Title: Walking for recreation and transport by geographic remoteness in South Australian adults.

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- NB: study design, data analysis, data interpretation, manuscript preparation
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Title: Walking for recreation and transport by geographic remoteness in South Australian adults.

Abstract

Objective: To determine differences in walking for recreation and transport between Accessibility/Remoteness Index of Australia (ARIA) categories, in South Australian adults.

Design: Cross-sectional self-reported data from adult telephone survey respondents between April and May in 2012 and 2013.

Setting: Population of South Australia

Participants: n=4004 adults (aged over 18 years), n=1956 males and n=2048 females. Area of residence categorised using ARIA (major city, inner regional, outer regional and remote/very remote).

Main outcome measure(s): Self-reported participation in walking for transport and recreation/exercise as the number of times and minutes per week. Data were analysed using Kruskal-Wallis Test for median minutes and negative binomial regression for times walked with adjustment for socioeconomic status, age and body mass index.

Results: Average age was 47.8 ± 18.5 years, 51.1% were female, 70.9% lived in the major cities, 14.6% in inner regional, 10.8% in outer regional and 3.6% in remote/very remote areas. Relative to major city, times walked for recreation was lower for only remote/very remote residents (IRR 0.74 [95%CI 0.59-0.92] p=0.008). This difference was only observed for men (IRR 0.54 [95%CI 0.39-0.73] p<0.001). Relative to major city, times walked for transport was less for inner regional (IRR 0.74 [95%CI 0.67-0.85, p<0.001) and outer regional (IRR 0.64 [95%CI 0.56-0.74] p<0.001) only. This difference in transport walking was seen in both men and women.

Conclusion: Frequency of walking varied by purpose, level of remoteness and sex. As walking is the focus of population-level health promotion, more detailed understanding of the aetiology of regular walking is needed.

Key words: walking, physical activity, rural, urban, public health

What this paper adds boxes.

1: What is already known on this subject?

- There has been consistent evidence for differences in physical activity participation between those living in rural/remote and urban areas.
- Walking is commonly the preferred mode of activity in the population, and can be stratified into two types, walking for recreation and walking for transport. In population surveys walking for recreation and transport is not commonly separated but walking for different purposes is likely to have different participation rates.
- Whilst disparities have been demonstrated in physical activity participation between urban and rural residents, to date there have been no Australian studies that have described recreation and transport walking across areas of remoteness.

2: What does this study add?

- This study demonstrates differences in walking for transport and recreation by remoteness, with those in inner and outer regional areas walking less for transport and those in very remote/remote areas walking less for recreation relative to those in the major city.
- The results demonstrate different walking behaviours in men and women with no effect of remoteness on walking for recreation in women.
- Regional and gender differences in walking participation indicate that interventions to increase walking participation in rural and remote areas need to be tailored to accommodate geographic location and differing preferences of men and women.

Introduction

There is consistent evidence for health disparities between rural and urban Australians, including marked differences in death rates (5.5 per 1,000 population compared to 8.4 per 1,000 in very remote areas), and higher rates of risk factors such as obesity, smoking, risky alcohol consumption and physical inactivity in rural populations relative to their urban counterparts.[1] This highlights the need for a clearer understanding of the aeitiology of health and lifestyle behaviours in rural Australians.

Regular physical activity is known to have significant health benefits including contributing to the prevention of many chronic conditions[2]. Walking has been identified as the most popular form of physical activity.[3] With its low cost and high accessibility, walking is ideal for promoting physical activity at the population level.[4] Walking promotion strategies in South Australia have focused on encouraging regular walking for leisure but also for transport to destinations.[5] Whilst differences in physical activity participation have been demonstrated between urban and rural Australians, less is known about the geographic distribution of walking for different purposes (leisure and transport).

The Accessibility-Remoteness Index of Australia (ARIA), often used to categorise geographic remoteness, is defined on the basis of road distance from any point to the nearest town and the index scores are categorised as major city, inner regional, outer regional, remote and very remote.[6]

To our knowledge there are no Australian studies that have described recreation and transport walking across areas of remoteness. The purpose of this study was to determine differences in walking for recreation and transport between ARIA categories, in a representative sample of South Australian adults.

Methods

Data for this study were collected using the South Australian Health Monitor Survey (HM). The HM is Computer Assisted Telephone Interview survey conducted by the Population Research and Outcome Studies at the University of Adelaide in conjunction with Harrison Health Research. All interviews were conducted on two occasions from April to May in 2012 and 2013. This study was approved by the Human Research Ethics Committees of SA Health and The University of Adelaide (Protocol number H-055-2010) and participants gave informed consent prior to participation. The sample for the survey consisted of randomly selected households within South Australia listed in the Electronic White Pages. Within households, the person (aged 18 years or over) with the most recent birthday was selected to participate and those selected must be able to speak English to complete the survey.[7] The full details of this methodology have been described previously.[7]

Respondents were asked to identify the number of times in the previous week they had "walked continuously for at least 10 minutes to get from place to place not for recreation or exercise" (i.e. walking for transport) and the number of times they had "walked continuously for at least 10 minutes for recreation or exercise". If the response was greater than zero they were then asked "what do you estimate was the total time that you spent walking in this way in the last week?"

ARIA was used to categorise area of residence of respondents. The term rural is typically used to describe non-metropolitan areas. For the purpose of this study when using the term rural in the broader context we consider all areas from inner regional to very remote to be 'rural' and major city to be 'urban' areas. Remote and very remote were combined due to small numbers in each of these individual categories.

The following demographic data were also collected: sex, age, education, country of birth, income, marital status, self-reported height and weight (to derive body mass index [BMI]) and Socio-Economic Indexes for Areas (SEIFA)[8] score.

Data Analysis

Data were analysed using IBM SPSS Statistics for Windows, Version 20.0 (Armonk, NY: IBM Corp).

To be representative of the South Australian population, data were weighted by age, sex, area (ARIA) and probability of selection in the household using the 2011 Australian Bureau of Statistics census data and the number of listings in the White Pages.

All categorical variables were described using frequency and proportions and differences in variables among four ARIA categories were evaluated by Chi-square tests.

Walking frequency was non-normally distributed and was therefore expressed as the median (interquartile range [IQR]) and compared using the Kruskal-Wallis Test. Because of known gender differences in physical activity participation, data were stratified by sex.

To determine differences in walking frequency (times walked) between areas of remoteness relative to the major city, data were analysed using negative binomial regression, adjusted for age, country of birth, BMI, income, education, marital status and SEIFA. Differences were considered statistically significant at $p<0.05$ for all analyses.

Results

The overall participation rates in the HM surveys were 63.7% in 2012 and 66.3% in 2013. In 2012, 3149 contacts were made, of whom 2005 were eligible and willing to participate. In 2013, 3017 contacts were made, of whom 1999 were eligible and willing to participate.

There were no significant differences in walking participation between survey years and thus data were pooled, resulting in a final sample of N=4004 (48.9% men, 28.4 % aged over 60 years, 23.7 % with a degree qualification or higher, 80.8% born in Australia and 70.9 % living in metropolitan Adelaide). There were significant differences in the proportion of respondents across ARIA categories for age, education, income, SEIFA, country of birth, marital status and BMI (Table 1), therefore these variables were included in the regression models as covariates.

Walking for Transport

Overall 47.5% (n=1772) reported participating in no walking for transport. There was a significant difference between ARIA categories in those who reported no walking for transport. In stratified analyses, differences persisted in men and women. In all cases, those living in outer regional areas were less likely to do any walking for transport than in other ARIA categories (Table 2).

Of those who reported walking for transport at least once per week there was a significant difference in median times walked for transport per week across ARIA categories with those in the major city walking more times per week relative to other areas (Table 3). There was also a significant difference in median minutes of walking each week across ARIA categories, with those in outer regional areas walking for less minutes each week. In men, there was no significant difference between ARIA categories for median minutes walked for transport but a significant difference in median times walked for transport, with those in

remote/very remote and outer regional areas walking fewer times. In women there was a significant difference in median minutes and a significant difference in times walked for transport between ARIA categories, with women in remote/very remote walking for less minutes and fewer times relative to other areas (Table 3).

Table 4 describes the adjusted negative binomial regression analysis of the number of times walked for transport by ARIA category. Relative to major city, residents in inner and outer regional areas reported fewer walking bouts for transport. This was evident among men and women separately.

Walking for Recreation

Overall, 38.7% (n=1510) reported no participation in recreational walking. There was a difference between ARIA categories, with a progressive increase in the proportion of respondents reporting no walking for recreation with increasing remoteness (Table 2). In the stratified analyses there was a significant difference between ARIA categories in men but not in women (Table 2).

Of those who reported walking for recreation at least once in a week, there was a significant difference in median times walked for recreation per week across ARIA categories with those in the outer regional area walking more times per week (Table 3). There was a significant difference in median minutes spent walking for recreation each week across ARIA categories, with those in the very remote/remote area walking for fewer minutes each week relative to other areas (Table 3).

In men, there was a significant difference between ARIA categories for both median minutes walked and median times walked for recreation, with those in remote/very remote walking less minutes than all other regions and fewer times than those in the inner and outer regional

areas. This was not seen in women, with no significant differences for median minutes or times (Table 3).

Table 4 describes the adjusted negative binomial regression analysis of the number of times walked for recreation by ARIA category (Table 4). Relative to major city residents, those in the remote/very remote areas reported fewer walking bouts, with no differences for inner and outer regional residents. In stratified analyses, this difference was only evident in men. No differences between ARIA categories among women.

Discussion

Overall, a disturbingly high proportion of respondents reported doing no walking for any purpose, regardless of where they lived. Considering demographic variables, walking behaviour was shaped by complex interactions of sex, purpose (recreation or transport) and level of remoteness. Men living in remote/very remote South Australia were less likely to walk for transport compared to those in the major city and there was a clear gradient of lower recreational walking with increasing remoteness. On the other hand, women in inner and outer regional areas were less likely to walk for transport than women in urban areas, whilst recreational walking among women was unrelated to where they lived. Similarly, Cleland and colleagues[9] reported young (18-45 years) urban women engaged in more transport-related physical activity than their rural counterparts. Our results support a greater motivation towards recreational walking in women irrespective of geographical location.

The lower frequency of recreational walking among men with increasing remoteness may be attributable to higher engagement in active occupations among men in rural settings. Those with higher occupational energy expenditure may be less likely to participate in active leisure.[10] Arguably occupational physical activity is protective of health in rural men and therefore active leisure is a low priority for intervention in this group. However higher rates of hypokinetic disease conditions among rural men[11] suggest that more research is needed to identify the behavioural drivers of their health.

This study does not identify other forms of physical activity and it may be that men have higher participation rates in other recreational pursuits. Perhaps there is an attitudinal reluctance among rural men to walk for health benefits and therefore active leisure options that are more compatible with their preferences should be more readily available. Health promotion strategies that engage and support men through sporting environments may have more traction with men who live in regional communities. A recent intervention

demonstrated effective engagement with men through professional football clubs to improve physical activity[12], appealing to participants because it was designed specifically for men.[13] This supports the premise that physical activity interventions are more likely to have a sustained effect if the program elements are tailored to the needs and interests of the target group.

The non-linear association of walking for transport in the current study, with higher likelihood in the major city and remote/very remote ARIA categories may reflect proximity to typical destinations such as shops and local services. Townships in remote regions may be small and concentrated, such that distances to destinations may be small and reachable on foot. Similarly, in major cities the higher population density and concentration of destinations encourage walking as a transport option. Alternatively, inner and outer regional settlements are more likely to be sparsely distributed with distances to destinations relatively inaccessible by foot for most people. However aspects of walkability, such as footpath quality and journey length are determinants of walking[14] that were not measured in this study.

Thus, the current study points to structural barriers to walking as a form of transport in inner and outer regional South Australia. Local councils are well placed to implement structural developments that encourage more walking within regional townships.

While a strength of the current study is the large representative sample, there are limitations that should be acknowledged. It is possible that walking may have been over-reported as respondents may make socially desirable responses when self-reporting.[15] Further, the proportion of households without landlines is increasing which may introduce bias into the sample.[16] However, the results presented were weighted, a common statistical approach to overcoming biases in survey data.

Recommendations for future work and practice

To our knowledge this study is the first to describe walking participation separately by purpose, levels of remoteness and sex, thereby providing evidence for targeted physical activity promotion strategies in regional South Australia. The results confirm that 'rural' regions are not homogeneous with respect to walking participation as evidenced by differences in participation across ARIA categories. This has been supported in other research showing differences in walking participation between rural South Australian towns based on differing demographics of the towns.[17] Interventions and policies need to be relevant to the local context, developed in partnership with stakeholders, and provide a range of options to ensure that the needs and preferences of men and women are accommodated.[18]

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Table 1 Demographic characteristics of the total study population. Data are presented as proportions of N.

	Major city	Inner Regional	Outer Regional	Remote/Very Remote	P
Sex					
N	**2839**	**586**	**434**	**146**	0.057
Male	48.6	45.6	52.5	55.5	
Female	51.4	54.4	47.5	44.5	
Age groups					
N	**2838**	**586**	**434**	**146**	
18 to 30 years	23.9	16.7	17.7	7.5	<0.001
31 to 44 years	23.5	27.3	21	36.3	
45 to 59 years	24.8	26.1	30.4	26	
60 to 74 years	17.6	20.6	21.7	19.9	
75 years and older	10.1	9.2	9.2	10.3	
Highest Education Attained					
N	**2829**	**584**	**433**	**145**	
Secondary School or lower	38.9	41.3	48.5	51	<0.001
Trade certificate	33	39.9	42	37.9	
Bachelor degree or higher	6	18.8	9.5	11	
Household Income					
N	**2839**	**586**	**432**	**145**	
<$40,000	19	24.7	22.2	18.6	<0.001

$40,001 to $80,000	23.3	22.7	25.2	28.3	
$80,001 to $150,000	24.4	22	20.8	28.3	
>$150,000	9.3	2.9	9	12.4	
Refused/don't know	24.1	27.6	22.7	12.4	
SEIFA Quintile					
N	**2838**	**585**	**433**	**145**	
Lowest	17.1	21.2	35.8	13.1	<0.001
Low	17.5	24.6	22.6	46.2	
Middle	21.2	20.3	22.9	13.1	
High	19.8	21.5	22.8	22.8	
Highest	24.5	12.3	4.8	4.8	
Country of birth					
N	**2838**	**585**	**434**	**146**	
Australian Born	77.6	83.9	92.6	95.2	<0.001
Non-Australian born – English speaking	12	11.1	5.3	2.7	
Born in Non-English speaking country	8	5	2.1	2.1	
Marital Status					
N	**9.7**	**584**	**433**	**146**	
Married/De-facto	62.9	66.1	70.7	74.7	<0.001
Separated/Divorced	7.1	6.3	8.5	6.2	
Widowed	5.7	5.5	6.7	6.8	

Never married	24.2	22.1	14.1	12.3	
Body Mass Index (BMI)					
N	**2647**	**535**	**400**	**135**	
Underweight	1.7	3	0.5	2.2	<0.001
Normal weight	44	37.9	30.3	31.1	
Overweight	35	39.6	38.8	37.8	
Obese	19.3	19.4	30.5	28.9	

The weighting of the data can result in rounding discrepancies or totals not adding. Remoteness categorised by Accessibility-Remoteness Index of Australia (ARIA), SEIFA= Socio-Economic Indexes for Areas, BMI categorised using World Health Organization cut offs[19]

Table 2 Proportion of participants reporting no walking for both recreation and transport by Accessibility-Remoteness Index of Australia (ARIA) category.

	Major city		Inner regional		Outer regional		Remote/ Very remote		
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**p***
Transport									
Total	1161	43.7	304	56.0	238	60.4	69	50.4	<0.001
Men	583	45.4	151	61.4	134	64.1	40	47.4	<0.001
Women	578	42.2	153	51.5	104	56.2	28	46.7	<0.001
Recreation									
Total	1025	37.1	227	39.5	190	44.9	68	47.9	0.002
Men	524	39.1	120	46.2	120	54.1	45	57.0	<0.001
Women	501	35.3	208	34.1	71	35.0	23	36.5	0.975

Analysis includes those who report at least one 10 minute bout of walking per week,
* P values are based on Chi-square tests.

Table 3. Median minutes and median times walked per week for recreation and transport in those who report doing at least one ten minute bout of walking per week for the overall sample, men and women, by remoteness.

	Recreation					Transport				
		Minutes walked per week		Times walked per week			Minutes walked per week		Times walked per week	
	N	Median (IQR)	p	Median (IQR)	P*	N	Median (IQR)	p	Median (IQR)	P*
Overall										
Major city	1735	120 (60-210)	0.027	3 (2-5)	0.005	1493	60 (20-130)	0.002	4 (2-7)	<0.001
Inner regional	347	99.2 (60-210)		3 (2-6)		239	60 (30-120)		3 (2-6)	
Outer regional	233	120 (60-240)		4 (2-7)		156	50 (30-112)		3 (2-5)	
Remote/ Very remote	74	90 (53-180)		3 (2-5)		68	60 (30-90)		3 (2-7)	
Men										
Major city	815	120 (60-210)	0.001	3 (2-5)	0.006	701	70 (40-150)	0.075	4 (2-7)	0.003

Inner regional	140	120 (60-238)		4 (2-7)		95	85.4 (30-226)		5 (2-7)	
Outer regional	102	180 (60-307)		5 (2-7)		75	60 (30-120)		3 (2-6)	
Remote/ Very remote	34	90 (40-145)		3 (2-7)		36	60 (31.5-90)		3 (2-7)	
Women										
Major city	920	120 (60-210)	0.238	3 (2-5)	0.086	792	60 (30-120)	0.005	4 (2-6)	0.001
Inner regional	207	90 (60-203)		3 (2-5)		144	60 (20-120)		3 (1-5)	
Outer regional	132	113.9 (60-180)		4 (2-6)		81	50 (234-90)		3 (2-5)	
Remote/ Very remote	40	90 (60-210)		4 (2-5)		32	43 (30-90)		3 (2-6)	

IQR, Interquartile range (25^{th}-75^{th} percentile); *P values are based on Kruskal-Wallis Test.

Table 4. Adjusted † Negative binomial regression models for the number of times walked per week for transport and recreation by Accessibility-Remoteness Index of Australia (ARIA) category.

	Transport			Recreation		
	n	**IRR (95% CI)**	**P**	**n**	**IRR (95% CI)**	**P**
Very remote/Remote	128	0.92 (0.74-1.14)	0.448	131	0.74 (0.59-0.92)	0.008
Outer Regional	379	0.64 (0.56-0.74)	<0.001	406	0.93 (0.82-1.06)	0.287
Inner regional	523	0.75 (0.67-0.85)	<0.001	547	1.00 (0.90-1.12)	0.961
Major city	2379	1		2471	1	
Men						
Very remote/Remote	74	0.75 (0.55-1.02)	0.066	76	0.54 (0.39-0.73)	<0.001
Outer Regional	212	0.60 (0.49-0.73)	<0.001	224	0.85 (0.71-1.02)	0.077
Inner regional	243	0.83 (0.70-0.98)	0.030	253	0.98 (0.83-1.16)	0.805
Major city	1221	1		1270	1	
Women						
Very remote/Remote	54	1.23 (0.89-1.72)	0.211	55	1.06 (0.76-1.47)	0.753
Outer Regional	167	0.73 (0.59-0.90)	0.004	182	0.98 (0.81-1.19)	0.851
Inner regional	280	0.71 (0.60-0.84)	<0.001	294	1.01 (0.86-1.18)	0.907
Major city	1158	1		1200	1	

IRR=Incidence rate ratio

†Adjusted by age, country of birth, body mass index, income, education, marital status, SEIFA