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Urban greenspace, physical activity and wellbeing: The moderating role of perceptions of neighbourhood affability and incivility

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ABSTRACT

The built environment can affect a resident's health and wellbeing. Land use planning has the potential promote the health and wellbeing of residents. The provision of greener urban environments is one mechanism through which land use planners might achieve this end. The purpose of this study is to examine how greenspace and physical activity may provide synergistic wellbeing benefits and how any such hypothesised synergy might depend on a resident's perceptions of neighbourhood affability and incivility. Using data from the Household, Income and Labour Dynamics in Australia (HILDA) survey and Geographic Information Systems (GIS), the results suggest that a friendlier and more supportive neighbourhood amplifies (by more than 10 times) the greenspace and physical activity synergy. In contrast, the results suggest that residents who engage in physical activity and have higher levels of greenspace in their local area suffer a wellbeing burden where the resident perceives higher levels of incivility in the neighbourhood. While certainly not without their own limitations, these results extend on existing research efforts directed at disentangling the complexity underpinning the links between greenspace, physical activity and wellbeing. Moreover, the findings reported in this study may prove useful to land use planners and policy makers seeking to reconcile the challenges of maintaining or improving residents' wellbeing in the face of pervasive neighbourhood perceptions, continuing population growth and declining per capita greenspace.

1. Introduction

The significance of the built environment for health and wellbeing is widely acknowledged (Barton, 2009; World Health Organization, 2010a,b). Land use planning has the potential to create built environments that promote the health and wellbeing of residents. Access to greenspace is a promising channel through which planning can support the health and wellbeing of residents (Barton, 2009; Carmichael et al., 2013).

The availability of greenspace in a resident's neighbourhood is thought to promote physical activity (Coombes et al., 2010), a substantial portion of which occurs within the boundaries of neighbourhoods (Hurvitz et al., 2014). The findings to date though are not unequivocal. For instance, evidence for an area of metropolitan Perth, Western Australia indicates that residents with very good access to large and attractive public open spaces are more likely to engage in higher levels of walking (Giles-Corti et al., 2005). However, in comparison, results from a cross-sectional study of two study areas (St. Louis, Missouri and Savannah, Georgia) in the United States report suggest that greenspace within a 5 min walk is not related to meeting physical activity guidelines and that other individual and environmental factors represent the antecedents to engagement in the recommended amount of physical activity (Hoehner et al., 2005). A similar result is observed by Hillsdon et al. (2006) among a cohort of middle-to-older age adults located in the city of Norwich, England and echoed by Maas et al. (2008) for the Netherlands. Coombes et al. (2010) provide more recent evidence for the city of Bristol, England that indicates living close to formal greenspaces (those with an organised layout and structured path network, and generally well maintained) is associated with a greater likelihood of achieving recommended levels of physical activity. Nevertheless, Mytton et al. (2012) and Mitchell (2013) unsettle the very foundations of the hypothesised relationship noting that such a link may not be explained by physical activity undertaken in green spaces. It may be the case that statistically significant associations actually reflect some omitted variable(s).

Beyond the well-established physiological and psychological benefits of physical activity (US Department of Health, 1996), there is a subset of the literature which concerns itself with the co-benefits of 'green exercise' (cf. Astell-Burt et al., 2013; Bodin and Hartig, 2003; Gladwell et al., 2013; Hug et al., 2009; Mitchell, 2013; Pretty et al., 2007; Sugiyama and Ward Thompson, 2008;

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Thompson Coon et al., 2011; Ward Thompson et al., 2012, inter alia). These co-benefits relate to psychological and even physiological benefits of natural environments in terms of reducing stress (Ulrich et al., 1991) and rejuvenating directed attentional capacity (Kaplan, 1995). Further synergistic benefits report include but are not limited to: improvements in social connectedness; greater appreciation of nature; enhanced mood, increased self-esteem, heightened vigour; and reduced feelings of anger, depression, tension and fatigue. It is argued that wellbeing (mental health) is improved by the enjoyment derived from spending time with other people, getting out into the fresh air, the scenery, the wildlife and participating in exercise itself (Barton et al., 2009; Peacock et al., 2007; Pretty et al., 2007). The hypothesised synergy between physical activity and greenspace is thought to improve the efficacy and longevity of physical activity interventions and concomitantly aid in informing residents on the importance of protecting the natural environment and embracing sustainable development (Thompson Coon et al., 2011).

However, despite the best efforts of earlier investigators a number of caveats remain (Mitchell, 2013). Thompson Coon et al. (2011) lament the research design problems they identified which hamper the interpretation and extrapolation of findings. For instance: small sample sizes; unrepresentative samples (often comprised of university students or already highly motivated participants); little geographic variation (most studies reviewed were conducted within university campuses in the United States); little information on participants (factors such as age and physical health which may confound results); a lack of independent assessment of participant outcomes and heterogeneous outcome measures which are not easily transferable.

Further and more carefully designed research is needed (Gladwell et al., 2013; Thompson Coon et al., 2011). The approach of this study involves matches data from the Household, Income and Labour Dynamics in Australia (HILDA) survey, a large spatially referenced national probability sample of Australians, to Geographic Information Systems (GIS) data. Quite unique in this literature this study employs a cluster-specific fixed effects estimator. An estimator which features more prominently in the applied microeconomics literature (cf. Shields et al., 2009), this estimator uses deviations of the dependent and independent variables from their broader local area (the Local Government Area (LGA) more specifically) means to identify the (moderated) association between greenspace and wellbeing (the measures for which importantly vary within the broader local area). In doing so, this technique allows for potentially confounding influences unique to the local area to be differentiated out using multiple observations (multiple residents) per local area. These potential confounders would otherwise lead to biased and inconsistent estimates (Cameron and Trivedi, 2009, 2010).

Despite the abovementioned criticisms of this increasingly active area of scholarly inquiry there are also studies which inspire optimism. In a particularly novel exploratory study (n = 25) Ward Thompson et al. (2012) use ecologically valid objective measures of stress (diurnal patterns of cortisol) to identify the links between exposure to greenspace and stress. The results point to greener environments offering better opportunities for moderating or coping with stress through pathways other than those related to physical activity. In contrast, in a large study of 260,061 middle-to-older age Australians Astell-Burt et al. (2013) investigate an interaction (explicitly operationalised) between greenspace and physical activity levels and observe that more greenspace in one's neighbourhood is associated with a lower likelihood of experiencing psychological distress for more physically active residents (although not for more sedentary residents). While such research efforts admirable further research is required to reach a definitive conclusion regarding the greenspace and physical activity synergy.

In particular, it may be the case that the triadic relationship between greenspace, physical activity and wellbeing is in fact be more complicated than has tended to be hypothesised. Different types of environment may elicit different psychological responses (Mitchell, 2013). Thus, the realisation of hypothesised synergistic benefits may be contingent on particular individual, social environmental and physical environmental conditions such as fear of crime in the neighbourhood (cf. Sreetheran and van den Bosch, 2014) or different dimensions of a resident's social environment (cf. McNeill et al., 2006). It may be that a resident's perceptions of neighbourhood affability[1] or incivility[2] motivate a resident's actions, which have their own implicit and explicit costs and benefits (Becker, 1968) and hence, implications for wellbeing.

This is a point which accords with earlier related research efforts into the link between greenspace and physical activity which identifies "...the potential moderating effects of factors such as social fragmentation or indicators of neighbourhood quality such as crime and disorder..." (Coombes et al., 2010). Relatedly, there remains is a need for studies "...to recognise and identify neighbourhood level and individual level factors that may moderate the strength of association between neighbourhood influences and physical activity...." (Li et al., 2005). In a single equation model one could expect this to be operationalised as a three-way interaction effect (e.g. greenspace × physical activity × affability of the neighbourhood).

The purpose of this study is to fill this gap in the literature and do so in a manner that circumvents methodological problems reported elsewhere. In doing so for the case of major Australian cities this study extends on earlier research efforts which seek to disentangle the complexity underpinning the links between greenspace, physical activity and wellbeing. Furthermore, the findings reported in this study may prove relevant to land use planners seeking to cultivate healthier and happier cities (Ballas, 2013) given the broader challenges posed by continuing population growth and declining per capita greenspace in cities. In what follows, Section 2 reports the method and data employed. Section 3 provides an account of the results. Finally, Section 4 discusses the findings and concludes.

2. Method

This section details the method and data employed to undertake this investigation. Section 2.1 describes Eq. (1). Section 2.2 describes Eq. (2). Section 2.3 explains the fixed effects estimation technique used throughout this study. Finally, Sections 2.4 and 2.5 describe the HILDA data and GIS data respectively.

2.1. Eq. (1)

To examine the hypothesised greenspace and physical activity synergy wellbeing is modelled using a cluster-specific fixed effects model as show in Eq. (1):

$$WB_{r,k} = \omega + \sum_{j=1}^{m} \beta_j x_{jr,k} + \gamma x_{r,k} y_{r,k} + \kappa_k + \varepsilon_{r,k} \quad (1)$$

Where, dependent variable $WB_{r,k}$ represents a resident's mental health. $x_{jr,k}$ denotes variables $j = 1...m$. These variables include: physical activity, greenspace and a number of socioeconomic variables. These socioeconomic variables these include for example; age, gender, ethnicity, health; similar to earlier studies of wellbeing

[1] Neighbourhood affability is defined as a resident's perceptions of behaviours in the neighbourhood being friendly or convivial in nature.

[2] Neighbourhood incivility is defined as a resident's perceptions of behaviours in the neighbourhood being characterised as unsociable or offensive.