retirement villages were contacted via email and asked to distribute information about the study and a link to the survey to their members. An email invitation to participate with the link to the survey was also sent to participants from a previous study who had agreed to be contacted for future studies (Veitch et al., 2022). Advertisements targeting older adults (≥65 years) in Australia were also posted on Facebook. Informed consent was required before participation and participants who completed the survey were given the opportunity to enter a draw to win one of the five $100 gift cards.

2.2. Procedures and measures

This study used Adaptive Choice-Based Conjoint (ACBC) analysis to determine the relative ranking of design features of outdoor fitness areas. ACBC analysis is a quantitative market research technique that evaluates respondents' values/preferences for various product features (design of outdoor fitness areas in this case) (Sawtooth Software Inc, 2014). ACBC analysis mimics real-life decision-making settings by taking into account multiple co-existing design features together rather than each design feature in isolation (Orme, 2010). It uses an interactive process to adapt choice tasks in accordance with each participant's preferences and selections (Orme, 2010).

The survey was hosted by Sawtooth Software and had three sections. The first section included socio-demographic items including age, gender, living status, education status, dog ownership, country of birth, marital status, mobility status, employment status and postcode to determine area-level socioeconomic status (SES) and remoteness. The second section included a series of ACBC tasks pertaining to the design of walking paths (not reported here) and outdoor fitness areas in a park, presented in random order. The last section included items to examine participants' park visitation over the past 3 months including park visitation frequency, park-based physical activity, park accompaniment, and outdoor fitness equipment use, and the number of days they performed at least 30 min/day of physical activity in a usual week.

The ACBC tasks for outdoor fitness areas were based on 10 different micro-level design features and each feature had 2–4 levels (Table 1). The micro-level design features included surface type, shade sails, light fixtures, location of fitness equipment, equipment designed for older adults, equipment distribution, shady trees, benches, drinking water and water body near fitness area. The features included were based on prior research identifying important design characteristics of

Table 1. Design features and feature levels of outdoor fitness area.

Features	Feature levels
1. Surface type	(i) Concrete/asphalt surface (hard) (ii) Rubber surface (cushioned) (iii) Natural ground (grass) (iv) Loose surface (wood chips)
2. Equipment designed for older adults	(i) Equipment designed especially for older adults (i) Equipment not designed especially for older adults
3. Shady trees around fitness areas	(i) Lots of shady trees around fitness area (ii) A few shady trees around fitness area (iii) No shady trees around fitness area
4. Bench near fitness area	(i) Provision of benches near fitness area (ii) No benches near fitness area
5. Drinking water fountain near fitness area	(i) Presence of drinking water fountain near fitness area (ii) No drinking water fountain near fitness area
6. Shade sails above fitness area	(i) Presence of shade sails over equipment (ii) No shade sails over equipment
7. Location of fitness area	(i) Fitness area is near playground (ii) Fitness area is near other activity area (e.g. sports field) (iii) Fitness area is secluded from other areas
8. Equipment distribution	(i) All equipment in one area (ii) Equipment scattered throughout park (iii) Equipment placed along the path
9. Light fixtures around fitness area	(i) Presence of light fixtures near fitness area (ii) No light fixtures near fitness area
10. Water body near fitness area	(i) Equipment has a view to water body (e.g. pond) (ii) No views to water body

outdoor fitness areas (Bettencourt & Neves, 2012; Chow, 2013; Cohen et al., 2012; Copeland et al., 2017; Cranney et al., 2016; Sami et al., 2020; Stride et al., 2017). Where relevant, the features/levels have been modified to suit the Australian context. Images and/or written descriptions of features and feature levels were presented to participants for familiarisation purposes before the ACBC tasks commenced.

ACBC tasks were completed in multiple steps (see Supplementary file 1 for screen capture of different questions within various steps of an ACBC task). First, in a 'pre-screener' question, the 10 different micro-level design features were presented, and participants were asked to select six features that were most important for them. The following steps then only included these six features and their respective levels. Second, in the 'build-your-own' step, participants were asked to choose a preferred level for selected features that had three or more levels. For example, for the feature 'location of fitness area', participants had to select if they would prefer the fitness area to be 'near a playground', 'near other activity areas' or 'secluded'. Third, a series of six 'screening' questions were presented, consisting of four design profiles of outdoor fitness areas with different combinations of features and feature levels. For each of the design profiles, participants were asked to indicate if the presented profile would encourage them to use the outdoor fitness equipment (i.e. I would/would not use this fitness equipment). If certain features were consistently 'avoided', participants were prompted to choose which of the 'avoided' features would be most 'unacceptable' for them. Likewise, if certain features were consistently 'included' they were prompted to choose one feature that was an absolute requirement for them. These 'unacceptable' and 'must-have' questions identified if certain features were non-compensatory to participants' choices and made sure the remaining tasks incorporated the feature levels that would best meet their needs. Finally, a series of 13 'choice tasks' were presented. Each task showed two design profiles and participants were asked to select the one design profile they most preferred. If a matching feature level appeared in both profiles, feature level was greyed out to make it easier for respondents to focus on the differences between the two design profiles.

To assess gender, participants were asked if they were male, female, prefer not to mention, or prefer to self-describe (open-ended). To assess mobility status, participants were asked if they had

a problem with balance and walking in the past 12 months (Yes/No), which was categorised as limited mobility, and no mobility limitations. To assess park accompaniment, participants were asked who they had visited a park with most often in the past 3 months. Responses were dichotomised as 'visit park alone' and 'visit park with someone'.

2.3. Data analysis

Descriptive statistics of the sample were calculated using Stata/BE 17.0 (Stata Corp. College Station, TX, USA). Hierarchical Bayes (HB) analysis using Sawtooth Software (SSI Web Lighthouse Studio 9.12.1) was used to calculate two parameters: average relative importance scores, and part-worth utilities (Orme, 2010). Average relative importance scores indicate the relative importance of each feature compared to others. The scores are presented in terms of percentage and signify the maximum impact each feature has on choice (Orme, 2010). For example, if a feature has an importance score of 20%, it is considered twice as important as a feature with a score of 10%. Part-worth utilities represent preference for levels of features. A higher, positive value for a feature level indicates that the level within each feature is more desirable (Orme, 2010). The part-worth utilities were zero-centred. For example, if the feature levels for surface type, (i.e. rubber, loose, natural ground and concrete) had part-worth utilities of 10, 6, −4, and −12, respectively, then the most preferred surface type was rubber and the least preferred was concrete. HB analyses were completed for the overall sample. The analysis for gender was conducted for males and females. The analysis for mobility status was completed for two subgroups, those with mobility limitations and those without, and for park accompaniment, only participants who had visited a park in the past 3 months were included in the analysis. For this subgroup, analyses were conducted for those who visited the park alone and for those who visited with someone.

Standard deviations, standard errors, and 95% confidence intervals were computed in Microsoft Excel (2016) to identify any significant differences between the features (importance scores) and their levels (part-worth utilities). Significant differences between relative importance scores and part-worth utilities were indicated by non-overlapping confidence intervals. Root Likelihood (RLH) values, which range from 0 to 1 (a higher value indicating a better fit of the model) was used to interpret the conjoint model's overall fit (Orme, 2010). RLH values ranged between 0.74 and 0.75.

3. Results

ACBC tasks related to outdoor fitness areas were completed by 372 participants (aged 65–93 years). Of those, 361 also answered questions about their park use and physical activity. Participants from all states and territories except the Northern Territory were recruited with the majority (64%) from Victoria. Table 2 presents the demographic characteristics and behaviours of the sample. The mean age of participants was 73.2 years (SD = 5.41), 57% were female and one preferred not to mention. Almost one-third reported having a problem with balance and walking, and 7% reported using mobility aids. Twelve per cent reported they had used outdoor fitness equipment in the past 3 months. Over 68% reported visiting a park at least once per week with 31% usually engaging in light activities and 50% in moderate- to vigorous activity while in a park.

3.1. Relative importance scores

For the overall sample, the two most important features of an outdoor fitness area, according to the importance score, were 'surface type' (21.5%, 95% CI 20.0, 22.9) and 'equipment designed for older adults' (18.7%, 95% CI 17.3, 20.2) (see Figure 1). These features were followed by 'shady trees around fitness area' (14.0%, 95% CI 12.9, 15.0) and 'bench near fitness area' (12.4%, 95% CI 11.5, 13.3) which were significantly lower than the top two features, but not significantly different from each other. The fifth, sixth and seventh most important features were 'drinking water near fitness

Table 2. Participant demographic characteristics.

	N= 372
Age, mean [SD]	73.2 [5.41]
Gender, n(%)[a]	
Male	159 (42.7)
Female	212 (57.0)
Country of birth, n(%)	
Australia	246 (66.1)
Other	126 (33.9)
Area-level socioeconomic status (SES), n(%)	
Low SES	48 (12.9)
Mid SES	85 (22.8)
High SES	239 (64.3)
Remoteness of residence, n(%)[b]	
Urban area	332 (89.2)
Regional area	39 (10.5)
Dog ownership, n(%)	93 (25.0)
Highest level of education, n(%)	
No formal qualifications	4 (1.1)
Some high school	26 (7.0)
Completed high school	31 (8.3)
Technical or trade school certificate or apprenticeship or diploma	70(18.8)
Tertiary qualification	241 (64.8)
Current employment status, n(%)	
Working full-time	14 (3.8)
Working part-time	31 (8.3)
Unemployed	2 (0.5)
Retired	325 (87.4)
Marital status, n(%)	
Married/de-facto	244 (65.6)
Separated/widowed/divorced	107 (28.8)
Never married	21 (5.6)
Living Status, n(%)	
Alone	114 (30.7)
With someone	258 (69.3)
Problem with balance or walking, n(%)	
Yes	107 (28.8)
No	265 (71.2)
Use mobility aids, n(%)	24 (6.5)
Usual frequency of park visits in the past 3 months, n(%)[c]	
Not visited in the past 3 months	53 (14.7)
At least once/week	246 (68.1)
<once/week	62 (17.2)
Usual accompaniment of park visits in the past 3 months, n(%)[d]	
Alone	101 (28.0)
With someone	207 (57.3)
Usual activity levels at park visit in the past 3 months, n(%)[d]	
Mostly sitting or lying down	9 (2.5)
Mostly standing	7 (1.9)
Mostly light activities	113 (31.3)
Mostly moderate activities	171 (47.4)
Mostly vigorous activities	8 (2.2)
Used outdoor fitness equipment in past 3 months, n(%)[d]	
Yes	37 (12.0)
No	271 (88.0)
Days physically active for at least 30 minutes/day in a typical week, mean (SD)[c]	5.3 (2.3)

[a]One participant preferred not to mention their gender.
[b]Remoteness of one postcode could not be identified.
[b]Only completed by a total of 361 participants.
[c]Only presented to participants who indicated that they had visited a park in the past 3 months.

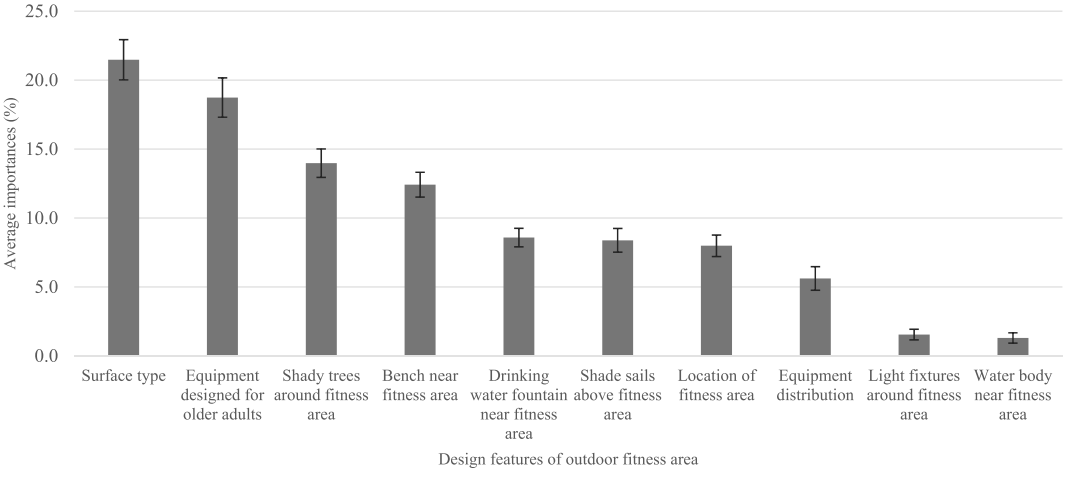

Figure 1. Average relative importance of design features for outdoor fitness areas for overall sample (n=372).

area' (8.6%, 95% CI 7.9, 9.3), 'shade sails above fitness area' (8.4%, 95% CI 7.5, 9.2), and 'location of fitness area' (8.0, 95% CI 7.2, 8.8) respectively. These features were significantly lower than the top four features but not significantly different from each other. These were followed by 'equipment distribution' (5.6%, 95% CI 4.8, 6.5) for which the importance scores were significantly lower. The two least important features were 'light fixtures around fitness area' (1.5%, 95% CI 1.2, 1.9) and 'water body near fitness area' (1.3%, 95% CI 0.9, 1.7).

A few significant differences in the order of relative importance were observed by gender (see Figure 2(a)). For females (n=212) the relative importance scores show that the 'location of fitness area' (9.3%, 95% CI 8.2, 10.4) was the fifth most important, whereas, for males (n=159), it was the seventh most important (6.5%, 95% CI 5.5, 7.6). 'Drinking water fountain near fitness area' was ranked seventh for females (7.5%, 95% CI 6.7, 8.3) and fifth for males (10.0%, 95% CI 8.9, 11.2). A few significant differences in the order of relative importance were observed by mobility status (see Figure 2(b)). For those with mobility limitations (n=107), 'bench near fitness area' was ranked third (14.8%, 95% CI 12.9, 16.6) and for those with no mobility limitations (n=265), it was ranked fourth (11.5%, 95% CI 10.4, 12.5). A 'Drinking water fountain near fitness area' was fifth most important for those with no mobility limitations (9.6%, 95% CI 8.7, 10.4) whereas it was ranked seventh for those with limited mobility (6.2%, 95% CI 5.1, 7.3). There was no significant difference in the order of relative importance according to park accompaniment (see Figure 2(c)).

3.2. Part-worth utilities

For the overall sample (see Figure 3), for the six features with two levels, the presence of a feature was always preferred over its absence. For example, the presence of 'shade sails over the equipment' (41.8, 95% CI 37.5, 46.1) was preferred over not having 'shade sails over the equipment' (−41.8, 95% CI −46.1, −37.5), based on part-worth utility scores. The results for the remaining four features that had more than two levels are described individually. For 'surface type', rubber surfaces (85.9, 95% CI 78.8, 93.0) were preferred over natural ground (53.0, 95% CI 47.4, 58.6), which was preferred over loose surfaces (−52, 95% CI −59.6, −44.3) and concrete/asphalt surfaces (−87.0, 95% CI −95.9, −78.0) and these levels were significantly different from each other. For 'shady trees around fitness area', lots of shady trees (51.4, 95% CI 46.7, 56.1) were preferred over a few shady trees (29.8, 95% CI 27.0, 32.6) which was preferred over no shady trees (−81.2, 95% CI −87.1, −75.2) and these levels were significantly different from each other. For 'location of fitness area', a location near other activity areas (e.g. sports field) (8.3,

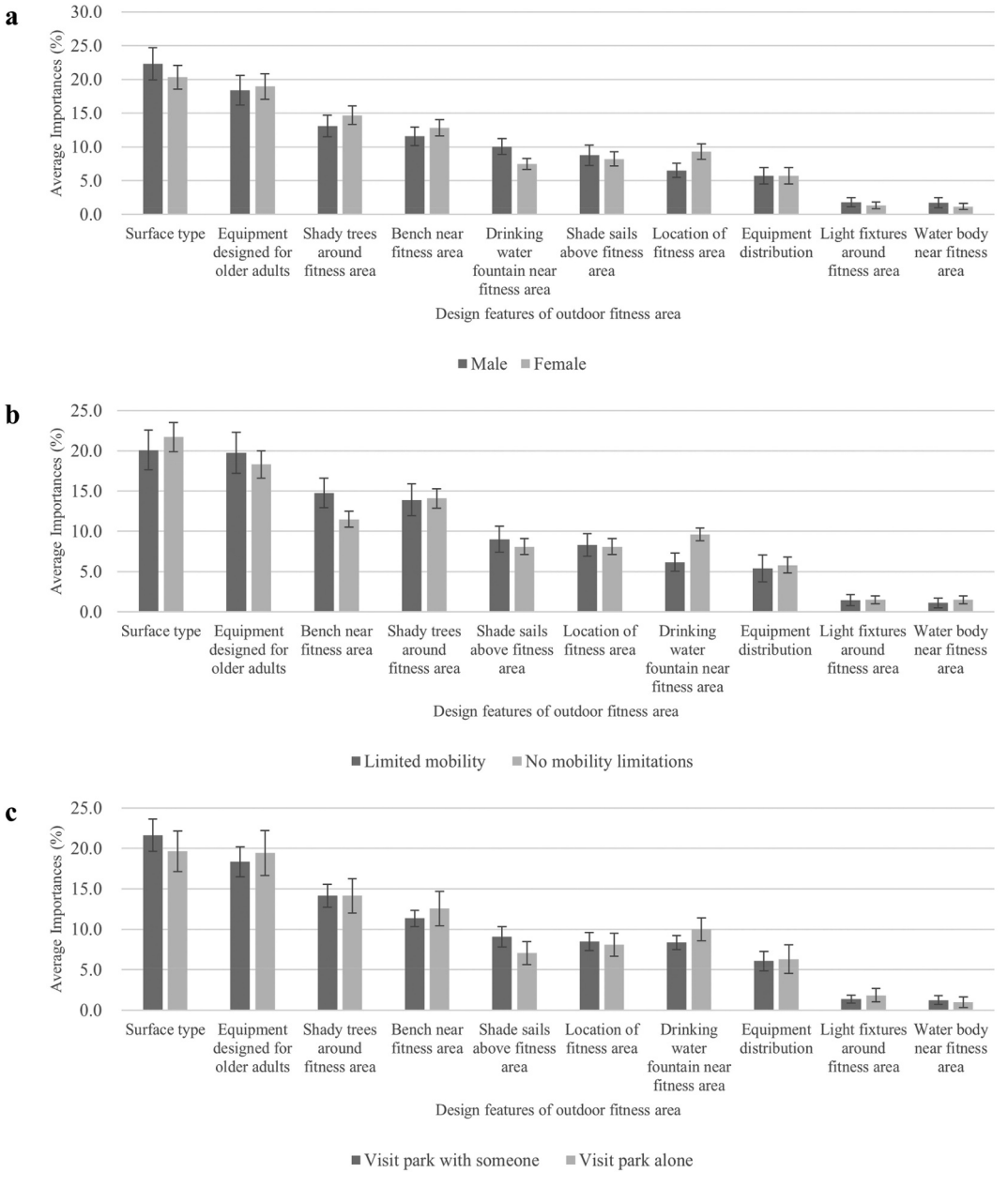

Figure 2. Average relative importance of design features for outdoor fitness areas (a) by gender; male (*n*= 159), female (*n*= 212) (b) by mobility status; limited mobility (*n*= 107), no mobility limitations (*n*= 265) (c) by park accompaniment; park visit alone(*n*= 101), park visit with someone (*n*= 207).

95% CI 4.4, 12.1) was the most preferred level, followed by near playground (1.4, 95% CI −2.5, 5.3), then secluded from other areas (−9.6, 95% CI −16, −3.3). The utility score for fitness area near other activity area was not significantly different to the score for fitness area near playground but it was significantly different to secluded from fitness area. For 'equipment distribution', all equipment in one area (11.6, 95% CI 6.1, 17.1) was preferred over equipment placed along walking paths (1.5, 95% CI −1.4, 4.4), which was preferred over equipment scattered

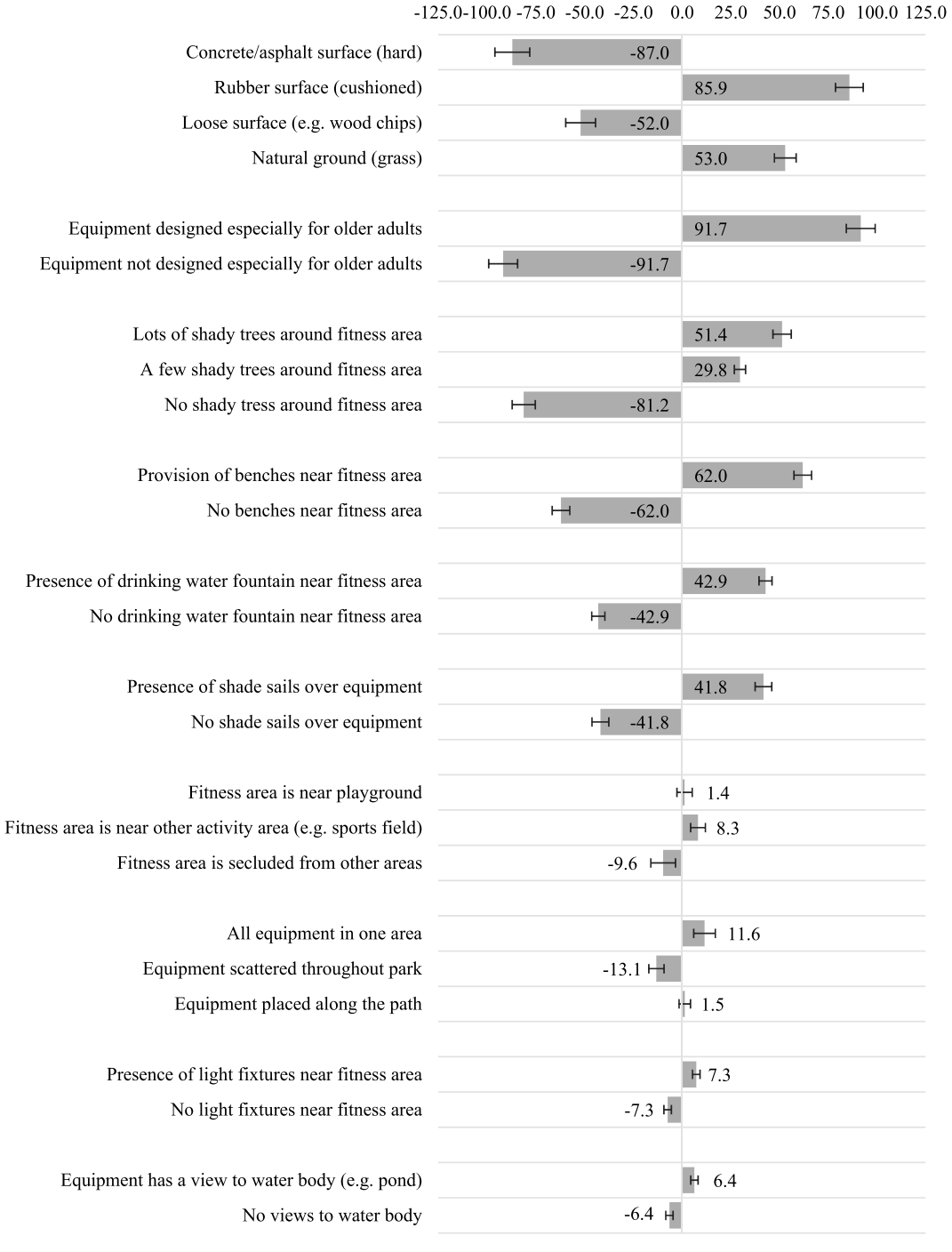

Figure 3. Average part-worth utilities of design features for outdoor fitness areas for overall sample of older adults (*n*=372).

throughout the park (−13.1, 95% CI −17, −9.2), and these were all significantly different from each other.

For gender and mobility status, the order of preferences for levels was the same as that for the overall sample (see Supplementary file 2). For park accompaniment, the order of preference for

levels was mostly similar to the overall sample except for 'location of fitness area' which differed slightly between groups (see Supplementary file 2).

4. Discussion

The purpose of this study was to examine the relative importance of micro-level design features of outdoor fitness equipment for encouraging use among older adults and to determine differences within gender, mobility status and park accompaniment. Understanding the relative importance of design features can help park designers know which features to prioritise when installing or renovating outdoor fitness areas for older adults. Despite the installation of outdoor fitness areas in parks becoming more common, there is little evidence regarding what specific design features of outdoor fitness areas are preferred by older adults. The findings of the present study show that surface type, equipment designed for older adults, shady trees around the fitness area, and seating near the fitness area were the four most important design features of an outdoor fitness area for older adults. Only a small number of significant differences in preference order were observed within subgroups, which implies that needs and preferences for design features are generally consistent regardless of gender, mobility status, or park accompaniment of older adults.

Rubber surfaces were the most preferred surface type, followed by natural ground, loose surfaces such as woodchips, and concrete surfaces. Previous studies have found the risk of injury due to falls to be greater for non-impact absorbing surfaces, such as concrete/asphalt, compared to impact absorbing surfaces, such as rubber (Chalmers et al., 1996). Loose surfaces may also be difficult for manoeuvring mobility devices, and uneven surfaces may be a tripping hazard for older adults. Since fear of falling is among the major concerns that limit older adults from participating in physical activity (Franco et al., 2015), stakeholders should strongly consider using rubber surfacing and avoid the use of concrete or loose surfaces when designing or refurbishing outdoor fitness areas.

Equipment that is designed especially for older adults was another highly ranked feature in our study. While our study did not explore the nuances of what equipment they consider to be most suitable for them, it is possible that this may include equipment with adjustable or low resistance levels that are easier to use for older adults with limited mobility, joint and muscle range (Marcos-Pardo et al., 2023). Furthermore, the equipment could be specifically designed to promote flexibility, balance, motor skills, coordination and social activities among older adults (Marcos-Pardo et al., 2023; Volkanovski & Marshall, 2015). Future in-depth qualitative studies are required to better understand what specific equipment would be best suited for this age group. The installation of outdoor fitness equipment designed specifically for older adults could instil confidence and encourage usage, especially if they observe individuals of a similar age using the equipment. Previous studies have found that group-based activities with the same age group were more valued by older adults (Franco et al., 2015). The impact of installing outdoor fitness equipment designed specifically for older adults on usage, physical activity and confidence should be examined. These natural experiments could also consider the impact of instructor-led group-based sessions for promoting physical activity and usage of the equipment.

The presence of shady trees around the fitness area was ranked the third most important feature in this study and the provision of shade sails over equipment was ranked sixth most important out of 10 design features. These results are consistent with previous qualitative research where the provision of shade was cited as a major enabler to use of outdoor fitness equipment by older Australians (Stride et al., 2017). Additionally, in a qualitative study conducted in Taiwan, older adults noted the need to place equipment under trees to relieve sunburn and heat during exercise (Chow, 2013). The presence of shady trees around the fitness area may also increase aesthetic appeal and create an inviting environment further encouraging park visitation and promoting usage. It should be acknowledged that trees take time to mature, and shade sails may be required during that period. However, it is important to note that this finding may be geographically specific, and shade may be less important in countries and regions with less sunshine.

Provision of amenities such as benches and drinking water fountains near the fitness area were ranked fourth and fifth most important, respectively, for the overall sample. Benches were ranked even higher (third) among those with mobility limitations which is unsurprising as they offer the opportunity to rest. In addition, benches provide a place to socialise which is important as previous research has found older adults' use of outdoor fitness areas was facilitated by social interaction (Lee et al., 2018). Supporting amenities such as benches and drinking water fountains can help make exercising in fitness areas more enjoyable and safer for older adults and should be incorporated as a priority in future outdoor fitness area (re) design.

The location of the fitness area was also deemed important relative to other features, ranking sixth out of 10 features for both park accompaniment groups (those visiting park alone and with a companion), and ranking seventh for the overall sample. Within this feature, locating fitness areas near other activity areas was most preferred and an isolated fitness area was the least preferred. These findings are consistent with previous research which found that fitness areas should be placed near other activity areas, such as sports fields (Bettencourt & Neves, 2016) and in more visible areas (Cohen et al., 2012). Locating outdoor fitness areas close to other activity areas can provide older adults using the facility a sense of safety through passive surveillance from other users and locating fitness areas near children's playgrounds can provide an opportunity for older adults to supervise children under their care while exercising.

5. Strengths and limitations

To the best of our knowledge, this study is the first to examine the relative importance of micro-level design features of outdoor fitness areas in parks and differences in preference among older adults overall and by sub-group. The findings can be used to meet the needs of older adults and help stakeholders to prioritise specific design features when planning and designing outdoor fitness areas. The analysis by gender, mobility status, and park accompaniment was important to determine whether specific groups of older adults have different needs. The use of ACBC analysis made it possible for participants to express their preference for one design over another by taking several features into account rather than just one feature. This technique helps to simulate real-life settings or choices. Further strengths of this study are the inclusion of older participants (65-93 years) living in low-, mid- and high SES and urban and regional areas. Our sample included participants who were regular and irregular park visitors, and those with limited mobility. This ensured the preferences of older adults with diverse backgrounds and experiences were represented. However, it is worth noting that the majority of participants were from high SES and urban areas, and most were active park visitors which may limit generalisability of the findings.

In this study, 10 pre-selected design features were used; however, other features not presented may have also been important to consider (e.g. signage). Presenting more features would have increased participant burden. As with the previous ACBC studies (Rivera et al., 2021; Veitch et al., 2017, 2022) written descriptions were used to describe features; however, it is possible that participants may have construed the features differently. This potential limitation was minimised by presenting images and written descriptions of the features and levels before starting the ACBC tasks. Furthermore, this study examined only design aspect of outdoor fitness areas and other aspects such as maintenance, quality and accessibility may also be important. Additionally, the preferences of older adults in this study may not relate to actual behaviour. Future studies should consider determining the impact of incorporating the findings of this study into new and/or refurbished installations in parks and examining the impact on usage and physical activity among older adults. Furthermore, the limited number of participants who reported using outdoor fitness equipment in the past 3 months (12%) may limit our understanding of the needs of those who use this equipment. Additionally, this study did not explore their overall experience with using outdoor fitness areas. Nevertheless, this study provides valuable insights into the preferences of

non-users, shedding light on what features might attract them to participate in the future. The survey was undertaken online, so older adults who were not confident in completing a computer-based survey may not have participated. Finally, given the survey was conducted in the spring and summer months there may have been seasonal differences in preferences for some design features (e.g. shade).

6. Conclusion

This study provides much-needed insights into the design features that older adults prefer in outdoor fitness areas, which can help inform design decisions. Rubber under-surfacing, equipment specific for older adults, lots of shady trees, provision of benches and drinking water fountains near the fitness area, and shade sails over the equipment were found to be important micro-level design features of outdoor fitness areas. These features should be prioritised when designing outdoor fitness facilities for older adults so that their needs and preferences are met and they are encouraged to be physically active, potentially improving their health and quality of life. These insights are particularly relevant for gym/fitness industry professionals, policymakers and stakeholders seeking to create age- friendly environments that contribute to the overall well-being of older adults. Future research should investigate additional factors influencing preferences such as psychological and social aspects. Longitudinal research is also critical as it can provide data on the sustained impact of these design features on user satisfaction and engagement.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Notes on contributors

Chahana Paudel is a PhD student at Deakin University. Her research focuses on optimising park design to promote active and healthy ageing among older adults.

Anna Timperio is a Professor whose research is focused on the behavioural epidemiology of physical activity. They have a strong interest in the role of the environment in shaping active living.

Jo Salmon is Director of the Institute for Physical Activity and Nutrition, Deakin University and holds a NHMRC Level 2 Investigator Grant. She has over 20 years of research experience developing effective programs to promote children's physical activity and reduce sedentary behaviour.

Venurs Loh is a lecturer and researcher in social epidemiology and public health. Her research focuses on the role of the built environment in promoting physical activity and active travel among adolescents.

Benedicte Deforche is a Senior Full Professor in Health Promotion. Her research focuses on the development, implementation, and evaluation of health promotion interventions.

Jenny Veitch is a Professor in behavioural epidemiology. Her research focuses on understanding how parks and public open spaces can be designed to encourage people of all ages to engage in physical activity.

References

Australian Government Department of Health. (2019). *Australia's physical activity and sedentary behaviour guidelines and the Australian 24-hour movement guidelines*. https://www1.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-strateg-phys-act-guidelines#npa%2065

Bettencourt, L., & Neves, R. (2012). Seniors' playground and physical activity: Perceptions and practices. *Journal of Aging and Physical Activity*, *20*, S276–S277. https://doi.org/10.13140/2.1.3203.1684

Bettencourt, L., & Neves, R. (2016). Senior playgrounds in the promotion of physical activity among the elderly - characteristics of use. *Journal Kairós Gerontología*, *19*, 59–72 .

Chalmers, D. J., Marshall, S. W., Langley, J. D., Evans, M. J., Brunton, C. R., Kelly, A. M., & Pickering, A. F. (1996). Height and surfacing as risk factors for injury in falls from playground equipment: A case-control study. *Injury Prevention*, *2*(2), 98–104. https://doi.org/10.1136/ip.2.2.98

Chow, H. W. (2013). Outdoor fitness equipment in parks: a qualitative study from older adults' perceptions. *BMC Public Health*, *13*(1), 1216. https://doi.org/10.1186/1471-2458-13-1216

Chow, H. W., Chang, K. T., & Fang, I. Y. (2021). Evaluation of the effectiveness of outdoor fitness equipment intervention in achieving fitness goals for seniors. *International Journal of Environmental Research and Public Health*, *18*(23), 12508. https://doi.org/10.3390/ijerph182312508

Chow, H. W., Ho, C. H., & Piacentini, M. F. (2018). Does the use of outdoor fitness equipment by older adults qualify as moderate to vigorous physical activity? *Public Library of Science ONE*, *13*(4), e0196507. https://doi.org/10.1371/journal.pone.0196507

Chow, H. W., Mowen, A. J., & Wu, G. L. (2017). Who is using outdoor fitness equipment and how? The case of xihu park. *International Journal of Environmental Research and Public Health*, *14*(4), 448. https://doi.org/10.3390/ijerph14040448

Chow, H. W., & Wu, D. R. (2019). Outdoor fitness equipment usage behaviors in natural settings. *International Journal of Environmental Research and Public Health*, 16(3), 391. https://doi.org/10.3390/ijerph16030391

Cohen, D. A., Marsh, T., Williamson, S., Golinelli, D., & McKenzie, T. L. (2012). Impact and cost-effectiveness of family fitness zones: A natural experiment in urban public parks. *Health & Place*, *18*(1), 39–45. https://doi.org/10.1016/j.healthplace.2011.09.008

Copeland, J., Currie, C., Walker, A., Mason, E., Truba, T., & Amson, A. (2017). Fitness equipment in public parks: Frequency of use and community perceptions in a small urban centre. *Journal of Physical Activity and Health*, *14*(5), 1–29. https://doi.org/10.1123/jpah.2016-0277

Cranney, L., Phongsavan, P., Kariuki, M., Stride, V., Scott, A., Hua, M., & Bauman, A. (2016). Impact of an outdoor gym on park users' physical activity: A natural experiment. *Health & Place*, *37*, 26–34. https://doi.org/10.1016/j.healthplace.2015.11.002

Cranney, L., Shaw, L., & Phongsavan, P. (2018). Are outdoor gyms located in areas of greatest need and impact? An audit in Sydney, Australia. *Annals of Leisure Research*, *22*(3), 395–403. https://doi.org/10.1080/11745398.2018.1523737

Evenson, K. R., Jones, S. A., Holliday, K. M., Cohen, D. A., & McKenzie, T. L. (2016). Park characteristics, use, and physical activity: A review of studies using SOPARC (system for observing play and recreation in communities). *Preventive Medicine*, *86*, 153–166. https://doi.org/10.1016/j.ypmed.2016.02.029

Franco, M. R., Tong, A., Howard, K., Sherrington, C., Ferreira, P. H., Pinto, R. Z., & Ferreira, M. L. (2015). Older people's perspectives on participation in physical activity: A systematic review and thematic synthesis of qualitative literature. *British Journal of Sports Medicine*, *49*(19), 1268–1276. https://doi.org/10.1136/bjsports-2014-094015

He, W., Goodkind, D., & Kowal, P. (2016). *International population reports, an aging world 2015*. U. S. G. P. Office.

Jansson, A. K., Lubans, D. R., Duncan, M. J., Smith, J. J., Plotnikoff, M., Robards, S. L., & Plotnikoff, R. C. (2022). Descriptive epidemiology of outdoor gym use in an Australian regional setting. *Journal of Public Health*, *30*(1), 159–165. https://doi.org/10.1007/s10389-020-01275-2

Joseph, R. P., & Maddock, J. E. (2016). Observational park-based physical activity studies: A systematic review of the literature. *Preventive Medicine*, *89*, 257–277. https://doi.org/10.1016/j.ypmed.2016.06.016

Kim, D. I., Lee, D. H., Hong, S., Jo, S. W., Won, Y. S., & Jeon, J. Y. (2018). Six weeks of combined aerobic and resistance exercise using outdoor exercise machines improves fitness, insulin resistance, and chemerin in the Korean elderly: A pilot randomized controlled trial. *Archives of Gerontology and Geriatrics*, *75*, 59–64. https://doi.org/10.1016/j.archger.2017.11.006

Lee, J. L. C., Lo, T. L. T., & Ho, R. T. H. (2018). Understanding outdoor gyms in public open spaces: A systematic review and integrative synthesis of qualitative and quantitative evidence. *International Journal of Environmental Research and Public Health*, *15*(4), 590. https://doi.org/10.3390/ijerph15040590

Levinger, P., Dunn, J., Panisset, M. G., Haines, T., Dow, B., Batchelor, F., Biddle, S., Duque, G., & Hill, K. D. (2022). The effect of the ENJOY seniors exercise park physical activity program on falls in older people in the community: A prospective pre-post study design. *The Journal of Nutrition, Health & Aging*, *26*(3), 217–221. https://doi.org/10.1007/s12603-021-1724-1

Levinger, P., Dunn, J., Panisset, M., Haines, T., Dow, B., Batchelor, F., Biddle, S. J. H., Duque, G., & Hill, K. D. (2021). The ENJOY project: Usage and factors to support adherence and physical activity participation. *Translational Journal of the American College of Sports Medicine*, *6*(3), 1–6. https://doi.org/10.1249/tjx.0000000000000163

Marcos-Pardo, P. J., Espeso-Garcia, A., Abelleira-Lamela, T., & Machado, D. R. L. (2023). Optimizing outdoor fitness equipment training for older adults: Benefits and future directions for healthy aging. *Experimental Gerontology*, *181*, 112279. https://doi.org/10.1016/j.exger.2023.112279

McPhee, J. S., French, D. P., Jackson, D., Nazroo, J., Pendleton, N., & Degens, H. (2016). Physical activity in older age: Perspectives for healthy ageing and frailty. *Biogerontology*, *17*(3), 567–580. https://doi.org/10.1007/s10522-016-9641-0

Ng, Y. L., Hill, K. D., Levinger, P., & Burton, E. (2021). Effectiveness of outdoor exercise parks on health outcomes in older adults—A mixed-methods systematic review and meta-analysis. *Journal of Aging and Physical Activity*, *29* (4), 695–707. https://doi.org/10.1123/japa.2020-0031

Orme, B. K. (2010). *Getting started with conjoint analysis: Strategies for product design and pricing research*. Research Publishers. https://books.google.com.au/books?id=u6ehQgAACAAJ

Rivera, E., Timperio, A., Loh, V. H., Deforche, B., & Veitch, J. (2021). Important park features for encouraging park visitation, physical activity and social interaction among adolescents: A conjoint analysis. *Health & Place*, *70*, 102617. https://doi.org/10.1016/j.healthplace.2021.102617

Sales, M., Polman, R., Hill, K. D., & Levinger, P. (2017). A novel exercise initiative for seniors to improve balance and physical function. *Journal of Aging & Health*, *29*(8), 1424–1443. https://doi.org/10.1177/0898264316662359

Sales, M., Polman, R., Hill, K., & Levinger, P. (2018). Older adults' perceptions of a novel outdoor exercise initiative: A qualitative analysis. *The Journal of Aging and Social Change*, *8*(1), 61–78. https://doi.org/10.18848/2576-5310/CGP/v08i01/61-78

Sami, M., Smith, M., & Ogunseitan, O. A. (2020). Placement of outdoor exercise equipment and physical activity: A quasi-experimental study in two parks in Southern California. *International Journal of Environmental Research and Public Health*, *17*(7), 2605. https://doi.org/10.3390/ijerph17072605

Sawtooth Software Inc. (2014). The adaptive choice-based conjoint (ACBC) Technical Paper. https://sawtoothsoftware.com/resources/technical-papers/acbc-technical-paper

Scott, A., Stride, V., Neville, L., & Hua, M. (2014). Design and promotion of an outdoor gym for older adults: A collaborative project. *Health Promotion Journal of Australia*, *25*(3), 212–214. https://doi.org/10.1071/HE14037

Stride, V., Cranney, L., Scott, A., & Hua, M. (2017). Outdoor gyms and older adults – acceptability, enablers and barriers: A survey of park users. *Health Promotion Journal of Australia*, *28*(3), 243–246. https://doi.org/10.1071/HE16075

United Nations. (2020). Department of economic and social affairs, population division. *World Population Ageing 2019*. https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/files/documents/2020/Jan/un_2019_worldpopulationageing_report.pdf

Veitch, J., Ball, K., Rivera, E., Loh, V., Deforche, B., Best, K., & Timperio, A. (2022). What entices older adults to parks? Identification of park features that encourage park visitation, physical activity, and social interaction. *Landscape and Urban Planning*, *217*, 104254. https://doi.org/10.1016/j.landurbplan.2021.104254

Veitch, J., Flowers, E., Ball, K., Deforche, B., & Timperio, A. (2020). Designing parks for older adults: A qualitative study using walk-along interviews. *Urban Forestry & Urban Greening*, *54*, 126768. https://doi.org/10.1016/j.ufug.2020.126768

Veitch, J., Salmon, J., Abbott, G., Timperio, A., & Sahlqvist, S. (2021). Understanding the impact of the installation of outdoor fitness equipment and a multi-sports court on park visitation and park-based physical activity: A natural experiment. *Health & Place*, *71*, 102662. https://doi.org/10.1016/j.healthplace.2021.102662

Veitch, J., Salmon, J., Deforche, B., Ghekiere, A., Van Cauwenberg, J., Bangay, S., & Timperio, A. (2017). Park attributes that encourage park visitation among adolescents: A conjoint analysis. *Landscape and Urban Planning*, *161*, 52–58. https://doi.org/10.1016/j.landurbplan.2016.12.004

Volkanovski, J., & Marshall, N. (2015). *Seniors' playgrounds may never get old* [Conference paper]. https://apo.org.au/node/63321

World Health Organization. (2020). *Physical activty*. https://www.who.int/news-room/fact-sheets/detail/physical-activity