



Research Paper

Neighbourhood greenspace is related to physical activity in England, but only for dog owners

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ABSTRACT

Evidence supporting a positive association between neighbourhood greenspace and physical activity is equivocal. Using data from a large, nationally representative survey in England ($n = 280,790$), we found that while a positive relationship between the amount of neighbourhood greenspace and the odds of achieving recommended weekly physical activity existed for dog owners, no relationship was found for non-dog owners. The findings highlight the importance of neighbourhood greenspaces for supporting physical activity through dog walking in the UK context, but also raise the issue of how to encourage non-dog owners to use greenspaces in health-promoting ways. The results may also help to explain previously mixed findings in the international evidence base, and emphasise the need to adequately account for dog-ownership in future research exploring the relationship between greenspaces and physical activity.

1. Introduction

Although regular physical activity is beneficial for health (National Institute for Health, 2008; World Health Organization, 2009), the majority of adults in England do not meet guidelines of at least 150 min of moderate-intensity activity a week (Health and Social Care Information Centre, 2017). Attempts to increase physical activity have targeted known determinants at the individual, social and environmental level, with mixed success (Ding et al., 2012; National Institute for Health, 2012; Ogilvie et al., 2007). This study advances the field by focusing on the way in which two different determinants, neighbourhood greenspace and dog-ownership, interact to possibly explain some of the ambiguities in previous research.

Evidence that greater neighbourhood greenspace, by itself, is associated with more physical activity including walking and cycling is equivocal. While some studies report a positive relationship (Astell-Burt, Feng, & Kolt, 2014; Coombes, Jones, & Hillsdon, 2010; Giles-Corti et al., 2005; Richardson, Pearce, Mitchell, & Kingham, 2013; Wendel-Vos et al., 2004), others find no effect (Hillsdon, Panter, Foster, & Jones, 2006; Maas, Verheij, Spreeuwenberg, & Groenewegen, 2008; Ord, Mitchell, & Pearce, 2013), or even a negative relationship (Triguero-Mas et al., 2015). Even among positive relationship studies, many only find significant differences between the most and least green areas, rather than a 'dose-response' pattern (Astell-Burt et al., 2014; Duncan & Mummery, 2005; Perchoux, Kestens, Brondeel, & Chaix, 2015). Inconsistencies have been explained in terms of differing

operationalisations of greenspace (Klomp maker et al., 2018; Mytton, Townsend, Rutter, & Foster, 2012) and/or physical activity (Lachowycz & Jones, 2011), and variation in included confounders (James, Banay, Hart, & Loden, 2015). Within the confines of utilising the measures of greenspace, physical activity and common confounders available, the current research focused on dog ownership as a potentially important confounder that has been under-researched to date.

The relationship between dog-ownership and physical activity, independent of local greenspace, is clear, with several reviews reporting a positive relationship (Christian et al., 2013; Toohey & Rock, 2011). Although the effect is generally small (Westgarth, Christley, & Christian, 2014), longitudinal work supports a causal relationship (Cutt, Giles-Corti, Knui man, & Burke, 2007). Crucially for the current study, 'walking the dog' is the most frequent greenspace activity in England, accounting for over 44% of all visits ≥ 0 min (approx. 580 million annually; (White et al., 2016)). Given that dog owners walk their dogs for, on average, 160 min a week (Toohey & Rock, 2011), and that most dog walking takes place within 2 miles of home (Elliott, White, Taylor, & Herbert, 2015), some of the ambiguity in previous findings investigating the relationship between greenspace and physical activity might be due to not having fully accounted for dog-ownership.

The current work explored this issue using data from the Monitor of Engagement with the Natural Environment (MENE) survey, a repeat cross-sectional survey running in England since 2009. Our central hypothesis was that any positive relationship between the amount of neighbourhood greenspace and achieving physical activity

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recommendations would be stronger for dog owners than non-dog owners because neighbourhood greenspace is an important facilitator of regular dog walking, itself a contributor to physical activity. Although dogs in public spaces may also inhibit activity and enjoyment amongst non-dog owners (Christian et al., 2013; Toohey & Rock, 2011; Westgarth et al., 2014), we did not explore this possibility here.

2. Method

2.1. Participants

Participants were 280,790 individuals from the first six waves (2009/10–2014/15) of the MENE survey. The survey is commissioned by Natural England, a government body promoting public understanding of the natural environment, and is part of a face-to-face, nationally representative omnibus survey conducted across England throughout the year to reduce geographical and seasonal biases. Details on sampling protocols, to ensure representativeness, are available elsewhere (Natural England, 2017).

2.2. Physical activity

Physical activity was derived from the question: “In the past week, on how many days have you done a total of 30 min or more physical activity which was enough to raise your breathing rate? This may include sport, exercise, and brisk walking or cycling for recreation or to get to and from places, but should not include housework or physical activity that may be part of your job” (Natural England, 2017; p. 50). This single item has good test-retest reliability and correlates well with more detailed measures (Milton, Bull, & Bauman, 2011). As UK guidelines are for a minimum of 150 min of moderate physical activity a week and one way of achieving this is ≥ 5 days of 30 min (Bull and The Expert Working Groups, 2010), our outcome variable was whether or not the individual reported engaging in ≥ 5 days of ≥ 30 min of leisure- or transport-related physical activity (LTPA) in the last week (White, Wheeler, Herbert, Alcock, & Depledge, 2014).

2.3. Neighbourhood greenspace and covariates

Neighbourhoods were defined as the Lower-layer Super Output Area (LSOA) of respondent residence, where each LSOA ($n = 32,482$ in England) contains approximately 1500 people and has an average size of 4 km². Neighbourhood greenspace was derived from the Generalised Land Use Database which categorises the total land use in each LSOA, at a resolution of 10 m², into nine types: greenspace, domestic gardens, fresh water, domestic buildings, nondomestic buildings, roads, paths, railways, and other (Department for Communities and Local Government, 2007). ‘Greenspace’ (excluding domestic gardens) includes, playing fields, parks, woodlands and farmland, and on average, accounts for 40.5% of LSOA land use in our sample. To aid interpretation, we structured this into 5 equal bands of greenspace for each LSOA: 0–19.99%; 20–39.99%; 40–59.99%; 60–79.99% and 80–100%. LSOA data were missing for 2.7% of the sample, so final analyses included $n = 271,071$ participants.

Based on Census definitions, LSOAs are categorised as ‘Urban’ (LSOAs situated within a conurbation of $> 10,000$ inhabitants), ‘Town & Fringe’ (within peri-urban areas and smaller conurbations), or ‘Rural’ (within villages, hamlets and sparsely populated areas). We collapsed the first two categories into a single ‘urban-peri-urban’ category to have the widest spread of greenspace availability in the non-rural category. This aggregation also results in inclusion of relatively similar types of greenspace access within the ‘urban’ category (primarily parks, public gardens etc. in urban, peri-urban and town settings, as opposed to wider ‘countryside’ availability in more sparsely populated rural settings). This resulted in 92.8% of the sample categorised as urban-peri-urban and 7.2% as rural. The socio-economic characteristics of each LSOA

(including unemployment, education and crime) were taken from the 2004 Indices of Deprivation (Department for Communities and Local Government, 2008). We used the total Index of Multiple Deprivation (IMD) score, divided by ten to aid interpretation of regression coefficients (White et al., 2014).

2.4. Dog-ownership

Dog-ownership was assessed with the question: “Do you have a dog?”, ‘Yes’ or ‘No’.

2.5. Individual & time-related control variables

Individual level control variables included: sex (male = *reference*), age (16–34 years = *reference*, 35–64 years, ≥ 65 years), Socio-economic status (SES) classification based on occupation (A/B = high/intermediate managerial, professional; C1 = supervisory, clerical, junior managerial; C2 = skilled manual worker; D/E = semi, unskilled manual worker = *reference*), employment status (full-time, part-time, in education, not working, retired, unemployed/not working = *reference*), marital status (married/cohabiting vs. single/separated/divorced/widowed = *reference*), children in the household (≥ 1 vs. 0 = *reference*), ethnicity (White British vs. other = *reference*), long standing work/mobility limiting health issue (No vs. Yes = *reference*), and access to own car/van (Yes vs. No = *reference*). These factors have all been associated with physical activity (Giles-Corti & Donovan, 2002; Lachowycz & Jones, 2011; White et al., 2014) and/or dog-ownership (Westgarth et al., 2014) in previous research. We also controlled for season and survey year in case there was variance across season as a function of dog-ownership (Lail, McCormack, & Rock, 2011; Temple, Rhodes, & Higgins, 2011; Wu, Luben, & Jones, 2017).

2.6. Analysis strategy

Analyses were conducted in SPSS v23 and constituted a series of logistic regressions estimating the odds of an individual achieving ≥ 5 (vs. < 5) days of LTPA a week. Three core models were run: a) an unadjusted model of the relationship between neighbourhood greenspace and LTPA; b) the same relationship controlling for dog-ownership and area, individual and temporal controls; and c) a model including the interactions between dog-ownership and greenspace. Additional models were stratified by season (presented in Supplementary Materials) and run for urban settings only (because the vast majority of rural dwellers were already in the highest quintile of greenspace coverage).

3. Results

Full descriptives are presented in Supplementary Table A. The simple (unadjusted) relationship between neighbourhood greenspace, dog-ownership and LTPA can be seen in Table 1. These unadjusted results suggest that those in the greenest areas were more likely to achieve LTPA guidelines (24.8%) than those in the least green areas (21.7%), as were dog owners (34.9%) compared to non-dog owners (19.1%). When stratified on dog-ownership, the relationship between greenspace and LTPA was positive for dog owners (from 33.4% in the least green neighbourhoods to 38.4% in the greenest), but not non-dog owners (from 19.2% to 18.8%).

Table 2 presents the logistic regression models. Model 2 shows that after all covariates are included, a significant relationship between greenspace and LTPA persists. This model also suggests that urban residents, females, older adults, those with a long-term illness or disability, and those in higher social grades were less likely to report meeting physical activity guidelines. White British participants, those unemployed/not working, and those interviewed in spring, summer and autumn (vs. winter) were more likely to report meeting guidelines.

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