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Do the individual, social and environmental correlates of physical activity differ between urban and rural women?

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Physical activity correlates in urban and rural women

Abstract

Associations between individual, social and environmental factors and physical activity among 3669 women (18-45 years) living in socioeconomically disadvantaged urban and rural areas were compared. In 2007-8, participants reported levels of leisure-time (LTPA) and transport-related (TRPA) physical activity, as well as five individual, four social and three environmental factors. Physical activity self-efficacy demonstrated stronger associations with LTPA among urban relative to rural women; childcare was associated with LTPA and intentions with TRPA among urban women only; and enjoyment and friend support were associated with TRPA among rural women only. Correlates of physical activity among urban and rural women were generally similar, although some tailoring of physical activity promotion strategies may be warranted.

Key Words

Health behaviour, adults, geographic location, social ecological model

Introduction

Physical activity is a modifiable behaviour that plays an important role in the prevention of a number of adverse health outcomes, including cardiovascular disease, type 2 diabetes, obesity, mental health problems, and some cancers (Haskell et al., 2007). Despite the substantial physical and mental health benefits, a significant proportion of the adult population in Western countries do not participate in physical activity at recommended levels; that is, they do not perform at least 30 minutes per day of moderate intensity activity on most days of the week (Bauman et al., 2003; Centers for Disease Control and Prevention, 2007). Of additional concern is that physical activity participation is socio-demographically distributed, with some population groups performing less activity than others. For instance, women are less active during their leisure-time than are men (Trost et al., 2002), and those experiencing socioeconomic disadvantage are less active than those who are less disadvantaged (Gidlow et al., 2006). Women experiencing socioeconomic disadvantage therefore represent a population group at high risk for physical inactivity.

Another population group that may be at high risk for physical inactivity consists of those living in rural areas. People living in rural areas generally have poorer health than those living in urban areas (Australian Institute of Health & Welfare, 2005; US Department of Health and Human Services, 2010). It could be hypothesised that a proportion of these health differentials are attributable to lower levels of physical activity, but little descriptive epidemiology of physical activity in rural populations exists. While the limited evidence base is not entirely consistent (Brown et al., 1999), a small number of studies have found urban adult populations to be more active than rural populations (Badland and Schofield, 2006; Centers for Disease Control and Prevention, 1998). Given these differences in physical activity according to geographic location, it is plausible that the correlates of physical activity may also differ according to urban-rural residence.

Understanding the correlates of physical activity among high-risk populations, such as socioeconomically disadvantaged rural-dwelling women, is important for the effective tailoring of strategies to promote physical activity. Social ecological models provide a useful framework for understanding behaviours such as physical activity (Sallis and Owen, 2002). These models posit that individual (e.g. self-efficacy, intentions, enjoyment, behavioural skills, outcome expectancies), social (e.g. social support from family and friends, accessible childcare, dog ownership) and environmental factors (e.g. aesthetics, personal safety, presence of footpaths) interact to influence behaviour. We have previously identified that factors from all three domains, but particularly individual and social factors, appear to be important correlates of physical activity amongst disadvantaged women (Cleland et al., 2010a; Cleland et al., 2008b); however, rural-urban variations were not examined in those studies and warrant detailed investigation.

Previous studies that have applied the social ecological framework to investigate correlates of physical activity among urban and rural populations have identified a range of factors that may have differential importance across geographic location. For example, one North American study found that although some correlates (social support, age, and the number of barriers to physical activity) were similar across geographic locations, higher education levels, more enjoyable scenery and more frequently seeing others exercising were positively associated with physical activity among rural but not urban women (Wilcox et al., 2000). Exercising on neighbourhood streets has demonstrated positive associations with physical activity among rural but not urban or suburban low-income residents, while having friends to exercise with, walking trails, and parks have shown positive associations with physical activity among urban and suburban but not rural residents in the United States (Parks et al., 2003).

While the studies described have examined correlates of physical activity among rural residents, this work has focused on older age groups (Wilcox et al., 2000), has not included an urban comparison

group (Eyler, 2003; Osuji et al., 2006; Sanderson et al., 2003; Wilcox et al., 2000), has not conducted formal statistical tests to examine differences across urban/rural location (Parks et al., 2003; Wilcox et al., 2000), and has not stratified results by sex (Parks et al., 2003; Plotnikoff et al., 2004). This latter point is important, given that influences on physical activity differ for men and women (Pan et al., 2009). Furthermore, most studies have examined correlates of leisure or total physical activity, with few studies including other domains of physical activity such as transport-related activity. Little is known about rural women's physical activity, about the correlates of rural women's physical activity, and about whether these correlates are different to those of urban women. This is particularly the case for socioeconomically disadvantaged populations. Given these gaps in the literature, this study builds directly on our previous work (Cleland et al., 2010a; Cleland et al., 2008b) and aims to: 1) describe and compare the distribution of two domains of physical activity (leisure and transport) amongst urban and rural women; 2) describe and compare the distribution of potential correlates of physical activity amongst urban and rural women; and 3) determine whether associations between potential self-reported physical activity correlates (individual, social and environmental) and physical activity differ between urban and rural women.

Methods

During 2007-8, data for this study were collected as part of the Resilience for Eating and Activity Despite Inequality (READI) study (Cleland et al., 2010a; Cleland et al., 2010b; MacFarlane et al., 2009). The Deakin University Human Research Ethics Committee approved this study, and written informed consent was obtained from all participants.

Participants

All areas of Victoria were classified using an area-level indicator of disadvantage known as the Socio-Economic Index for Areas (SEIFA). This indicator is based on the population census and considers a range of factors including area-level employment, education and income (McLennan, 1998). Those

areas within the bottom SEIFA third for Victoria were classified as 'disadvantaged', and from these 40 urban and 40 rural areas were randomly selected. The definitions of urban and rural are described in detail elsewhere (Cleland et al., 2010b), but in brief, urban areas included metropolitan Melbourne; rural cities (defined by the Regional Infrastructure Development Act 1999 [Vic]) and all suburbs completely within a 10km radius of the centroid of these cities; and all suburbs completely within a 10km radius of the centroid of other Victorian cities with a population of ≥20,000. Rural areas were those falling outside of metropolitan Melbourne and outside of a 25km radius of the rural cities.

Using the Australian electoral roll (upon which registration is compulsory from age 18 years for Australian citizens), 150 women aged 18-45 years within these urban and rural areas were randomly identified (n=11,940; some areas had <150 eligible women). Each of these women were mailed a package containing a letter of invitation, a consent form, the questionnaire, and a $1 'scratch and win' token (as encouragement to participate). A total of 4,938 women completed a postal questionnaire (45% response rate after excluding from the denominator 861 women whose surveys were returned marked 'return to sender',). Excluded from the study were those who moved from the sampled area prior to completing the survey (n=571), those who were not the intended participant but completed the survey (n=3), those who withdrew their data after completing the survey (n=2), or those who were <17- or >46-years old (n=13). Of the remaining 4,349 eligible participants, those who were pregnant (n=210), had missing pregnancy data (n=40), missing leisure time or transport-related physical activity data (n=263), or more than one missing demographic or potential correlate variable (n=167) were excluded from the analyses, leaving 3,669 participants for the analyses.

Measures

Physical Activity

Physical activity was self-reported using the long version of the International Physical Activity Questionnaire (Craig et al., 2003). This reliable and valid instrument collects information on the duration, frequency and intensity of past week physical activity within leisure, transportation, occupational and domestic domains of physical activity. Leisure activity is discretionary and transport activity is being promoted as a way to accumulate more physical activity; these two domains may be more amenable to intervention than occupational and domestic activity and so were the focus of this study. Hours per week of leisure activity and transport activity were calculated, and each of these physical activity variables were categorised because of substantial skewness and the large number of 'zero' responses. Data for each physical activity variable was categorised as none (0), with the remaining non-zero data categorised by tertiles and classified as low (1), medium (2) or high (3). This approach was selected because domain-specific physical activity recommendations do not currently exist. For leisure-time physical activity, the low, medium and high activity categories represented 1-119 mins/week, 120-279 mins/week, and ≥280 mins/week respectively. For transport-related physical activity, the low, medium and high activity categories represented 1-89 mins/week, 90-209 mins/week, and ≥210 mins/week respectively.

Potential Correlates

The self-reported individual, social and physical environmental factors examined in this study have been described in detail elsewhere and all displayed at least acceptable internal reliability (Cronbach's alpha≥0.7) (Cleland et al., 2010a). They are described here briefly.

Demographic Factors: Participants self-reported a range of demographic characteristics including age; marital status (categorised as married/living as married, previously married, or not married); highest level of education (categorised as low=less than Year 12; mid=Year 12, certificate/trade/diploma; high=tertiary); current employment status (categorised as full-time work, part-time work, or not employed); number of hours worked in the last week (0, 1-15, 16-24, 25-34,

35-40, ≥40); night shift work (never, sometimes or often/always do night shift); weekend shift worker (never, sometimes or often/always do weekend shift); number of children <18 years in the household (none, 1, 2, 3+); age group of any children (≥1 child <2 years, ≥1 child 2-4 years, ≥1 child 5-12 years, ≥1 child 13-18 years); and country of birth (Australia or outside Australia).

Individual Factors: Participants rated their confidence in being physically active in five difficult circumstances (self-efficacy) on a five-point Likert scale (Marcus et al., 1992), and responses were summed (Cronbach's alpha=0.82). Responses to six items on a seven-point Likert scale about enjoyment of physical activity were summed (Kendzierski and DeCarlo, 1991) (Cronbach's alpha=0.95), and responses to six reasons for doing physical activity (outcome expectancies) on a four-point scale were summed (Lechner et al., 2006) (Cronbach's alpha=0.79). Intentions to be active were reported using a seven-point Likert scale (Giles-Corti and Donovan, 2003) and the sum of two questions about the past week frequency of goal setting and planning for physical activity were used to assess participants' basic behavioural skills (Giles-Corti and Donovan, 2003) (Cronbach's alpha=0.83).

Social Factors: Participants reported access to childcare if they wanted to be active (not applicable, yes, no), and dog ownership (yes, no). Participants were asked how often in the past year family members engaged in physical activity with them or encouraged them to be physically active (Sallis et al., 1987); responses to the two questions were summed (family social support; Cronbach's alpha=0.76). The same questions were asked in reference to friends/work colleagues (friend social support; Cronbach's alpha=0.69).

Perceived Environmental Factors: An existing measure (Mujahid et al., 2007) was adapted to assess perceptions of personal safety, neighbourhood aesthetics, and the neighbourhood 'walking environment'. Participants rated their agreement with statements about their neighbourhood on a

five-point Likert scale (1=strongly agree, 5=strongly disagree), and responses were summed. Personal safety was assessed by responses to the following statements: 'I feel safe walking in my neighbourhood, day or night', 'Violence is not a problem in my neighbourhood', 'My neighbourhood is safe from crime' (Cronbach's alpha =0.85). Neighbourhood aesthetics were assessed by responses to the statements: 'There is a lot of rubbish on the street in my neighbourhood', 'There is a lot of noise in my neighbourhood' 'In my neighbourhood the buildings and homes are well-maintained', 'The buildings and homes in my neighbourhood are interesting', 'My neighbourhood is attractive' (Cronbach's alpha =0.76). The neighbourhood 'walking environment' was assessed by responses to the statements: 'My neighbourhood offers many opportunities to be physically active', 'Local sports clubs and other facilities in my neighbourhood offer many opportunities to get exercise', 'It is pleasant to walk in my neighbourhood', 'The trees in my neighbourhood provide enough shade', 'In my neighbourhood it is easy to walk places', 'I often see other people walking in my neighbourhood', 'I often see other people exercising (e.g. jogging, bicycling, playing sports) in my neighbourhood' (Cronbach's alpha =0.80).

Analyses

Chi-square tests were used to test for differences in demographic characteristics, categories of each domain of physical activity, and categorical individual, social and environmental characteristics according to geographic location (urban or rural). One-way ANOVA (for equal variances) or the Kruskal-Wallis equality-of-populations rank test (for unequal variances) was used to test for urban-rural differences in continuous individual, social and environmental characteristics, and in physical activity.

To assess for confounding, the association between each demographic factor and the dependent variable (leisure-time physical activity or transport-related physical activity) and the independent variables (each of the 12 individual, social and environmental factors) was examined. Demographic

factors associated with both the dependent and independent variables were considered potential confounders.

Multinomial logistic regression was inappropriate because of the ordinal nature of the dependent variable (Stata, 2009), and because the proportional odds/parallel regression assumption was violated for a number of variables (determined from the Brant test of the parallel regression assumption), ordinal logistic regression was also deemed inappropriate. Generalised ordered logistic regression was therefore employed by using the 'gologit2' command (Williams, 2006) in Stata Version 10.2 (Statacorp, College Station, Texas) to calculate odds ratios (OR) and 95% confidence intervals (CI) separately for urban and rural women. In generalised ordered logistic regression, the actual values of the dependent variable are irrelevant except that it is assumed that larger values correspond to "higher" outcomes. The results of these analyses indicate the odds of participating in increasing levels of physical activity associated with a one-unit increase in the independent variable (e.g. a one-unit increase in self-efficacy). To examine the 'main effects', partially adjusted models examined the association between each individual, social and environmental factor and each physical activity outcome separately, adjusting for confounding demographic factors, and stratified by urban/rural location. All individual, social and environmental factors were then entered simultaneously into a fully adjusted model (adjusted for confounding demographic factors as described above, and all other independent variables) to determine the relative contribution of each factor to physical activity.

Where significant associations were identified between an independent and dependent variable, the equality of the regression coefficients for urban and rural women was tested using the formula described by Paternoster and colleagues (1998):

$$Z = \frac{\beta_1 - \beta_2}{\sqrt{SE\beta_1^2 + SE\beta_2^2}}$$

This test is appropriate when aiming to determine whether an empirical relationship estimated within two independent samples is equivalent. For example, this test identifies whether a statistically significant difference exists between the regression coefficient estimated for a relationship between an independent variable (e.g. self-efficacy) and a dependent variable (e.g. leisure-time physical activity) in one group (e.g. urban women) and the regression coefficient estimated for a relationship between the same independent variable and the same dependent variable in another group (e.g. rural women). P-values of <0.05 were deemed statistically significant, but p-values <0.10 were also considered of potential importance.

Results

Compared to urban women, a greater proportion of rural women were married, had low levels of education, had partners with low levels of education, were in part-time employment, had partners in full-time employment, did no paid work, more frequently did weekend shift work, had two or more children, had children aged 5 years or older, or were born in Australia (**Table 1**). Rural women were significantly (p<0.001) older (35.4 vs. 33.4 years), and reported significantly (p=0.04) more leisure-time physical activity (mean: 3.5 hours/week, standard deviation [SD]: 4.6 hours/week) than urban women (mean: 3.3 hours/week, SD: 4.4 hours/week). In contrast, urban women reported significantly (p=0.02) more transport-related physical activity (3.1 hours/week, SD: 4.7 hours/week) than rural women (2.9 hours/week, SD: 4.5 hours/week).

Compared to urban women, rural women reported significantly (p<0.01) higher physical activity self-efficacy (score of 14.1 vs. 13.3), physical activity enjoyment (31.9 vs. 30.9), intentions to be active (5.2 vs. 5.0), family support (6.1 vs. 5.7), personal safety (3.6 vs. 2.8), more favourable

neighbourhood aesthetics (3.9 vs. 3.5), a more favourable walking environment (3.8 vs. 3.5), available childcare where applicable (80.1 vs. 73.6%), and dog ownership (64.1 vs. 44.2%). No significant rural-urban differences were observed for outcome expectancies (18.8 vs. 18.7), behavioural skills (4.5 vs. 4.5), or friend support (4.5 vs. 4.4).

In the partially adjusted ('main effects') models, similar patterns of association of leisure-time physical activity with most individual, social and environmental factors were observed for urban and rural women (**Table 2**). For instance, a one-unit increase in self-efficacy was associated with 25%, 24% and 23% higher odds of ≥1min/wk (vs. <1 min/wk), ≥120 min/wk (vs. <120 min/wk)and ≥280 min/wk (vs. <280 min/wk) leisure-time physical activity respectively among urban women, and with 19%, 21% and 19% higher odds, respectively, among rural women. Dog ownership and personal safety appeared to demonstrate associations with some levels of leisure-time physical activity among urban but not rural women. Similar patterns of association were also observed between transport-related physical activity and most individual, social and environmental factors for urban and rural women (**Table 3**). For example, a one-unit increase in intentions to be active was associated with 17%, 19% and 23% higher odds of ≥1 min/wk (vs. <1 min/wk), ≥90 min/wk (vs. <90 min/wk) and ≥210 mins/wk (vs. <210 min/wk) transport-related physical activity, respectively, among urban women, and with 12%, 14% and 16% higher odds, respectively, among rural women. Personal safety was associated with transport-related physical activity among urban women only.

While a significant positive association between self-efficacy and leisure-time physical activity was observed in the fully adjusted models among both urban and rural women (**Table 4**), the equality of regression coefficients test indicated that the association with doing any (≥1 minute/week) and doing the most (≥280 minutes/week) leisure-time physical activity was stronger (p=0.02 and p=0.08) among urban women (12% and 11% higher odds, respectively) compared to rural women (5% and 6% higher odds, respectively). The equality of the regression coefficients test indicated that the

association between available childcare and achieving ≥120 minutes/week leisure-time physical activity differed (p=0.06) between urban and rural women. Urban women with available childcare had significantly greater odds (75%) of achieving ≥120 minutes/week of leisure-time physical activity, while no association was evident among rural women.

The equality of the regression coefficients test in fully adjusted models indicated that enjoyment, friend support, and intentions to be active were differentially associated with transport-related physical activity among urban and rural women (**Table 5**). A one-unit increase in enjoyment was significantly associated with 3% higher odds of doing ≥210 minutes/week transport-related physical activity among rural women, but no association was evident among urban women (p=0.01 from the equality of the regression coefficients test). Similarly, friend support was differentially associated across urban/rural locations (p=0.05 from the equality of the regression coefficients test), demonstrating higher odds (9%) of doing any (≥1 minute/week) transport-related physical activity among rural women, but no association among urban women. In contrast, intentions to be active were associated with greater odds (10%) of achieving ≥90 minutes/week transport-related physical activity among urban women, but no association was identified for rural women (p=0.07 from the equality of the regression coefficients test).

Discussion

This study found that, on the whole, the associations between individual, social and perceived environmental factors and leisure-time and transport-related physical activity did not differ substantially according to urban/rural area of residence. These results were evident despite differences in the distribution of women's physical activity which suggested that urban women reported more transport-related physical activity while rural women reported being more active in

their leisure-time. Differences in the distribution of the individual, social and environmental characteristics assessed were also evident, with rural women generally reporting more favourable characteristics hypothesised to influence physical activity. This is one of the few studies in the international literature to explore correlates of physical activity amongst rural women, and whether these differ to those observed amongst urban women. The results have important implications for the development of physical activity interventions designed for women living in socioeconomically disadvantaged areas, suggesting that these may not require substantial tailoring according to geographic location.

This is one of only a few studies to describe and compare the distribution of two specific domains of physical activity, leisure-time and transport-related activity. Rural women were found to be more active during their leisure-time, but urban women reported more transport-related physical activity. The former finding is in contrast to previous research in the United States, which has found rural women to be more likely to be classified as sedentary during their leisure-time than urban women (Brownson et al., 2000; Wilcox et al., 2000). These disparities may be due to socio-cultural differences such as different values placed on and beliefs around physical activity, physical environmental differences such as differences in terrain and climate, or differences in the measures of leisure-time physical activity used. The results in relation to active commuting are novel as no previous research has compared this type of activity across area of residence. Plausibly, transport-related physical activity is more feasible for urban women because their physical environments are more supportive of transport activity, for example, there may be shorter distances to destinations, a greater variety of destinations, or better neighbourhood 'walkability' (e.g. availability of footpaths and bicycle lanes), all of which are factors that have been associated with active transportation (Ball et al., 2007; Cleland et al., 2008a). Interestingly, neighbourhood aesthetics and safety were not associated with transport-related physical activity in the current study, and a positive association was seen among both urban and rural women for perceived walking environment.

Despite the similarity of both leisure-time and transport-related physical activity correlates between urban and rural women, a small number of differences were observed which may warrant further investigation. Self-efficacy, enjoyment, intentions, childcare, and support from friends have all been found to correlate with physical activity in previous studies (Cleland et al., 2008b; McIntyre and Rhodes, 2009; Trost et al., 2002), so it is of interest that differential associations by place of residence were observed in the current study. The association between self-efficacy and leisure-time physical activity was stronger in urban women than in rural women, but the reasons for these differences are unknown. Rural women in this study had higher levels of self-efficacy to be active, and potentially these high levels generally may not have discriminated between those women who were more or less active. Alternatively, the weaker correlation of self-efficacy with physical activity amongst urban women may suggest that self-efficacy does not always translate into higher levels of activity for these women, potentially due to the greater influence of other unmeasured factors. The availability of childcare was important for leisure-time physical activity only among urban women, which may reflect the greater availability of childcare reported by rural women, the older age of rural women, the higher number of children among rural women, or the older age of rural women's children who may be less likely to require formal childcare. However, each of these factors was adjusted for in the analyses, suggesting that for urban women with children, childcare availability is an important facilitator of participation in physical activity.

Among rural but not urban women, enjoyment of activity was associated with achieving higher levels (≥210 mins/wk) of transport-related physical activity and support for physical activity from friends was important for participating in any (≥1 min/wk) transport-related physical activity. These results suggest that identifying enjoyable activities and establishing friendship networks that are supportive of physical activity may play a role in the promotion of transport-related physical activity among rural women. The reasons why enjoyment of transport-related activity were important

among rural women are unclear, but it could be hypothesised that rural women need to make more of a concerted effort to participate in active travel behaviours, and therefore rural women who enjoy physical activity generally may be more inclined to make this effort. In contrast, active travel for urban women may be done through necessity or convenience, rather than because of an enjoyment of physical activity generally, which could explain the lack of association amongst these women. The results around social support are in contrast to those observed by Wilcox and colleagues (Wilcox et al., 2000) who found social support was non-differentially associated with physical activity across area of residence, and to those observed by Parks and colleagues (Parks et al., 2003), who found that 'having friends to exercise with' increased the odds of activity among urban but not rural residents. However, the former study used leisure-time activity as the outcome variable while the latter used a combined measure of occupational and recreational activity. In the current study this finding was only evident for transport-related physical activity, which could explain these differences.

Intentions to be active were differentially associated with transport-related physical activity, with an association identified in urban but not rural women. This result may be related to the comparative ease in which transport-related physical activity may be performed in urban compared to rural areas. Active commuting may be more difficult for rural women, given the greater geographical distances to destinations which may represent a barrier that overrides any positive intentions to be active. Comparisons with other studies are difficult because few that have examined urban/rural differences have included assessment of intentions as an explanatory variable, despite it being identified as a consistent positive correlate of physical activity (Trost et al., 2002) and an essential construct in the theory of planned behaviour (Ajzen, 1985). As with the results for self-efficacy and leisure-time activity, it may be that despite greater intentions to be active among rural women, this may not translate into higher levels of activity due to the other barriers that may exert a greater influence on actual participation.

In contrast to previous research, most of the perceived physical environmental factors assessed were not associated with leisure or transport-related activity in either urban or rural women. Wilcox and colleagues (2000) found more enjoyable scenery (that is, aesthetics) were associated with leisure activity, but only among rural women, while Parks and colleagues (2003) found walking trails and parks to be positively associated with physical activity among urban and suburban but not rural residents. These differences across studies are likely due to the measures of physical activity and the physical environment. For example, the latter study assessed leisure and occupational physical activity and it could be argued that features of the physical environment (e.g. parks and walking trails) are unlikely to influence occupational physical activity which occurs in the workplace – that is, measures of physical activity should be settings-based and context-specific (Giles-Corti et al., 2005). Reasons why the physical environment was generally not related to physical activity in the current study are unclear, but are consistent with two previous studies of women living in socioeconomically disadvantaged areas (Cleland et al., 2010a; Cleland et al., 2008b), both of which found that individual and social but not physical environmental factors were related to physical activity. However, each of these studies (including the current study) used a limited number of self-reported measures of the physical environment, and the relationship between self-reported and objective measures of the physical environment is unclear (Ball et al., 2008; Leslie et al., 2005). Additionally, there may be different amounts of variability in rural compared to urban areas in different countries.

There are some limitations of this study that should be considered when interpreting the results. The cross-sectional study design precludes conclusions about the temporal and causal nature of associations. While the response rate may have resulted in some selection bias, that 45% of potential participants responded could be seen as encouraging given the typically lower response rates observed among populations of low socioeconomic position (Madigan et al., 2000; Sheikh and Mattingly, 1981).The measurement error inherent in self-reported physical activity questionnaires

may bias findings towards the null, although the tool used in the current study has demonstrated excellent reliability and acceptable validity (Craig et al., 2003). The individual, social and environmental factors that were examined were not exhaustive; there may be other factors that are more important for physical activity in the target populations, although the factors selected were based on a theoretical framework and results from existing literature. Objective measures of the physical environment may have produced different findings, but debate exists over whether perceptions of or the actual environment are most important for behaviour (Ball et al., 2006). Both appear to contribute useful information, and it is recommended that objective environmental measures are included in future studies of these populations. Prior to doing so, a better understanding of how objective measures of the physical activity environment are operationalised in rural areas is required.

Defining what constitutes a 'rural neighbourhood' is difficult and definitions are likely to vary within and between countries. A recent review examining how studies conceptualise and measure rural neighbourhoods highlighted some of the difficulties encountered in defining rurality, including the lack of uniformity in neighbourhood structures and the diversity of distances to closest neighbours, services and facilities (De Marco and De Marco, 2010). The review noted five different approaches used to define 'rural neighbourhoods' including administrative units (census block groups, census tracts, electoral wards), town segments (parishes, geographic parcels, small towns), local actor-mapped regions (where key informants defined boundaries), distance from home, and self-definitions (where no definition of 'neighbourhood' was provided). The parameters used in the current study were developed to ensure a locally-relevant definition of 'urban' and 'rural' neighbourhoods and were based on population size within specified distances from cities defined by government authorities as 'rural'. As a result of these locally-relevant definitions, the findings from this study may not be generalisable to other countries that employ different definitions.

This study also had a number of important strengths. It comprised a large sample of women living in socioeconomically disadvantaged urban and rural areas, an important high risk target group for physical activity promotion. This is the first study of which we are aware that statistically tested for differences in associations between a range of theoretically driven factors and physical activity across area of residence. Furthermore, this is the first investigation of which we are aware comparing transport-related physical activity across urban/rural location. This is important because transport-related physical activity may be somewhat discretionary (although the literature is equivocal) and therefore amenable to intervention. Understanding the influences on this domain of physical activity has provided unique insights for effective tailoring of interventions. An additional strength of this study was the description and comparison of the distribution of leisure and transport activity and a multi-domain group of potential correlates between urban rural women, which has not been previously documented.

In conclusion, this study found few differences in associations between a range of individual, social and environmental factors and physical activity among women living in socioeconomically disadvantaged urban and rural areas of Victoria, Australia. These results suggest that interventions aimed at promoting physical activity among women may not need specific tailoring according to geographic location of residence. However, some differences were noted, suggesting that strategies targeting urban women might consider an additional focus on enhancing self-efficacy, improving intentions and increasing availability of childcare, while strategies targeting rural women might consider focusing on promoting enjoyment of activity and support for physical activity from friends. Further research should employ longitudinal study designs and employ objective measures of physical activity and the physical activity environment to investigate whether the results observed in the current study are replicable. The appropriateness of these measures in rural populations also requires investigation.

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