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Gender and age differences in walking for transport and recreation: Are the relationships the same in all neighborhoods?☆

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ABSTRACT

Introduction. Walking as regular physical activity (PA) is central to healthy aging, and environments influence walking. Multilevel neighborhood-based studies that only report average (fixed-effect) walking differences for gender and age implicitly assume that neighborhood environments influence the walking behavior of men and women, and younger and older persons, similarly. This study tests this assumption by examining whether gender and age differences in walking for transport (WfT) and walking for recreation (WfR) are similar or different across neighborhoods.

Methods. This paper used data from the HABITAT multilevel study, with 7,866 participants aged 42–68 years in 2009 living in 200 neighborhoods in Brisbane, Australia. Respondents reported minutes spent WfT and WfR in the previous week, categorized as: none (0 mins), low (1–59mins), moderate (60–149mins) and high (≥150 mins). Multilevel multinomial logistic models were used to estimate average differences in walking by gender and age, followed by random coefficients to examine neighborhood variation in these individual-level relationships.

Results. On average, women were more likely to engage in WfR at moderate and high levels (no gender differences found in WfT); and older persons were less likely to do WfT and more likely to do high levels of WfR. These average (Brisbane-wide) relationships varied significantly across neighborhoods.

Conclusion. Relationships between gender and walking, and age and walking, are not the same in all neighborhoods, (i.e. the Brisbane average conceals important information) suggesting that neighborhood-level factors differentially influence the walking behaviors of men and women and younger and older persons. Identifying these factors should be a priority for future research.

1. Introduction

Walking is an important health behavior that can significantly reduce or postpone morbidity and mortality (Fortes et al., 2013; Murtagh et al., 2015), particularly among women (Brown et al., 2012). It is also the most popular form of physical activity (PA) among older populations (Satariano et al., 2012; Touvier et al., 2010). Walking is typically undertaken within the local neighborhood (Van Dyck et al., 2009; Sugiyama et al., 2009) for the purposes of transport or recreation (Inoue et al., 2010). Walking can be incorporated into daily routines at minimal cost, hence it is the most modifiable form of PA among adult populations (Rhodes et al., 1999), with resultant public health, social and economic gains (Panter and Jones, 2010). However, seniors walk less at levels that contribute to recommended PA guidelines, particularly older women (Harris et al., 2009).

During the last decade, there have been numerous neighborhood-based multilevel studies of walking for transport and recreation that have included gender and age as part of their analyses (Van Dyck et al., 2013; Sundquist et al., 2011; Li et al., 2005; Shigematsu et al., 2009; Gauvin et al., 2008; Gómez et al., 2010; Van Dyck et al., 2012; Sugiyama et al., 2014; Kerr et al., 2015). Typically, these studies use gender and age as covariates or effect-modifiers (Van Dyck et al., 2013; Van Dyck et al., 2012; Sugiyama et al., 2014; Kerr et al., 2015), and only occasionally as primary predictors of substantive interest. Findings from these studies show that on average, women are less likely to walk for transport (Sundquist et al., 2011; Owen et al., 2007; Forsyth et al., 2009; Doescher et al., 2014) and recreation (Sundquist et al., 2011)

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than men, while seniors walk less for transport (Van Dyck et al., 2012; Doescher et al., 2014; Turrell et al., 2014; Shimura et al., 2012) and more for recreation (Van Dyck et al., 2013).

Neighborhood studies that report average differences in walking by gender and age make the implicit assumption that the walking behaviors of men and women and younger and older persons are similarly affected by the neighborhood environment. However, average gender and age differences are produced by summing-over (i.e. pooling) neighborhoods, effectively ignoring the possibility that the average relationship might not be observed in all areas. For example, in low crime neighborhoods gender and age differences in walking for recreation might be minimal due to all demographic groups walking at high levels, whereas in high crime neighborhoods these differences might be more pronounced, with young males more likely to have a higher crime threshold for walking. In short, average effects obfuscate between-neighborhood variation in individual-level relationships, hence important information about how neighborhoods influence walking behavior is possibly omitted.

One approach to testing the assumption that individual-level associations are the same in all neighborhoods is via the use of random coefficient models. These models allow the examination of whether relationships between gender and walking, and age and walking, are the same everywhere (reflecting the average effect) or whether the relationships vary across neighborhoods (Merlo et al., 2005). This paper aims to advance current understanding of the contextual effects on walking by using random coefficient models to examine whether gender and age differences in walking for transport and walking for recreation are similar or different across neighborhoods as a complementary approach to multilevel analyses where only average gender and age differences in walking are reported.

Based on previous evidence, we hypothesized that men would report more transport (Owen et al., 2007; Forsyth et al., 2009; Doescher et al., 2014) and recreational (Sundquist et al., 2011) walking than women, while seniors would walk more for recreation (Van Dyck et al., 2013) and less for transport (Van Dyck et al., 2012; Doescher et al., 2014; Turrell et al., 2014; Shimura et al., 2012). Importantly, we expected these associations to vary significantly between neighborhoods, thus challenging the implicit assumption that neighborhood environments have a similar influence on the walking of all residents.

2. Methods

2.1. Study design and data collection

This investigation uses data from the second wave (2009) of the How Areas in Brisbane Influence healTh And acTivity (HABITAT) multilevel study of mid-age adults living in Brisbane (Australia). HABITAT uses a social-ecological framework that allows for the exploration of the relative contributions of environmental, social, psychological and socio-demographic factors on walking. Details regarding HABITAT's sampling design have been published elsewhere (Burton et al., 2009). Briefly, a multi-stage probability sampling design was used to select a stratified random sample (n = 200) of Census Collection Districts (CCDs), with a random sample of people aged 40–65 years from each CCD subsequently selected. Eligible participants were mailed a survey; of the 16,127 in-scope participants, 11,035 valid responses (68.4%) were received at baseline (2007) and of the 10,849 in-scope participants in the second wave, 7,866 valid responses (72.5%) were received in 2009. The baseline sample was representative of the general Brisbane population (Turrell et al., 2010). The HABITAT study received ethical clearance from the Queensland University of Technology Human Research Ethics Committee (Ref. no. 3967H & 1300000161).

2.2. Measures

2.2.1. Outcome variables

Walking for transport (WfT): a single question asked participants to report the total time (converted to minutes) spent WfT (i.e. traveling to and from work, to do errands, or to go from place to place) in the previous week. Walking for recreation (WfR): a single question asked participants to report the total time (converted to minutes) spent WfR, leisure or exercise in the previous week. These questions were closely modeled on the questions asked in the Active Australia (AA) survey: the AA questions have demonstrated reliability (Brown et al., 2004a) and validity against accelerometer measures (Timperio et al., 2004) and have been recommended for Australian population-based research (Brown et al., 2004b).

The distribution of the WfT and WfR variables were positively-skewed and included outlier values, which were top-coded to 840 minutes (i.e. equivalent to a maximum of two hours of walking per day) (Australian Institute of Health and Welfare, 2003). The quantitative measures of WfT and WfR (minutes per week) were categorized into: none (0 mins), low (1–59 mins), moderate (60–149 mins) and high (≥150 mins), as previously used in HABITAT investigations (Turrell et al., 2013; Wilson et al., 2012). Those in the high category met the current international (World Health Organization, 2010) and Australian PA guidelines (Commonwealth Department of Health, 2014), recommending at least 30 minutes of moderate intensity PA on most days of the week, through WfT alone or WfR alone.

2.2.2. Independent variables

Participants reported their gender and date of birth. A single-year age for each respondent was derived. Since an aim was to test for a dose–response relationship with age, participants were grouped into the following categories: 42–46; 47–51; 52–56; 57–61 and 62–68 years. A combined gender/age ten-category variable was also generated (with category 1 referring to men aged 42–46 and category 10 denoting women aged 62–68) to explore how particular gender-age subgroups differed in their walking behavior.

2.3. Statistical analyses

Of the 7,866 participants who returned a valid questionnaire in 2009, the following were excluded from further analyses: 567 (7.2%) who moved from their original neighborhood at baseline (2007) to capture a common neighborhood exposure effect; 28 (0.4%) were a different participant from baseline with missing age; 267 participants (3.7%) did not indicate minutes spent on WfT and 202 (2.8%) did not indicate minutes spent on WfR. The resulting analytic sample comprised 7,004 participants for WfT and 7,069 for WfR (Table 1) nested within 200 CCDs. The non-respondents to the WfT question did not significantly differ from the respondents on the basis of age or gender; however, WfR non-respondents were significantly more likely to be female (OR 1.39; CI 1.04–1.87).

WfT and WfR were analyzed in 2015 separately using multilevel multinomial regression models of participants within neighborhoods, corresponding to HABITAT's nested data structure. Data were prepared in Stata v.13 (StataCorp, 2016) and analyzed in MLwIN v.2.30 (MLwiN Version 2.35, 2015). Gender and age were the primary predictors of walking in the statistical models, undertaken in two stages. First, we fitted two-level random intercept Markov chain Monte Carlo (MCMC) multinomial logit models (first-order marginal quasi-likelihood base estimates, burn-in = 500, chain = 50,000) to determine the average neighborhood effects in the relationship between gender, age and the combined gender/age variable and levels of WfT and WfR. The reference categories for analysis were non-walkers (0 mins), men and the youngest age group (42–46 years). Results are presented as odd ratios (ORs) with 95% credible intervals (CrI). Second, we specified random coefficients (where the variance is calculated as a function of individual