



## Perspective Essay

## Towards a better understanding of the relationship between greenspace and health: Development of a theoretical framework

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## HIGHLIGHTS

- ▶ We develop a framework which documents relationships between greenspace and health.
- ▶ The framework highlights key mediators which underpin the relationship.
- ▶ Moderators affect the relationship, such as socio-economic status and greenspace type.
- ▶ The framework can be used to inform and improve planning of research studies.

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## ABSTRACT

A growing body of evidence investigates whether access to greenspace, such as parks and woodland, is beneficial to well-being. Potential health benefits of greenspace exposure include opportunity for activities within the space and psychological benefits of viewing and interacting with nature. However, empirical research evidence on the effects of greenspace exposure shows mixed findings. Hence we suggest that the key questions of “if, why and how?” greenspace influences health remain largely unanswered. We argue that researchers have inadequately considered the causal pathways which drive the relationship. In particular, an improved understanding is needed of potential mediators and moderators. In this paper we draw on social–ecological theories and a review of the literature to develop a novel theoretical framework which summarises current knowledge about hypothetical causal pathways between access to greenspace and health outcomes. The framework highlights how mediators – such as use of greenspace and perceptions of the living environment – drive associations between access and both physical and psychological health outcomes. We propose key moderators based on evidence that associations between greenspace and health differ by demographic factors such as gender, ethnicity and socio-economic status, living context, greenspace type and climate. We discuss the evidence for how and why these factors act as moderators and consider the implications which arise from this improved understanding of the relationship between greenspace and health. In conclusion, we discuss how the framework can be used to inform planning of research studies, and how it may be developed in the future as more evidence emerges.

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## 1. Introduction

Social–ecological models of health seek to explain how environments in which people live and work offer constraints and opportunities for individuals to engage in health-promoting and demoting behaviours (Sallis, Owen, & Fisher, 2008). One environmental factor that has particular potential to influence health is availability of greenspace. Definitions of what constitutes

greenspace are subjective and vary widely, but broadly encompass publicly accessible areas with natural vegetation, such as grass, plants or trees (e.g. CDC, 2009; Kit Campbell Associates, 2001). They include built environment features, such as urban parks, as well as less managed areas, including woodland and nature reserves.

Greenspace is important because of its multifaceted potential to influence health. It can be a resource for physical activity if used for walking, running, cycling and sports, all actions for which health benefits are well established (Manley, 2004). The wider benefits of experiencing ‘green’ environments are well documented, stemming from the seminal research by Kaplan and Kaplan in the 1980s which outlined the psychological benefits of experiencing nature (Kaplan & Talbot, 1983). Recent research has shown

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that time in natural environments is associated with reduced negative emotions and better energy levels, attention span and feelings of tranquillity compared with being in synthetic settings (Bowler, Buyung-Ali, Knight, & Pullin, 2010). There are also wider non-physical potential benefits of greenspace (Lee & Maheswaran, 2010), such as promoting social cohesion by providing areas for people to participate in group activities (Maas, van Dillen, Verheij, & Groenewegen, 2008).

Given the evidence for the potential health value of greenspace, it follows that there may be health benefits to living and working in neighbourhoods which have good availability of public green areas. Indeed, access to greenery has historically been regarded as important in urban planning, evidenced by examples such as widespread creation of public parks in the UK during the Victorian era (Walker & Duffield, 1983). Recently there has been a re-emergence of the recognition of the importance of greenspaces when planning for healthy communities and a simultaneous proliferation of new studies examining associations between greenspace exposure and health, summarised in a number of systematic reviews (Kaczynski & Henderson, 2007; Lachowycz & Jones, 2011; Lee & Maheswaran, 2010).

Given the theoretical importance of greenspace it is perhaps surprising that, whilst some studies have reported evidence of positive associations between greenspace access and health, others have shown little or no relationship and some have even found negative associations. In a systematic review of 50 quantitative studies examining relationships between greenspace access and physical activity, 20 reported positive associations (higher physical activity with increased greenspace access), 15 were weak or mixed, 2 were negative and 13 found no evidence of any association (Lachowycz & Jones, 2011). Furthermore, several studies found associations only for certain groups, in particular areas or for particular types of greenspace, suggesting relationships are sensitive to specific populations and geographical areas. For example, within studies looking at greenspace access and BMI, Scott et al. found that relationships differed by ethnic group (2009) and others found that associations with BMI are only present for certain types of greenspace (Potwarka, Kaczynski, & Flack, 2008; Witten, Hiscock, Pearce, & Blakely, 2008). The equivocal nature of the research evidence may in part reflect the disparate nature of study designs. This may partially result from the fact that there is no comprehensive evidence-based conceptual framework which documents key theoretical relationships and specifies likely causal mechanisms by which greenspace may influence health. Indeed, the need to generate improved theoretical models is well recognised in literature discussing socio-ecological approaches (Sallis et al., 2008). There is also recognition of the need to identify mediators and moderators, terms which are commonly confused across the literature, particularly in topics such as this where research findings are mixed (Baron & Kenny, 1986; Bauman, Sallis, Dzewaltowski, & Owen, 2002).

We argue the lack of theoretical models means that research on links between access to greenspace and health is often based on loosely defined theoretical concepts, with little consideration of what particular casual pathways are being tested. An improved understanding of potential mediators, which sit on the causal pathway between greenspace access and health, could assist interpretation of research findings and help future studies test specific pathways of influence. In addition, identification of moderating factors which alter the strength or direction of associations could improve understanding of which groups benefit most from greenspace exposure, enabling planners to better identify when and how greenspace provision may lead to health improvement.

In this paper we present a novel conceptual framework which illustrates the theoretical relationship between access to greenspace and health. The framework documents key hypothesised causal pathways and illustrates potential moderating and

mediating factors. The framework is then discussed in relation to available evidence, with a particular focus on factors which studies have identified as potential moderators. In conclusion, we consider future use and development of the framework to assist planning of research studies and target greenspace provision for population health gains.

## 2. Development of a theoretical framework for greenspace and health

To develop our framework we undertook a comprehensive, although not systematic, review. Using search terms including green space, open space, nature and park (for a full list see Lachowycz & Jones, 2011), we searched relevant databases (SCOPUS, Medline, Embase and PYSCHINFO) to identify quantitative studies which looked at greenspace access in relation to health outcomes, including markers of general health and morbidity, measures of mental health and wellbeing, and physical activity behaviours. We consulted key examples of existing socio-ecological models looking at environmental influences on health and health-related behaviours, including mental health and physical activity (for a summary of models see Sallis et al., 2008). We reviewed available quantitative studies investigating relationships between greenspace access and health, drawing on systematic reviews (Kaczynski & Henderson, 2007; Lachowycz & Jones, 2011; Lee & Maheswaran, 2010), but expanding to include other articles that contained relevant material to the production of our framework. The reference lists of identified studies were also reviewed and we used reverse snowballing to identify more recent publications. We also looked at references within the grey literature, found through searching the internet and checking key websites (e.g. Commission for Architecture and the Built Environment (CABE) and Government sites).

Drawing on the literature, we documented hypothetical causal explanations for how objectively measured greenspace access could lead to health improvement, therefore identifying potential health outcomes and mediators. We then reviewed the studies to identify factors for which evidence exists of them acting as a moderator, i.e. stratification by the variable has resulted in different strengths of relationship between greenspace exposure and the health outcome. In addition, we included some factors not yet empirically tested, but for which we believe there is good theoretical basis to suggest they may act as moderators.

The resultant framework, shown in Fig. 1, illustrates the hypothetical causal pathway between access to greenspace and health outcomes. Along this pathway we illustrate the main tiers of moderating factors, the mechanisms of moderation and the key processes of mediation. We discuss the evidence used to construct the framework below, working in reverse, as this was the order used to construct the framework. We hence first discuss the health outcomes, then the pathways of mediation which result in these outcomes and end with a discussion of the moderating factors and mechanisms of moderation.

### 2.1. Health outcomes

The potential health outcomes resulting from greenspace exposure are discussed extensively across the literature. Our framework categorises these outcomes into two broad groups: physical and psychological. This dichotomy is commonly used, with physical health benefits generally attributed to physical activities within greenspace, and psychological benefits gained from exposure to nature and social interactions. This dichotomy belies the interaction between physical and mental health outcomes and, therefore, our framework shows them as interacting states and does not

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