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Greenspace access, use, and physical activity: Understanding the effects of area deprivation

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ABSTRACT

Objectives. To understand the patterning of greenspace provision and use by area deprivation, and determine how deprivation moderates relationships with physical activity.

Methods. The responses obtained from 6821 respondents to the 2005 'The Quality of Life in your Neighbourhood Survey' undertaken in Bristol, England, were combined with objective measures of access to greenspaces. Area deprivation was determined using the Index of Multiple Deprivation. Descriptive analyses examined how mean distance, perceived greenspace access and safety, visit frequency, and physical activity varied by deprivation quartile. Logistic regression models examined how relationships were moderated by deprivation.

Results. Respondents in more deprived areas lived closer to greenspaces, but reported poorer perceived accessibility, poorer safety, and less frequent use. Frequency of use declined with distance but only in the most affluent areas. Relationships between physical activity and perceived accessibility, safety, and visit frequency were moderated by deprivation.

Conclusions. The accessibility of greenspaces was better in more deprived areas but those residents had more negative perceptions and were less likely to use the greenspaces. Interventions may be most effective if they target the perceptions and needs of residents of deprived neighbourhoods.

Introduction

Only 40% of men and 28% of women in England currently meet Government recommendations of at least 30 min of moderate intensity physical activity 5 days a week (Craig and Mindell, 2008). Personal characteristics are key correlates of physical activity behaviours (Ogilvie et al., 2008) but attributes of the physical environment also seem important (Jones et al., 2007). Hence there is a focus on the potential of interventions based on the provision of supportive environments to increase physical activity prevalence (van Sluijs et al., 2007).

Considerable attention has been focused on the role of urban parks and greenspaces for physical activity (Bird, 2007). Indeed, the establishment of the public park movement in the 19th Century had origins in the social ideal of providing places of recreation that were equally available for all (Young, 1996). There is evidence that populations with better provision of greenspaces use them more (Neuvonen et al. 2007), are more likely to be physically active overall (Giles-Corti and Donovan, 2002), during leisure time (Huston et al. 2003) and walk (Wen et al. 2007), and cycle more (Wendel-Vos et al. 2004). However, provision of these amenities may not nowadays be equal (Taylor et al. 2007; Panter et al. 2008).

Evidence that greenspace provision may be poorer for more deprived populations comes mostly from the USA and Australia. Talen (1997) reported access to parks in two American towns was best in white, high-income suburban locations. In a small US city, Estabrooks et al. (2003) concluded that communities with lower socio-economic status had inferior provision of public parks and walking trails. In Melbourne Australia, Crawford et al. (2008) found that greenspaces in poorer neighbourhoods had fewer amenities to support physical activity amongst children. Elsewhere, Macintyre et al. (2008a) found public parks were better provided in more affluent areas of Glasgow, Scotland. These findings are concerning given that deprived populations exhibit lower physical activity (Kristensen et al., 2006), and residents of deprived neighbourhoods may be less active even after adjustment for personal socioeconomic circumstances (Kavanagh et al. 2005).

Inequities in the provision of greenspaces may contribute to social gradients in physical activity, but evidence is from a limited number of settings. Furthermore, few studies move beyond comparisons of provision by area deprivation, examining how perceptions, accessibility, and usage of greenspaces are moderated by area deprivation, and how these factors may contribute to the observed gradients. This is important in light of the findings of Macintyre et al. (2008b) in Glasgow that perceived distances to public parks poorly equated with those measured objectively. Hence it may hence be that perceptions are more driven by social factors that act to moderate associations

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with physical activity rather than by actual greenspace provision. Using the setting of the city of Bristol, England, this study provides new evidence on these issues.

Methods

Setting

The study used data from the 2005 'The Quality of Life in your Neighbourhood Survey,' a postal questionnaire survey of adult Bristol residents undertaken by Bristol City Council. The population was stratified by the 35 Bristol electoral wards (census tracts), representing a mix of urban areas and suburbs and including the most affluent and deprived areas. Some 380 people were randomly selected from the electoral register within each ward. Wards with high levels of deprivation have a lower response rate so a further 570 people were selected from the 12 most deprived areas, to provide a total sample of 20,140 individuals. Each person was sent a questionnaire to return by post, with one follow-up for initial non-responders. Overall, 6821 residents participated; a response rate of 34%.

Data collection

Information on each respondent's age, gender, and self rated health (rated 'good,' 'fairly good,' or 'not good') was obtained from the questionnaire. Respondents were asked to state frequency of greenspace use and also frequency of participation in sport and moderate physical activity (e.g. brisk walking, gardening, heavy housework or DIY) on a 5-point scale ranging between "5 times a week or more" and "less than once a year." For analysis, the physical activity frequency responses were re-coded to differentiate those respondents reporting participation at least five times a week (current UK guidelines) from those less active.

Two environmental perception measures were recorded by the survey, both on a 5-point scale; the respondent's perception of greenspace access ("very easy" to "very difficult") and of greenspace safety ("very safe" to "very unsafe"). Home locations of respondents were mapped based on postcodes using the ArcGIS 9.2 Geographical Information System (GIS) (ESRI, California). The UK Ordnance Survey Code-Point product was used, which provides a 1 m precision grid reference of the house nearest the weighted centroid of each postcode zone. Within a city, all addresses will typically fall within 50 m of the centroid. The neighbourhood surrounding each centroid was identified as the area within 800 m (equating to a 10 min walk) along the road network.

Neighbourhood deprivation was measured using the 2004 English Index of Multiple Deprivation (IMD). The value for the neighbourhood around each home was estimated using area weighted IMD scores based on the Super Output Areas (small census tracts) that fell within each neighbourhood. The IMD scores provide an indicator of material deprivation based on several components including income, employment, health, education, housing, environment, and crime (ODPM, 2004). High scores indicate high levels of deprivation.

The locations of all public greenspaces within Bristol were mapped using a GIS database provided by Bristol City Council. This included details of the size and type of each greenspace. Greenspaces were grouped into five typological categories: Formal (organised layout and structured path network, and generally well maintained), Informal (informal design and less managed feel), Natural (heathland, grassland or woodland), Young People's (for use by children or teenagers), and Sports (e.g. playing fields and tennis courts). Where a greenspace fell into more than one category, the area of each was delineated separately. The GIS database was cross referenced with aerial photography so that no spaces were omitted or erroneously included. Only spaces of at least 2 ha in size were considered, as those smaller were deemed unsuitable for use by adults for the purpose of being physically active. Of the 441 separate areas (1770 ha) of greenspace in the database, 306 (69%) were excluded based on size, although their area (140 ha) was just 7% of the total. They were typically features around roads, such as verges or central reservations. Using the Ordnance Survey Meridian database, the shortest distance via the road network between each postcode centroid and an access point to a qualifying greenspace was identified.

Statistical analysis

Trends across IMD quartiles in the measures were tested by correlating each with the quartiles specified as a continuous variable, whilst differences in greenspace perceptions and visit frequency, and the achievement of physical activity guidelines were examined across quartiles of IMD scores using Chi-squared tests. Logistic regression models were fitted to examine how distance to the nearest greenspace of each type considered was associated with the odds of visiting a greenspace at least once a week and achieving physical activity levels. To examine the moderating effect of deprivation, separate models were fitted for the lowest (most affluent) and highest (most deprived) quartiles of IMD. All models were adjusted for respondent age, sex, and self-rated health. Analyses were undertaken in SPSS 16.0 (SPSS Inc, Chicago).

Results

Compared to the population of Bristol at the 2001 Census, respondents were more likely to be female (59% sample vs. 51% Bristol), not in employment (55% vs. 60%), retired (27% vs. 15%), and home owner-occupiers (73% vs. 63%). Ethnic minorities were under-represented (4.4% vs. 6.8%) (Bristol City Council, 2005).

Table 1 shows the mean distance respondents live from their nearest greenspace by quartiles of neighbourhood deprivation. It illustrates that access to greenspace was generally better for those living in more deprived neighbourhoods, with shortest mean distances generally in the most deprived quartile. Exceptions were formal greenspaces and those used for sports, where the reverse was observed.

Table 2 shows that trends in perceptions of greenspace access were not in the same direction as the objective measures. Those in the most affluent neighbourhoods were more likely to report that access was "very easy" compared to those in the most deprived areas. Similarly, compared to the most affluent, over three times the percentage of respondents in the most deprived neighbourhoods felt that access was "fairly difficult" or "very difficult." Similar

Table 1
Greenspace accessibility by deprivation: distance (metres) to nearest greenspace.

	Overall mean distance (m)	Distance to nearest greenspace (m) for IMD quartiles								*p*-value[a]
		1 (most affluent)		2		3		4 (most deprived)		
		MEAN	95% CI	MEAN	95% CI	MEAN	95% CI	MEAN	95% CI	
All greenspaces	334	428	(415–442)	301	(286–315)	319	(306–333)	289	(277–300)	<0.001
Formal greenspaces	1758	1532	(1474–1590)	1816	(1758–1875)	1662	(1602–1722)	2020	(1955–2085)	<0.001
Informal greenspaces	481	626	(608–644)	471	(453–490)	438	(421–455)	390	(374–406)	<0.001
Natural greenspaces	570	680	(660–699)	510	(488–531)	571	(550–591)	521	(505–538)	<0.001
Young people's greenspaces	2207	1967	(1920–2014)	2846	(2784–2908)	2361	(2296–2426)	1654	(1618–1691)	<0.001
Sports greenspaces	1082	1111	(1083–1138)	1010	(984–1036)	972	(946–997)	1235	(1207–1262)	<0.001

Bristol, England, 2005.
CI, confidence intervals; IMD, index of multiple deprivation.
[a] From test for trend.