



A review on the effects of physical built environment attributes on enhancing walking and cycling activity levels within residential neighborhoods



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ABSTRACT

The growing worldwide awareness of the significant impacts of physical activities on physical and physiological health has aroused great interest in the role of the physical built environment plays in walking and cycling activities. This comprehensive review shows how specific details of the built environment enhance people's walking and cycling. This was accomplished through identifying the barriers to walking and cycling activities as well as the general and specific characteristics of the major physical built environment attributes within a residential neighborhood that can help overcome these barriers and enhance the walking and cycling activity levels. Also the effectiveness of some individual attributes was also compared. Of particular value of this study is that its structure and level of details of information laid out in this review can facilitate building designers and neighborhood planners in creating a supportive environment within residential neighborhoods.

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1. Introduction

Sedentary and physical inactive lifestyles have been adopted by a significant proportion of people in countries around the world (Van Dyck et al., 2013). More than 30% of the adults in the 122 countries around the world (Hallal et al., 2012) were found to be physically inactive, a figure that increases to nearly half of Americans (Hallal et al., 2012; Parks, 2003). Only 43% of adults in Australia were found to be able to meet the “sufficiently active” threshold between 2011 and 2012 (Australian Institute of Health & Welfare, 2003). The trend has also been spread to developing countries. 18% of the population in less developed countries were found to be physically inactive compared to 27% in developed countries (Dumith, Hallal, Reis, & Kohl, 2011). The average physical activity level of Chinese adults decreased by more than 30% from 1999 to 2006 (Ng, Norton, & Popkin, 2009), and 80% of adolescents were found to be physically inactive (Chen, Zheng, Yi, & Yao, 2014). 12% of Chinese students reported that they only exercised when they were not in school (Tudor-Locke, Ainsworth, Adair, Du, & Popkin, 2003). About 43% men and 46% women adults in South Africa were physically inactive between 2002 and 2003 (Guthold, Ono, Strong, Chatterji, & Morabia, 2008). Worse still, the sedentary rates are expected to grow.

People lacking adequate physical activities suffer from higher risks of overweight and obesity. Overweight and obese individuals are exposed to higher risks of Type 2 diabetes (Burchfiel et al., 1995; Katzmarzyk,

Church, Craig, & Bouchard, 2009), osteoporosis (Schmitt, Schmitt, & Dören, 2009), metabolic syndrome (Healy et al., 2008; Swinburn & Shelly, 2008), high blood cholesterol level (Craig, Bandini, Lichtenstein, Schaefer, & Dietz, 1996; Healy et al., 2008; Katzmarzyk et al., 2009; Swinburn & Shelly, 2008), and chronic diseases as a result of increasing blood lipids and blood pressure (Dunstan et al., 2010; Healy et al., 2008; Katzmarzyk et al., 2009). Also, they suffer from higher risks of colon cancer (Dunstan et al., 2010) and ischemic heart disease (Sesso, Paffenbarger, & Lee, 2000) and even the possibility of premature death (Blair, 1989; Inoue et al., 2008). The chance of overweight and obesity can be reduced by increasing energy expenditure, which can be achieved by increasing the physical activity level.

Besides improving the physical health conditions, physical activity can also benefit people physiologically by exerting positive influences on their mental health. Physical activity can improve emotion, sense of recognition, whole life quality, anxiety neurosis (Ohmatsu et al., 2014), and reduce pressure (Kario, Schwartz, Davidson, & Pickering, 2001; Vancampfort et al., 2014) and depression (Dunn, Trivedi, & O'Neal, 2001). Also, physical activity has been linked to sociality (Lee, 2011). Physical activity can improve the self-esteem of young girls and elders, and also increase their body size satisfaction (Dishman et al., 2006; McAuley et al., 2005), strengthen their confidence on getting in touch with others. In addition, some forms of physical activity can improve the sense of belonging of community of residents while some can be used by parents to enhance family's cohesion via children games.

In view of its profound impacts on health and well-being, it is vital to identify the major factors that affect individuals' physical activity levels. Fig. 1 shows that apart from human factors (i.e. personal and social factors), natural and built environment characteristics also play an

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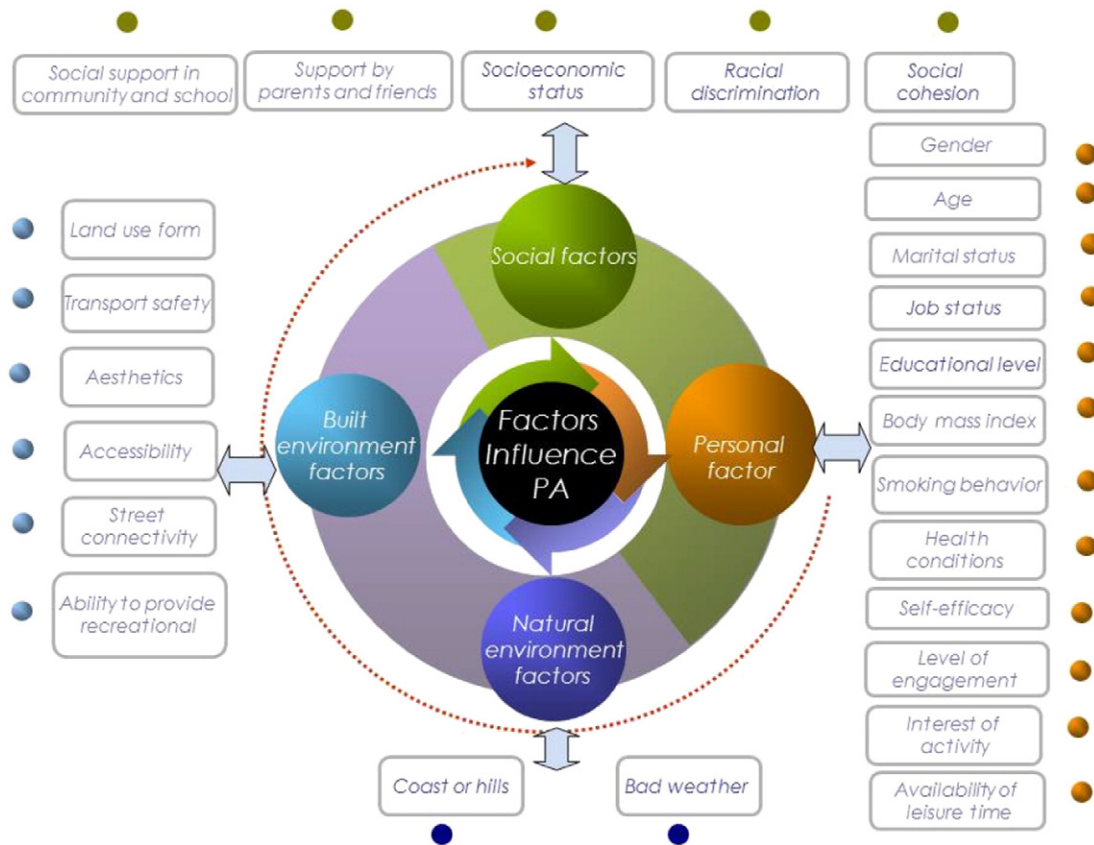


Fig. 1. Factors influencing an individual's physical activity level.

important role on an individual's physical activity level (Dahlgren & Whitehead, 1991; Kahn et al., 2002; Leslie et al., 1999).

Outdoor natural environment can produce either positive or negative influences on individual's physical activity levels. Natural environments are more exposed to uncontrollable extreme weather conditions which may induce discomfort or even may pose health threats. Inclement weather with hot and cold seasons lowered the participation rate, frequency and duration of physical activity (Spinney & Millward, 2011). Bad weather was found to be a major obstacle to doing exercise (Chan & Ryan, 2009; Weir, Etelson, & Brand, 2006) especially for elders (Sumukadas, Witham, Struthers, & McMurdo, 2009) and students (Bélanger et al., 2009). Fear of some kinds of sickness caused by weather, e.g. asthma, rheumatoid arthritis might also lower people's activity levels (Chan & Ryan, 2009). Besides, high level of pollution was one of the strong environmental barriers to physical activities for leisure (Singhal & Siddhu, 2014).

People generally more prefer to undertake walking and cycling activities in places surrounded by natural sceneries, e.g. coasts and hills (World Health Organization, 2006). Other physical conditions and characteristics of built environment also exert influences on individuals' walking and cycling activity levels. They include land use form (Frank, Schmid, Sallis, Chapman, & Saelens, 2005), transport safety (Hoehner, Brennan Ramirez, Elliott, Handy, & Brownson, 2005; Owen, Humpel, Leslie, Bauman, & Sallis, 2004) and security (Addy et al., 2004; Foster & Giles-Corti, 2008; Giles-Corti & Donovan, 2002a; Humpel, Owen, & Leslie, 2002; King et al., 2000; Shigematsu et al., 2009; Van Dyck et al., 2013), esthetic appearance of the surrounding environment (Owen et al., 2004), accessibility of facilities (Kirtland et al., 2003), street connectivity (Owen et al., 2007; Shigematsu et al., 2009), and the ability to provide recreational opportunities (World Health Organization, 2010).

Among all the physical built environment characteristics, some act as motivators for physical activities (Addy et al., 2004; Humpel et al.,

2002; Witten et al., 2012), which are defined as the forces acting on a person to initiate physical activity. Convenient transport (Ball, Bauman, Leslie, & Owen, 2001), public transit (Hoehner et al., 2005), activity destination (Addy et al., 2004; Giles-Corti & Donovan, 2002b; Lopez & Hynes, 2006), esthetics and pleasant sceneries (Giles-Corti & Donovan, 2002a; Inoue et al., 2010; McCormack et al., 2004; Owen et al., 2004; Shigematsu et al., 2009; Van Dyck et al., 2013), bicycle parking spaces (Pikora, Giles-Corti, Bull, Jamrozik, & Donovan, 2003; Pucher, Dill, & Handy, 2010; Sallis, Frank, Saelens, & Kraft, 2004), proper trail surface (Brownson et al., 2000) and well-maintained neighborhoods (Hoehner et al., 2005) are all powerful motivators for physical activity. On the other hand, other physical built environment conditions and characteristics act as barriers to physical activities (Addy et al., 2004; Humpel et al., 2002; Witten et al., 2012), which are defined as obstacles to engaging in behavior which might otherwise help prevent physical activity. City sprawl (Lopez & Hynes, 2006), unpleasant vistas (Ball et al., 2001; King et al., 2000), ill-maintained roads and facilities (Bedimo-Rung, Mowen, & Cohen, 2005), a dirty environment (with dog waste) (McCormack, Rock, Toohey, & Hignell, 2010), garbage, or broken glass (Bedimo-Rung et al., 2005) have all been shown to produce negative effects on physical activity.

Among all different types of physical activities, walking and cycling activities have been receiving greater attention from both civic and academic communities lately as a means to boost individuals' physical activity levels. A number of reasons contributed to their popularity. Firstly, walking and cycling are suitable for all age groups as they do not require special skills or facilities. Secondly, walking and cycling allow people to choose their own favorite movement intensity notwithstanding that cycling is more suitable for longer trips. Thirdly, walking and cycling can also help people, especially those from the low income groups, to break out of their sedentary and inactive lifestyles (Brownson et al., 2000).

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