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Research paper

Examining neighborhood influences on leisure-time walking in older Korean adults using an extended theory of planned behavior

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HIGHLIGHTS

- Neighborhood quality and safety were indirectly associated with walking behavior.
- Influences of environmental variables were mediated by personal and social factors.
- The extended TPB model increased the variance explained in leisure-time walking.
- Improved walking environments may help increase walking among older Korean adults.

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ABSTRACT

Promoting walking for health among older adults in Korea has received growing attention, but limited research on the association of environmental factors with walking has been conducted. This study examined the association of personal, social, and environmental variables with leisure-time walking in older Korean adults. Structural equation modeling (SEM) was used to analyze the integration of environmental variables into a model based on the theory of planned behavior (TPB). A cross-sectional survey of a convenience sample ($N = 335$) of older Korean adults measured perceived environmental variables, attitude, subjective norm, perceived behavioral control (PBC), intention, and walking. Data were analyzed using a two-step approach: a measurement model was fit to the data; then structural models (TPB-only and TPB plus environmental variables) were tested and compared. SEM revealed that neighborhood quality and safety had significant positive relationships with the TPB variables and indirectly influenced intention and walking. Personal and social factors mediated the relationship between neighborhood environment and walking, and PBC was important in directly and indirectly influencing walking. The extended TPB model explained 65.0% of the variance in intention, and 45.0% of the variance in walking. The inclusion of neighborhood variables in the TPB model resulted in an additional 0.6% increase in the variance explained in walking habits. These findings suggest that perceived environmental variables might help explain older adults' walking and that the TPB model with the environmental variables provides a useful framework to predict walking in older Korean adults.

1. Introduction

Regular physical activity in older adults is associated with numerous health benefits and better quality of life, including improved functional capacity and better mood states (Penedo & Dahn, 2005; Taylor et al., 2004). Despite these benefits, only 12.4% of adults aged 65 and over in Korea do moderate physical activity on a regular basis and 40.8% walk regularly, with the percentage declining each year (Korean Ministry of Health and Welfare, 2012). Walking is the most accessible and popular form of physical activity for older Korean adults; therefore, promoting walking is important for increasing the overall physical activity level of older adults in Korea (Sunwoo, 2008). It is necessary to understand and address the correlates of walking behavior among older adults to promote regular walking and establish comprehensive walking programs (Kerr, Rosenberg, & Frank, 2012).

A range of studies of the determinants of physical activity in older adults, which examined personal cognitions, such as self-efficacy, intentions, and social supports have been conducted (Allison & Keller, 2004; Marcus, Selby, Niaura, & Rossi, 1992;

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McAuley, Jerome, Marquez, Elavsky, & Blissmer, 2003; Rhodes et al., 1999). Recently, increasing emphasis has been placed on the importance of physical environment and the application of ecological models, which incorporate multiple levels of influence on health behaviors (Sallis, Owen, & Fisher, 2008). Studies have found significant associations between walking behavior and the proximity of parks or retail shops, sidewalk quality, land-use mix, neighborhood aesthetics, and safety (e.g., Duncan & Mummery, 2005; Hoehner, Brennan Ramirez, Elliott, Handy, & Brownson, 2005; Humpel, Marshall, Leslie, Bauman, & Owen, 2004; Inoue et al., 2010; Ishii, Shibata, & Oka, 2010; Kaczynski & Henderson, 2007; Kamphuis, van Lenthe, Giskes, Brug, & Mackenbach, 2007; Phongsavan, McLean, & Bauman, 2007; Suminski, Poston, Petosa, Stevens, & Katzenmoyer, 2005). The relevance of the neighborhood environment to the activity patterns of older people, who are more likely to be sensitive to contextual constraints, has also been reported in recent studies (e.g., Berke, Koepsell, Moudon, Hoskins, & Larson, 2007; Joseph, Zimring, Harris-Kojetin, & Kiefer, 2006; King et al., 2005; Li et al., 2005; Mowen, Orsega-Smith, Payne, Ainsworth, & Godbey, 2007; Nagel, Carlson, Bosworth, & Michael, 2008; Sugiyama & Thompson, 2007). Studies have found that the number of retail destinations within walking distance (Patterson & Chapman, 2004; King et al., 2005) and safe walking paths (Booth, Owen, Bauman, Clavisi, & Leslie, 2000) were positively associated with increased walking among older adults, whereas perceived traffic was negatively associated with walking in this population (Wilcox, Bopp, Oberrecht, Kammermann, & McElmurray, 2003). Sugiyama and Thompson (2007) found an association between supportive neighborhood environments and walking in older adults in Great Britain. Although these findings suggest a relationship between perceived neighborhood and physical activity, there is a lack of a theoretical framework explaining the interactions among personal, social, and environmental variables to predict the physical activity of older adults (Nelson, Wright, Lowry, and Mutrie, 2008). In addition, most studies investigating the influences of participants' perceptions of the environment on walking have been conducted in western countries and very few have been done in Asian settings (Kim & Kosma, 2013; Shibata, Oka, Harada, Nakamura, & Muraoka, 2009).

To develop more effective physical-activity interventions for older adults, it is important for interventions to be based on theoretical models that adequately explain and predict physical activity (Booth et al., 2000). The theory of planned behavior (TPB) has been one of the most widely used health theories to predict and explain motivation and behavior related to physical activity (Ajzen, 1991; Eves, Hoppéa, & McLaren, 2003). The basic premise of this theory is that personal intention is a determinant of the implementation of behavior, and intention is determined by the constructs of attitude, subjective norm, and perceived behavioral control (PBC). Attitude refers to an individual's overall positive or negative evaluation of the performance of a particular behavior. Subjective norm refers to an individual's perception of the social pressure or support to perform or not perform the behavior (Ajzen, 1991). PBC is described as the individual's perception of the ease or difficulty associated with performing a behavior. The term self-efficacy is also used to describe peoples' beliefs in their capabilities to perform a behavior (Bandura, 1997). Behavioral intention signifies a plan and determination to undertake a targeted behavior. PBC is considered a factor that, together with behavioral intention, can directly influence actual behavior (Ajzen, 1991). In general, an individual's intention to undertake a certain behavior grows stronger in accordance with having a positive attitude about the behavior, increased social support, or heightened self-efficacy in controlling a situation. The stronger a person's intention is to undertake a behavior, the more likely the behavior will be performed (Ajzen, 1991).

Recent studies have developed an extended or modified the TPB model by adding more predictors to the original TPB model to improve the percentage of explained intentions and behaviors (e.g., de Bruijn, Kremers, Singh, van den Putte, & van Mechelen, 2009; Donald, Cooper, & Conchie, 2014; Gretebeck et al., 2007; Hagger, Anderson, Kyriakaki, & Darkings, 2007; Hamilton & White, 2008; Rhodes & Courneya, 2003). Hagger et al. (2007) examined the effects of personal and social identity as predictors of intentions and exercise behavior, and suggested that identity influences the decision-making process related to exercise behavior. An understanding of walking might also benefit by integrating the individual's perceptions of the environment with social-cognitive constructs (Carlson et al., 2012). Several studies have integrated measures of perceptions of neighborhoods with TPB constructs to predict walking (Arbour-Nicitopoulos, Martin Ginis, & Wilson, 2010; de Bruijn et al., 2009; Dill, Mohr, & Ma, 2014; Giles-Corti & Donovan, 2002; Maddison et al., 2009; Rhodes, Brown, & McIntyre, 2006; Rhodes, Courneya, Blanchard, & Plotnikoff, 2007). The extended TPB model by Rhodes et al. (2007) revealed that the effects of neighborhood aesthetics on walking were mediated by attitudes and intention, and that the intention—walking relationship was moderated by proximity to recreation facilities. Carlson et al. (2012) found that the interaction between perceptions of sidewalks and self-efficacy helped predict the likelihood of walking for recreation. McCormack, Spence, Berry, and Doyle-Baker (2009) found that the perception of access to services in the neighborhood influenced PBC, which then affected the use of walking as a means of transportation. These results suggest that the perceived environment may influence walking intention and behavior indirectly through personal and social variables. However, most of the extended TPB studies have investigated other age groups, and few studies have focused on senior groups, except a study by Gretebeck et al. (2007), which integrated the extended TPB model with a functional ability variable to explain the physical activity of older adults.

Given the absence of an integrated theoretical framework to predict leisure-time walking in older Korean adults (Yoo & Lee, 2008), the present study aimed to investigate the association of personal, social, and perceived environmental variables with leisure-time walking in older Korean adults using structural equation modeling (SEM) of the extended TPB model. SEM, a multilevel modeling method, has been used increasingly to examine the interaction among variables (Nelson et al., 2008). This study adopted an extended TPB model, in which environmental variables perceived by individuals were hypothesized as common precursors of attitude, PBC, and subjective norm as determinants of leisure-time walking among older adults (Nelson et al., 2008) as shown in Fig. 1. The hypotheses of this study were as follows: (1) attitude, subjective norms, and PBC would be positively related to intention, and intention would be positively related to leisure-time walking behavior as per the tenets of the TPB (Ajzen, 1991); (2) the inclusion of the perceived environmental variables in the TPB model would result in an increase in the explained variances; and (3) the perceived environmental variables would influence leisure-time walking behavior indirectly through the TPB constructs (Arbour-Nicitopoulos et al., 2010; de Bruijn et al., 2009; Dill et al., 2014). The present study focused on walking during leisure time among older Korean adults and excluded walking for transport.

2. Methods

2.1. Participants and data collection

A cross-sectional survey was conducted in three senior centers (Bundang, Sujeong, and Joongwon) in Seongnam City, South Korea with a convenience sample of 335 participants. The city-owned