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RESEARCH PAPER

Nearby outdoor environments and seniors physical activities

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Abstract
More than 60% of older Americans have sedentary lifestyles[1] and are recommended more physical activities for health benefit. Nearby outdoor environments on residential sites may impact older inhabitants' physical activities there (defined as walking, gardening, yard work, and other outdoor physical activities on residential sites). This study surveyed 110 assisted-living residents in Houston, Texas, regarding their previous residential sites before moving to a retirement community and physical activities there. Twelve environmental features were studied under four categories (typology, motivators, function, and safety). Based on data availability, a subset of 57 sample sites was analyzed in Geographic Information Systems. Hierarchical linear modeling was applied to estimate physical activities as a function of the environments. Higher levels of physical activity were found to be positively related with four environmental features (transitional-areas, connecting-paths, walk-ability, and less paving).

1. Introduction

Associated with generally increased life expectancy, aging is a global phenomenon. World-wide monthly growth of the senior population group (65 and older) was 795,000 in 2000 and estimated to be 847,000 in 2010 (Kinsella and Velkoff, 2001). From 2000 to 2030, this population segment will increase from 35 million to 71.5 million in the U.S. (FIFARS, 2004). For Americans aged 65 years, the current life expectancy is 19.2 more years on average (FIFAS, 2012). More than 60% of older Americans have sedentary lifestyles (DHHS, 1996). It was found that older adults spend an average of 19.5 h per day at their homes, which was the longest found among different age groups (Brasche and Bischof, 2005; Moss and Lawton, 1982).

For older adults, the U.S. Surgeon General recommends at least 30 min of moderate physical activities most days of

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[1]According to DHHS (1996).

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the week (DHHS, 2001). By engaging in appropriate physical activities, the risk of heart disease, diabetes, colon cancer, and high blood pressure can be reduced; the strength of bones, joints, and muscles can be improved (CDC, 1996). Outdoor environments near home, including neighborhoods and the outdoors on residential sites or properties, can be the most readily available places for older adults to engage in physical activities. The most popular physical activities among older adults include walking, gardening, and yard work (DHHS, 1996). These activities are inexpensive, require minimal equipment, and can adapt flexibly to different schedules. Furthermore, by being physically active in the yard or on the property in which they live, older adults can access to nature and possibly engage in social interactions. Viewing delightful nature scenes may tend to increase positive emotions and reduce depression (Ulrich, 1991). Engaging in social interactions can reduce the risk of dementia in older adults (Wang et al., 2002).

To make older adults more physically active, their nearby outdoor environments should make physical activities more attractive, functional, and safe. In the neighborhoods with functional pedestrian facilities, such as comfortable sidewalks along walking routes, senior residents were found to engage in more physical activities (Owen et al., 2004; Patterson and Chapman, 2004; Wang and Lee, 2010). Moreover, having desirable destinations within walking distance from home may motivate people to walk outdoors. In traditional urban neighborhoods, where pedestrians have access to recreational and utilitarian destinations for daily living, older adults have high levels of outdoor physical activities (Patterson and Chapman, 2004; Saelens et al., 2003; Wister, 2005). Further, environmental safety from traffic and crime could be a critical concern of less-competent older adults going outside. Neighborhood safety is related to older adults' outdoor physical activities (Humpel et al., 2002; Owen et al., 2004). Most of the above findings were regarding neighborhood environments. There is limited evidence to indicate the specific site environmental factors related with physical activities.

Immediately adjacent to home, residential site environments such as yards are both origins of outdoor trips and destinations on the way back to home. Distinguished from necessary physical activities (such as walking to bus stations for a daily commute), most physical activities on residential sites or properties are optional. As older adults are typically more environmentally docile than young people, the quality of residential site environments is an important concern in promoting physical activities among the elderly (Lawton, 1985, 1989; Lawton and Simon, 1968). Adding value to the previous literature, this research studied twelve environmental features on and around residential sites, which are thought to be associated with older adults' physical activities.

2. Methodologies

The structure of relationships between physical activities and personal factors, social and physical environmental factors was described in the Social Ecological Model (Zimring, Joseph et al., 2005). Based on this model, the value of physical environmental factors on residential sites in predicting levels of older adults' physical activities was examined in this study. Table 1 listed the studied personal and social factors.

Table 1 Personal and social factors.

Personal variables	Social variables
*1. Age**	*1. Living arrangement* (alone or not)
2. Gender	*2. Building ownership**
3. IADLs (a measure of functional competence)	3. Environmental safety from traffic
4. Self-efficiency	*4. Environmental safety from Crime*
*5. Education**	

Notes: *p*-Value determines the significance of results in hypothesis tests; a small *p*-value (typically ≤ 0.05) indicates strong evidence supporting the hypothesis.

*Significant variables, $p<0.05$. Italic: test variables filtered from all variables of interest by correlation tests. IADLs: Instrumental Activities of Daily Living – a measure of functional competence.

Focus of this study is the residential site environments, which older adults can access without crossing streets or vehicular traffic. The environments should be attractive, functional and safe, as perceived by older adults both from the indoors and in the outdoor settings. Based on findings from previous research, twelve environmental factors were studied under four categories: (1) Typology, (2) Motivators, (3) Functionality, and (4) Safety (Table 2).

If people could pass through multiple spaces while traversing a residential site/lot and have destinations (e.g., gardens) to visit there, the site environments should be attractive to those who consider engaging in site walking and gardening. This research studied the presence of transitional-areas (e.g., side-yards and other areas relatively independent or semi-enclosed) and landscaping as motivators to older adults' physical activities. Moreover, the environments can be functional to physical activities if there are convenient paths connecting separated areas around the building. This study included the sum of connecting paths (defined as outdoor paths of at least 10 feet wide), presence of paving, canopy shading, and perceived walkability in the category of functionality factors. Along with the social factors of safety, the size of building setback and the distance from site entrance to the nearest street intersection were studied as physical environmental factors of safety.

Physical activities studied in this research included walking, gardening, yard work, and other outdoor physical activities on residential sites or properties. Physical activities were measured at high, medium and low levels, ranging from less than once every two days to at least twice per day for the frequency variable, and from less than ten minutes per occurrence to at least one hour per occurrence for the duration variable.

Data of this study were collected through survey and in Geographic Information Systems (GIS). A survey questionnaire was specially developed for this research. The draft questionnaire was refined after a pilot study conducted in