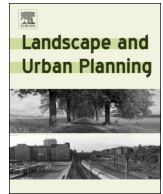




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Perspective Essay

## Advantages of public green spaces in enhancing population health

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## ABSTRACT

Since the burden of chronic diseases is rising globally, there is an urgent need to develop population-level approaches to reducing the risk of chronic diseases. Neighborhood environments, where people spend much of their time, are relevant in this context because they can influence residents' daily behaviors related to health. In particular, public green spaces (PGS) can confer health benefits through facilitating physical activity, contact with nature, and social interaction. PGS may also mitigate socio-economic inequalities in health. However, despite growing evidence, PGS are generally not fully utilized as a resource for physical activity. Thus, there is substantial scope for enhancing population health through increased visits and active use of PGS. This essay argues that PGS are not only health-enhancing but also practical and workable environmental resources to promote population health. We discuss three "advantages" of using PGS as health promotion initiatives: PGS are easier to modify (than are other structural environmental features); PGS can involve programs to help residents initiate physical activity; and PGS are valued by residents. The essay concludes with a discussion of future research topics, the result of which can be used to convince and assist local authorities and other key stakeholders to use PGS as readily available resources for health promotion.

## 1. Introduction

Chronic diseases, which include heart diseases, cancers, diabetes, respiratory diseases, and mental disorders, are the leading cause of poor health, disability, and death (World Health Organization., 2014). The burden of chronic diseases is rising globally with the contribution of chronic diseases to the total number of deaths increasing from approximately 60% in 2001 to 68% in 2012 (World Health Organization, 2014). Chronic diseases consume high levels of health care resources for treatment, and have an enduring detrimental impact on people's quality of life. In the case of mental disorders, health systems are failing to meet the demand for mental health treatment (World Health Organization., 2013). Since many chronic diseases are preventable, there has been a call for population-wide preventative action to address behavioral risk factors that contribute to chronic diseases, which include smoking, physical inactivity, alcohol consumption, and an unhealthy diet (Bauer, Briss, Goodman, & Bowman, 2014). An important concept in epidemiology is that a large number of people at a small risk may produce more cases of disease than the small number exposed to high risk (Rose, 1985). Along with programs targeting high-risk

individuals, more effort in population-based approaches, which aim at lowering the level of risk for the population, is needed to reduce the burden of chronic diseases and enhance population health.

To lower the risk of chronic diseases, "health behaviors" discussed above need to be modified. This is a challenging task, given that our daily behaviors are highly habitual (Marteau, Hollands, & Fletcher, 2012). An example of a successful population-based behavioral change program to prevent chronic diseases is tobacco cessation. In Australia, adult smoking rates decreased from 35% in 1980 to 13% in 2013, which contributed to declining deaths due to heart disease and stroke (Willcox, 2014). The significant reduction in smoking rates was attributable to a comprehensive effort acting on a wide range of determinants: health promotion campaigns, regulation (e.g., prohibiting smoking in public places, limiting tobacco advertising), and taxation worked together to achieve the reduction (Australian Institute of Health & Welfare, 2014). Such concerted multi-sectoral collaboration is key to effective population-based approaches to promoting people's health.

Physical inactivity, which is one of the major risk factors of chronic diseases (World Health Organization, 2014), is also habitual and requires multi-sectoral efforts influencing wider determinants to

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stimulate behavioral change. A non-health sector considered to contribute to addressing physical inactivity is urban design and planning. How neighborhood environments are designed and built can influence residents' daily physical activity such as walking (Sallis, Floyd, Rodríguez, & Saelens, 2012), which is known to have preventative effects on chronic diseases (Kelly et al., 2014; Murtagh, Murphy, & Boone-Heinonen, 2010). Among environmental features/elements, this essay discusses the role of public green spaces (PGS), which include parks, trails, nature reserves, and urban forest, in promoting physical activity and enhancing population health. Historically, PGS has been integrated into efforts to enhance population health (Ward Thompson, 2011). For instance, the Garden City Movement, proposed by Ebenezer Howard, integrated green space into settlements in response to overcrowding and unhygienic living conditions in cities following the Industrial Revolution in the U.K. (Howard, 1902). Frederick Law Olmsted, an influential landscape architect in the 19th century in the U.S.A., also designed urban parks as places that counteracted unhealthy urban environments (Sutton, 1971). We argue in this perspective essay that PGS have a unique and practical capacity to contribute to human health in our society. We briefly summarize the health benefits of PGS first, then discuss practical advantages of using PGS in reducing risk of chronic diseases and enhancing population health.

## 2. Health benefits of PGS

Some evidence suggests that PGS can provide health benefits (Lee & Maheswaran, 2011; Tzoulas et al., 2007). A framework developed building on existing research has conceptualized that PGS confer health benefits through facilitating physical activity, contact with nature, and social interaction (Lachowycz & Jones, 2013). In the following, we outline several pathways through which the use of PGS can benefit human health.

PGS provide a venue for residents to engage in recreational physical activity within its boundaries and as a walkable destination (Koohsari et al., 2015). Studies have shown that the presence of and access to PGS are positively associated with physical activity among youth (Limstrand, 2008; Oliveira, Moreira, Abreu, Mota, & Santos, 2013), adults (Kaczynski, Potwarka, & Saelens, 2008; Sallis et al., 2016), and older adults (Eronen, von Bonsdorff, Rantakokko, & Rantanen, 2014; Rosso, Auchincloss, & Michael, 2011). However, non-significant associations of PGS with physical activity have also been reported (Maas, Verheij, Spreeuwenberg, & Groenewegen, 2008; Saelens et al., 2012; Schipperijn, Bentsen, Troelsen, Toftager, & Stigsdotter, 2013; Triguero-Mas et al., 2015), suggesting that some PGS are not performing well as a physical activity facility. It can be argued that PGS in general have the capacity to enable participation in physical activity, but some are not well-resourced or may pose safety concerns, which can act as a barrier (Cohen et al., 2010). This can be interpreted as suggesting the potential of PGS to further promote physical activity.

Research has also shown mental health benefits of PGS. It has been found that the presence of and access to PGS are associated with better mental well-being (Sturm & Cohen, 2014; Wood, Hooper, Foster, & Bull, 2017). Stress, which is common in modern life, is a known risk factor of mental illness such as depression (Cohen, Janicki-Deverts, & Miller, 2007). Research suggests that PGS can alleviate stress. It has been shown that a greater amount of PGS is associated with lower levels of stress measured by cortisol (Ward Thompson et al., 2012) and with a lower risk of psychological distress (Astell-Burt, Feng, & Kolt, 2013). Contact with nature is likely to be a key factor as physical and visual exposure to green space has been shown to be associated with lower stress (Hazer, Formica, Dieterlen, & Morley, 2018; Honold, Lakes, Beyer, & van der Meer, 2016), and to produce positive physiological responses indicative of a relaxed state (Tsunetsugu et al., 2013). Evidence also suggests that physical activity in natural settings is more beneficial to mental health than physical activity in other settings (Hartig, Evans, Jamner, Davis, & Garling, 2003; Mitchell, 2013). PGS

may also facilitate incidental social interaction among nearby residents (Kazmierczak, 2013), and social ties developed in PGS can contribute to mental health. The importance of social ties on mental health is well known (Umberson & Montez, 2010). PGS can help nurture “weak ties”, i.e., interaction with people on the periphery of one's social network (e.g., neighbors), which are known to have positive effect on mental well-being (Sandstrom & Dunn, 2014).

Another potential benefit of PGS is that they might mitigate health inequalities between those living in low and high socio-economic status (SES) areas. A study in England reported that differences in mortality (from all causes and from cardiovascular disease) between low and high SES areas were less pronounced among those who had the highest exposure to green space (Mitchell & Popham, 2008). It was also found that higher levels of greenness were associated with reduced risk of chronic diseases and mental health problems (depression) more strongly among residents of lower SES neighborhoods, in comparison to those of higher SES neighborhoods (Brown et al., 2016; Brown et al., 2018), suggesting a possibility that the presence of greenspace may mitigate socio-economic disparity in health. It should be noted that these studies examined all types of greenspaces in the neighborhood, including non-public greenspaces. We will further discuss how PGS may contribute to narrowing the health gaps in the Discussion section.

## 3. Advantages of PGS for enhancing population health

Despite growing evidence on the health benefits of PGS, they are generally not used to their full capacity as a resource for physical activity. For instance, a study in which participant's activities and their location were identified using accelerometer and global positioning systems data found that only 3% of light physical activity, 5% of lower moderate physical activity, and 8% of moderate-to-vigorous physical activity was conducted in PGS (Evenson, Wen, Hillier, & Cohen, 2013). It has been also shown that the majority of PGS use is sedentary or low in activity level: a study observing two metropolitan parks in Australia (size: 120 ha and 329 ha, with facilities such as walking/cycling paths and playgrounds) found that over 60% of the users observed were either standing, sitting, or lying (Veitch et al., 2015). Another observational study in the U.S. found that 68% of the individuals observed in 30 urban parks were sedentary (Cohen et al., 2010). Thus, there is substantial scope for enhancing population health through increased visits and active use of PGS. A few commentary papers have already emphasized the health benefits of natural spaces including PGS (Lachowycz & Jones, 2013; Shanahan et al., 2015). We argue in this essay that PGS are not only health-enhancing but also practical and workable environmental resources for health promotion, and describe their specific advantages compared with initiatives involving other neighborhood environmental attributes, such as population density, street connectivity, land use diversity, and access to public transit.

### 3.1. PGS are easier to modify (compared to other features of the built environment)

A major challenge in urban design/planning approaches to health promotion is the difficulties associated with modifying existing environments. For instance, access to utilitarian destinations (e.g., local shops and services) is known to be a strong predictor of walking for transport (Sugiyama, Neuhaus, Cole, Giles-Corti, & Owen, 2012); however, it is not easy to increase these destinations in existing neighborhoods. Simply assigning commercial use to more land is unlikely to be effective: higher population density is needed to attract and support more shops and services. Similarly, other factors that can facilitate active travel, such as well-connected street layout and infrastructure for public transport, are structural elements of the built environment and are difficult to change in existing neighborhoods. In contrast, existing PGS are considered by a range of stakeholders to be relatively easy to modify (Stankov, Howard, Daniel, & Cargo, 2017).

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