

Environmental barriers and enablers to physical activity participation among rural adults: a qualitative study

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Abstract

Issue addressed: Social-ecological models of health behaviour acknowledge environmental influences, but research examining how the environment shapes physical activity in rural settings is limited. This study aimed to explore the environmental factors that act as barriers or facilitators to physical activity participation among rural adults.

Methods: Forty-nine adults from three regions of rural Tasmania, Australia, participated in semi-structured interviews that explored features of the environment that supported or hindered physical activity. Interviews were digitally recorded, transcribed verbatim and analysed thematically.

Results: Four key themes emerged: functionality, diversity, spaces and places for all and realistic expectations. ‘Functionality’ included connectivity with other destinations, distance, safety, continuity, supporting infrastructure and surfacing. While there was limited ‘diversity’ of structured activities and recreational facilities, the importance of easy and convenient access to a natural environment that accommodated physical activity was highlighted. ‘Spaces and places for all’ highlighted the importance of shared-use areas, particularly those that were family- and dog-friendly. Despite desires for more physical activity opportunities, many participants had ‘realistic expectations’ of what was feasible in rural settings.

Conclusions: Functionality, diversity, spaces and places for all and realistic expectations were identified as considerations important for physical activity among rural adults. Further research using quantitative approaches in larger samples is needed to confirm these findings.

So what? Urban-centric views of environmental influences on physical activity are unlikely to be entirely appropriate for rural areas. Evidence-based recommendations are provided for creating new or modifying existing infrastructure to support active living in rural settings.

Key words: exercise behaviour, exploratory, non-metropolitan, social-ecological approach.

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Introduction

The health and economic benefits of physical activity are now well accepted^{1–4} but less than 50% of adults in Australia and many other developed nations are active at recommended levels.^{5,6} The proportion of adults not meeting physical activity guidelines is even higher among those living in rural areas.^{7–13} In order to develop appropriate public health strategies to increase physical activity, it is crucial to understand the factors that influence this behaviour. Social-ecological models highlight the roles of individual, social and environmental factors that may influence behaviour.^{14,15}

Features of the urban environment known to promote physical activity include access to facilities and destinations, high residential

density, land use, walkability scores, safety, exercise equipment and footpaths/sidewalks.¹⁶ Although differences in environmental attributes related to physical activity (playgrounds, gyms, swimming pools, public open space) have been previously reported on in urban and rural Australia,¹⁷ little remains known about the role of the environment in supporting or hindering physical activity in rural settings.¹⁸ A 2010 review identified 20 mostly cross-sectional ($n=19$), mostly North American ($n=19$) and mostly quantitative ($n=16$) studies that concluded that some of the built environment correlates of physical activity differed between urban and rural populations.¹⁹ Qualitative studies, which are highly appropriate in the early stages of investigation of such issues, have identified

accessibility, destinations and sidewalks,²⁰ physical activity equipment in the home²¹ and, for senior citizens, a lack of indoor physical activity opportunities²² as potentially important influences on physical activity in rural settings.

The purpose of this study was to explore the environmental factors that may act as barriers or facilitators to physical activity participation among adults in rural settings.

Methods

This was a qualitative study conducted in 2011 to identify features of the rural environment that impact on rural adults' physical activity participation. Ethics approval was granted by the Tasmania Social Sciences Human Research Ethics Committee, and the study followed the Consolidated criteria for reporting qualitative research (COREQ) guidelines.²³ We report the findings on the salience of six commonly reported urban physical activity environment constructs (manuscript under review).

Participants

The Australian Standard Geographical Classification (ASGC) Remoteness Structure, which classifies geographical areas based on characteristics of remoteness,²⁴ was used to classify all postcodes in the state of Tasmania, Australia. Three rural areas (two ASGC-defined as Outer Regional, one as Remote) were purposefully selected to represent diversity in the locality (northern, central and southern Tasmania), local environment (e.g. a coastal area, the central highlands and lakes district plateau and a forest/waterway area) and local industry (e.g. vegetable production, mixed agriculture and tourism, and mixed forestry and fruit growing). Characteristics of these areas are summarised in Table 1.

Purposive sampling was used to recruit 34 women and 15 men (18–55 years) from these areas for semi-structured interviews. Study resourcing resulted in unequal numbers of women and men (more funding was available for interviews with women). The recruitment strategies employed included local newspaper advertisements, local radio, posters in key community locations (libraries, community houses, neighbourhood centres) and notifying key community contacts. Participants referring other

eligible members of their community introduced an element of snowball sampling.

Data collection

Prior to the semi-structured interviews, participants completed a questionnaire to provide a demographic profile. Characteristics of the sample are detailed in Table 2. From the reported height and weight measures, body mass index (BMI; kg/m²) was calculated and weight status classified using standard definitions of overweight (BMI 25–<30 kg/m²) and obesity (BMI ≥30 kg/m²).

The interviews were carried out by a research officer (*n*=45) and one of the authors (VC; *n*=4). Both interviewers followed the same semi-structured interview schedule, which explored physical activity and features of the rural physical environment. Specifically, participants were asked open-ended questions about physical activity (the intensity, duration and frequency of physical activity in the past two weeks at work, to get from place to place, around the house/yard and during leisure/discretionary/spare time) which was deliberately defined broadly as 'any activity that lasts for at least 10 min and causes your body to work harder than normal – so your heart rate might go up, you might breathe a little heavier like huffing and puffing, and you might 'warm up' a bit'; definitions of neighbourhood and community; ease or difficulty of being active in the local area; relevance and understanding of urban physical activity environment constructs (functional characteristics, road and personal safety, destinations, aesthetics, availability and accessibility); whether these constructs impacted on their physical activity; environmental factors or features that would help the participant be more active if they wanted to be and any other aspects of their environment that may impact on physical activity.

Data analysis

Interviews were digitally recorded, transcribed verbatim and imported into NVivo software (QSR NVivo 8), which was used to support data coding and organisation of emergent themes. Data were analysed thematically by one analyst (KS), with constant and frequent discussion and refinement of themes with a second author (VC); a third independent person also contributed to the further refinement of themes. Coding and continuous cross-comparison

Table 1. Characteristics of the study areas

Characteristic	Area 1	Area 2	Area 3
Location	North	Central	South
Region type	Coastal	Central highlands/ lakes district	Forest/channel
Industry	Vegetable production	Mixed agriculture and tourism	Forestry/apple and fruit growing
Remoteness area ^A	Outer regional	Outer regional	Remote
Population ^A	10 323	991	1584
Area (sq. km)	131.8	336.3	3578.3
Population/sq. km	78.3	2.9	0.4
IRSAD ^{A,B}	914.4	865.8	885.9
<i>N</i> participants (male/female)	25 (10/15)	14 (4/10)	11 (2/9)

^ABased on Australian Bureau of Statistics data from the 2006 Population Census.

^BIndex of Relative Socioeconomic Advantage and Disadvantage (IRSAD), where 1000 represents the national average.

Table 2. Demographic characteristics of study participants, by sex

Characteristic	Women (n = 34)	Men (n = 15)
Age, mean (min., max.)	43 (26, 55)	47 (34, 59)
Born in Australia, n (%)	29 (85)	13 ^A (93)
Education, n (%)		
Low (year 12 or less)	5 (15)	1 (7)
Medium (trade/ apprenticeship/ certificate/diploma)	11 (32)	6 (40)
High (university)	18 (53)	8 (53)
Employment status, n (%)		
Full-time work	12 (35)	14 (93)
Part-time work	12 (35)	0 (0)
Not in the labour force	10 (30)	1 (7)
Marital status, n (%)		
Live with partner	30 (88)	12 (80)
Do not live with partner	4 (12)	2 (14)
Children in household, n (%)		
None	21 (62)	9 (60)
One or more	13 (38)	6 (40)
Children in household age (years), min, max	0.6, 26	1.5, 22
Access to motor vehicle, n (%)	34 (100)	15 (100)
Has injury/illness/disability preventing activity, n (%)	1 (3)	1 (6)
Height (cm), mean (min., max.)	169 (153, 184)	181 (162, 196)
Weight (kg), mean (min., max.)	67 (52, 96)	91 (69, 123)
Body mass index ≥ 25 kg/m ² , n (%)	10 (33) ^B	10 (67)

^AData missing for 1 participant (denominator = 14).

^BFour female participants declined to provide height and/or weight data (denominator = 30).

was used to identify relevant recurrent patterns and to establish significant themes.

Results

Functionality of walking and cycling networks

A central theme to emerge was the notion of functionality. Participants described features of walking and cycling networks that positively influenced their physical activity. Irrespective of participant area or sex, this was described by the majority ($n = 47$; 94%) as an important aspect of the usability of these networks. Key aspects were connectivity with other destinations, flat terrain, distance and safety. For example:

It's a great ride. And you can pop your thermos in your bike basket and some morning tea and ride out there, tie your bike up and sit by the beach. And then ride back ... it's brilliant. (Female, 50 years, North)

We've got a Platypus Walk and there's good footpaths. Ah, there's a BBQ area in there and it's used fairly heavily ... there's actually a good walking track ... halfway through [Town] and at [Town]. And it's done on Crown land around [Town] ... It's only a kilometre but people use it. And it's nice. (Male, 59 years, South)

Interruptions to the continuity, lack of pathways and/or other infrastructure and surfacing were considered barriers to physical activity by several participants ($n = 26$; 52%) for a range of reasons:

They are a little bit scary because of rivers or bridges going over the geographical features. The bridges themselves actually narrow the roads, so you are then forced back into the traffic ... Cycling to [Town] a couple of weeks ago ... I got to the bridge ... then all of a sudden there is basically no bit on the side of the road. You're on the road. And I nearly got cleaned up by a bus going across the bridge. (Male, 50 years, North)

It is about crossing roads ... There is one place where you cross at the roundabout – there's not even any footpaths there. There's cars coming in all different directions and somehow you've got to get across. And it's interesting because the footpath just stops right bang where the roundabout is, where most of the traffic is. (Male, 56 years, Central)

Also mentioned by some rural residents, particularly females ($n = 18$ of 21 comments), was street lighting, or a lack of, which was considered a modifiable aspect of the environment that might help support more regular activity. For example:

Street lighting is an issue. Just about every street that I've walked down in the evening, the lighting is almost always on the other side of the street to the footpath. (Female, 41 years, North)

Diversity of opportunities to be active

The second theme to emerge was the diversity (or lack) of opportunities to be active. While for many rural residents the variety of opportunities was limited, one positive aspect that participants ($n = 30$; 60%) mentioned was the diversity of physical activity options available in natural settings. For example:

Just across the river from us there's the big [Name] mountain range. There's walking tracks all through there. There's also mountain bike tracks. People can go on tracks to find fishing spots, lots of horse riding. (Male, 56 years, North)

And where I live in [Town] is only 250 metres from the river. So I kayak – I can just drag it down there and hop on, and off I go, and explore ... On a weekend, I'll either go kayaking, or more cycling, walking ... And the beach – you can walk a couple of kilometres on a stretch of beach here. (Female, 51 years, North).

While most participants were able to list at least one place to be active in their region, the lack of variety was an important barrier to physical activity. Several suggestions were made for structured or organised activities that would help facilitate participation:

If there was a walking group of like-minded souls that I thought I could engage with, that was at an appropriate time of the day or something, maybe yeah. (Female, 51 years, Central)

Zumba's really popular these days. If someone did a class every Wednesday night at [Town] at the hall, then I would go. And I think a lot of other people would too. But we don't have that at all. (Female, 43 years, Central)

But I think, you know, if they had badminton or if they had Tai Chi or if they had aerobics or something ... I think that

would really make it easier for me to access and more likely to ... So in an ideal world, if you have a good-sized hall or something and somebody that's taken the initiative or funded to provide a couple of different [classes] ... I think that would have the dual effect of increasing physical activity but also connections amongst people. (Female, 35 years, North)

Some participants ($n = 16$; 13 female) from each region indicated that a greater diversity of sporting or recreational infrastructure would assist them to be more active:

If we had a tennis court we might be able to hire that ... (Female, 46 years, South)

If there was a netball court down the road ... then I would probably play netball one night a week and if there was a tennis club or just people doing social tennis on a Monday night, I would block that out in my diary ... (Female, 42 years, Central)

Places and spaces for all

Many participants highlighted the importance of shared-used areas, indicating that their environment was accessible for both families ($n = 23$; 46%) and dog owners ($n = 18$; 36%), which encouraged physical activity:

[Name] Park is great for families. So families get down there, have BBQs, play sport and run. Ah, there are a number of different ovals down there. And there's that water track that goes beside the river. (Male, 56 years, Central)

I think if that policy wasn't in place and they said no, there is no dog walking on beaches, I think you would certainly cut back a lot of the people that do access a lot of the walking facilities because it's a dog-friendly town. (Male, 52 years, North)

A small number of participants also raised equity concerns related to accessibility of opportunities to be active for people who are mobility-impaired or people with young children:

Some of our older-style footpaths are a bit sudden – they don't have that sort of easability [sic] to get anything wheeled on or off. You know, scooters, wheelchairs or whatever ... (Male, 47 years, North)

One thing that I hadn't really thought about until I had a diabetic on one of the walking groups – he actually had to stop because a lot of it was on gravel roads, and it hurt his feet too much. He didn't have good feet anyway because of his diabetes, and he just found it too hard. (Female, 50 years, Central)

Realistic expectations

The notion of realistic expectations – the acceptance of environmental limitations to maintaining a physically active lifestyle as part of rural life – emerged as a common theme:

We choose to live in [a] spread-out area. So I guess the bottom line is to get the quality of life that we want, we've got to give up certain things. (Male, 59 years, South)

Like the roads that are a bit narrow and the bridge that sort of really hasn't got a walkway. But then again, it's only our family and one other bloke that lives on this side of the river. So they're not going to spend \$40 000 on a walkway for us. (Male, 35 years, Central)

Sometimes we are a little bit limited with some of our services ... My father drummed into me a bit that ... you can't have a view without some wind. And the same is, you know, it's lovely to have our quieter lifestyle, but you can't have that whilst being surrounded by services and activities. So there's that trade-off. (Male, 47 years, North)

Rather than accepting a lack of infrastructure as a barrier to physical activity, some participants had adopted pragmatic solutions to overcome these limitations. For example:

You can't really walk or cycle on the [Name] Highway with the log trucks and everything. That's one limiting factor. There'd be no way you could fit a cycleway on it anyway. So that's why, if I was going to go for a ride, I'd throw the bike in the ute and go down to [Town] or somewhere a bit flatter. (Male, 53 years, Central)

Well obviously because [Town] hasn't got the infrastructure we're never going to get footpaths, so [you can't] get up and just go for a walk ... I would get in the car and you'd have the bike in the car, or you'd have your running shoes and you'd drive somewhere, and then you'd go for a run. (Female, 52 years, South)

Discussion

This study aimed to explore the environmental factors that act as barriers or facilitators to physical activity participation among rural adults. Four key themes – functionality, diversity, spaces and places for all, and realistic expectations – emerged from the data. These themes provide insights into environmental factors that could be targeted to support rural adults to engage in more physical activity. While some of these themes are similar to those observed in the urban literature, some appear uniquely rural.

The theme of functionality of walk and cycle ways is a similar construct to that observed in the urban literature. For example, Pikora *et al.*²⁵ discussed the functional aspects of the environment as one of four key environmental determinants of walking and cycling; of the 20 functional factors outlined in their framework, six were mentioned by participants in this study: direct routes, gradients, other access points, path continuity, path maintenance and path surface. Interestingly, many of the functionality issues raised by participants in this study came from those living in the Central region. This may be due to the lack of a central focal point in these areas – in contrast, the northern region has a substantial coastline and the southern region has waterfront with a large and nearby waterway, both of which provide a focus and an amenable route for cycling and walking networks.

The diversity of sporting and recreational opportunities was considered limited; a notion that is consistent with prior studies.¹⁹

Their availability may be limited by a lack of facilities or qualified personnel. Further work should be undertaken to explore the feasibility of setting up additional group training programs in these areas. On the contrary, the perceived ease of access to physical activity opportunities in the natural environment appears to be uniquely rural. For example, numerous participants mentioned ease of access to places for bushwalking, mountain biking and horse-riding activities; and to rivers, lakes and beaches for aquatic activities. While some of these opportunities may be available for urban-dwellers, it appeared that the diversity and convenience of opportunities was a central enabler of physical activity for these rural adults. This finding suggests that supporting opportunities that exist in the natural environment may be a low-cost strategy for promoting physical activity among rural adults.

The spaces-and-places-for-all theme highlighted the importance of consideration of the shared-usage spaces in the community, in particular, that opportunities are family-friendly and dog-friendly. Higher dog ownership in rural areas²⁶ suggests that the provision of areas that allow dog-walking may be important. Accessibility issues, as noted previously in rural adults,²⁰ were also of concern to participants. These findings highlight the important role of local government policies that promote more, rather than less, access to shared-use spaces.

The participants in this study acknowledged many environmental barriers to physical activity and highlighted numerous improvements that could be made in their local area to promote physical activity participation. However, there was a general acknowledgement that some of these improvements were likely to be unrealistic. Participants talked about the trade-off between the positive aspects of a rural lifestyle and the limited access to physical activity opportunities and supporting infrastructure. This point is undocumented in the urban literature.

These findings support some, but not all, of the seven planning considerations detailed in the Heart Foundation's urban-focused Healthy by Design guidelines.²⁷ Our findings do not directly support two of the planning considerations ('streets', 'public transport');

two were directly supported ('walking and cycling routes', 'supporting infrastructure'); and three had relevant constructs that may require some tailoring for rural settings ('local destinations', 'open space', 'fostering community spirit'). For example, the walking and cycling routes planning consideration promotes (among other things) making connections, creating stimulating and attractive routes, creating safe and functional routes and maximising accessibility of walking and cycling routes for all. The supporting infrastructure consideration includes providing seating for people with restricted mobility, lighting to routes and spaces used at night to increase safety and facilities that encourage and support cycling and walking. Many of these issues were raised by participants in the current study, highlighting their relevance. The local destinations planning consideration, while relevant at a broader level, focuses mostly on destinations of more salience to urban settings (e.g. food stores, newsagents, chemists, schools and cafes), which were not commonly mentioned in this study. Similarly, the concept of open spaces was relevant at a broad level (e.g. connecting people with the natural environment), but some specific planning considerations (e.g. providing open spaces within safe and comfortable walking and cycling distance) may not be of direct relevance and may require tailoring for rural communities.

Some of the limitations of this study include the restriction to one state (Tasmania) of Australia, although three diverse regions were sampled, including one region with a similar population density to rural areas of Europe²⁸ and the United States of America;²⁹ a relatively small sample ($n = 49$) of volunteers who may not be representative of the general rural population, particularly in regards to the generally higher levels of education observed in this study (median age, proportion Australian-born, and proportion of men classified as overweight or obese was similar to the general Australian rural population); the possibility that participants who were more active had greater exposure to the environment and hence greater awareness of facilities and infrastructure; and the lack of standardised measurement of physical activity levels.

Despite these limitations, there are few qualitative studies that seek to understand environmental influences on the physical activity of

Box 1. Recommendations for policy and practice

Theme 1: Ensure functionality of walking and cycling infrastructure to support physical activity

- Design cycle ways and walking tracks that meet the needs of all users by ensuring they are continuous, connected, accessible and well maintained
- Consider retrofitting infrastructure such as cycle ways and footpaths when replacing or upgrading roadways and bridges
- Position street lighting near footpaths and explore the use of solar power to illuminate cycle ways and walking tracks.

Theme 2: Value and promote diversity of opportunities to be active

- Promote activities that take advantage of the natural environmental features that exist in rural areas
- Promote and resource structured and organised activities (such as walking groups or dance classes) through the use of existing programs and facilities
- Explore strategies to increase and maximise usage of existing sporting and recreational facilities.

Theme 3: Ensure places and spaces for all

- Ensure shared-use and the promotion of family- and dog-friendly aspects when creating new or modifying existing spaces and places for active recreation
- Ensure equitable access to cycle ways, walking tracks and footpaths for those with limited mobility.

rural adults; therefore, this study provides some important insights for informing the direction of further quantitative studies in rural areas. It highlights the applicability of some constructs from urban-focused planning guidelines and, if confirmed in larger, quantitative studies, provides additional guidance for planners, designers, developers and health promoters working to create new or modify existing infrastructure in rural areas to support active living (Box 1). These recommendations deliberately focus on retrofitting and modifying existing environments, rather than the creation of new developments due to limited residential and commercial growth in rural areas.

Conclusion

The findings from this study indicate that an urban-centric view of the environmental influences on physical activity may not be entirely appropriate in the rural setting. Although the theme of functionality in particular may be common to both rural and urban environments, this study has uncovered some uniquely rural environmental influences on physical activity that warrant consideration both in further research and in the refinement of existing or development of new planning guidelines.

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References

1. Vuori I. Physical activity and health: metabolic and cardiovascular issues. *Adv Physiother* 2007; **9**: 50–64. doi:10.1080/14038190701395887
2. Lee I-M, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet* 2012; **380**: 219–29. doi:10.1016/S0140-6736(12)61031-9
3. Medibank Private. The cost of physical inactivity. Medibank Private; 2007. Available at: http://www.medibank.com.au/Client/Documents/Pdfs/pyhsical_inactivity.pdf [Verified 15 June 2015].
4. Haskell WL, Lee IM, Pate RR, Powell KE, Blair SN, Franklin BA, Macera C, Heath GW, Thompson PD, Bauman A. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med Sci Sports Exerc* 2007; **39**(8): 1423–34. doi:10.1249/mss.0b013e3180616b27
5. Australian Bureau of Statistics. Australian Health Survey: Physical Activity, 2011–12. Canberra: ABS; 2013.
6. Hallal PC, Andersen LB, Bull FC, Guthold R, Haskell W, Ekelund U. Global physical activity levels: surveillance progress, pitfalls, and prospects. *Lancet* 2012; **380**(9838): 247–57. doi:10.1016/S0140-6736(12)60646-1
7. Australian Institute of Health & Welfare. Rural, regional and remote health: indicators of health status and determinants of health. Canberra: Australian Institute of Health and Welfare; 2008. Cat. no. PHE 97.
8. Centers for Disease Control and Prevention. Self-reported physical inactivity by degree of urbanization—United States, 1996. *MMWR Morb Mortal Wkly Rep* 1998; **47**(50): 1097–100.
9. Dobson A, McLaughlin D, Vagenas D, Wong KY. Why are death rates higher in rural areas? Evidence from the Australian Longitudinal Study on Women's Health. *Aust NZ J Publ Heal* 2010; **34**(6): 624–8. doi:10.1111/j.1753-6405.2010.00623.x
10. Martin SL, Kirkner GJ, Mayo K, Matthews CE, Durstine JL, Hebert JR. Urban, rural, and regional variations in physical activity. *J Rural Health* 2005; **21**(3): 239–44. doi:10.1111/j.1748-0361.2005.tb00089.x
11. Parks SE, Housemann RA, Brownson RC. Differential correlates of physical activity in urban and rural adults of various socioeconomic backgrounds in the United States. *J Epidemiol Commun H* 2003; **57**(1): 29–35. doi:10.1136/jech.57.1.29
12. Van Dyck D, Cardon G, Deforche B, De Bourdeaudhuij I. Urban–rural differences in physical activity in Belgian adults and the importance of psychosocial factors. *J Urban Health* 2011; **88**(1): 154–67. doi:10.1007/s11524-010-9536-3
13. Badland H, Schofield G. Understanding the relationship between town size and physical activity levels: a population study. *Health Place* 2006; **12**(4): 538–46. doi:10.1016/j.healthplace.2005.08.007
14. Sallis J, Owen N. Ecological models of health behavior. In: Glanz K, Rimer BK, Lewis FM, editors. *Health behavior and health education: theory, research & practice* (pp. 462–84). 3rd edition. San Francisco: Jossey-Bass; 2002.
15. Stokols D. Translating social ecological theory into guidelines for community health promotion. *Am J Health Promot* 1996; **10**(4): 282–98. doi:10.4278/0890-1171-10.4.282
16. Bauman A, Bull FC. Environmental correlates of physical activity and walking in adults and children: a review of reviews. National Institute of Health and Clinical Excellence; 2007. Available at <http://www.nice.org.uk/guidance/ph8/evidence/environmental-correlates-of-physical-activity-review2> [Verified 15 June 2015].
17. Thornton LE, Crawford DA, Cleland VJ, Timperio AF, Abbott G, Ball K. Do food and physical activity environments vary between disadvantaged urban and rural areas? Findings from the READI study. *Health Promot J Austr* 2012; **23**(2): 153–6.
18. Bauman AE, Reis RS, Sallis JF, Wells JC, Loos RJ, Martin BW. Correlates of physical activity: why are some people physically active and others not? *Lancet* 2012; **380**(9838): 258–71. doi:10.1016/S0140-6736(12)60735-1
19. Frost SS, Goins RT, Hunter RH, Hooker SP, Bryant LL, Kruger J, Pluto D. Effects of the built environment on physical activity of adults living in rural settings. *Am J Health Promot* 2010; **24**(4): 267–83. doi:10.4278/ajhp.08040532
20. Chrisman M, Nothwehr F, Yang G, Oleson J. Environmental influences on physical activity in rural midwestern adults: a qualitative approach. *Health Promot Pract* 2015; **16**(1): 142–8. doi:10.1177/1524839914524958
21. Kegler MC, Swan DW, Alcantara I, Feldman L, Glanz K. The influence of rural home and neighborhood environments on healthy eating, physical activity, and weight. *Prev Sci* 2014; **15**(1): 1–11. doi:10.1007/s11211-012-0349-3
22. Aronson RE, Oman RF. Views on exercise and physical activity among rural-dwelling senior citizens. *J Rural Health* 2004; **20**(1): 76–9. doi:10.1111/j.1748-0361.2004.tb00010.x
23. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care* 2007; **19**(6): 349–57. doi:10.1093/intqhc/mzm042
24. Australian Bureau of Statistics. Australian Statistical Geography Standard (ASGS): Volume 5 – Remoteness Structure. Canberra: ABS; 2011.
25. Pikora T, Giles-Corti B, Bull F, Jamrozik K, Donovan R. Developing a framework for assessment of the environmental determinants of walking and cycling. *Soc Sci Med* 2003; **56**(8): 1693–703. doi:10.1016/S0277-9536(02)00163-6
26. Cleland V, Ball K, King AC, Crawford D. Do the individual, social and environmental correlates of physical activity differ between urban and rural women? *Environ Behav* 2012; **44**(3): 350–373.
27. National Heart Foundation of Australia. Healthy by design. A guide to planning and designing environments for active living in Tasmania. National Heart Foundation of Australia; 2009. Available at: <http://www.heartfoundation.org.au/SiteCollectionDocuments/Tasmania-healthy-by-design.pdf> [Verified 15 June 2015].
28. Eurostat. Demography statistics by urban-rural typology (urt_demo): population density (urt_d3dens) 2012. Available from: http://ec.europa.eu/eurostat/en/web/main/data/database?node_code=urt_d3dens. [Verified 19 December 2014].
29. United States Census Bureau. Census Urban and Rural Classification and Urban Area Criteria 2010. Available from: <https://www.census.gov/geo/reference/ua/urban-rural-2010.html> [Verified 19 December 2014].

Physical activity and sedentary behaviour among Asian and Anglo-Australian adolescents

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Abstract

Issue addressed: Evidence suggests that physical activity (PA) and sedentary behaviour (SB) participation varies among culturally and linguistically diverse (CALD) adolescents. The present study examined differences in PA and SB among a CALD sample of Chinese Australian, South-east Asian and Anglo-Australian adolescents.

Methods: Data from 286 adolescents aged 12–16 years involved in the Chinese and Australian Adolescent Health Survey in metropolitan Melbourne, Australia, were analysed. Accelerometry outcomes included median activity counts per minute (counts.min⁻¹) and minutes per day (min.day⁻¹) spent in light-intensity PA (LPA), moderate-to-vigorous-intensity PA (MVPA) and sedentary time (ST). Kruskal–Wallis one-way analysis of variance and sequential multiple hierarchical linear regressions were used to examine CALD differences in PA and ST.

Results: Multivariate analyses of accelerometry data found Chinese Australian and South-east Asian adolescents engaged in significantly less daily MVPA (5–8 min.day⁻¹) and LPA (50–58 min.day⁻¹; $P < 0.05$), but greater daily ST (40–41 min.day⁻¹), than Anglo-Australian adolescents, after adjusting for age, gender and socioeconomic category.

Conclusion: The results demonstrate lower engagement in daily MVPA and LPA and greater engagement in ST using accelerometry among Chinese Australian and South-east Asian adolescents compared with Anglo-Australian adolescents. These findings have important public health implications in furthering our understanding of CALD differences in PA and SB.

So what? An understanding of the CALD differences in physical activity and sedentary behaviour among Australian adolescents has important implications for intervention planning and delivery as well as the wider health implications of these behaviours. This article furthers the current understanding of CALD adolescents' participation in physical activity and sedentary behaviour, of which limited information is available.

Key words: adolescent, Chinese, ethnicity, exercise, sedentary lifestyle.

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Introduction

The Australian population is culturally and linguistically diverse, with approximately 26% of the entire population born overseas, many of whom come from non-English speaking countries.¹ The term 'culturally and linguistically diverse' (CALD) is customarily used to refer to the wide range of cultural groups that represent the Australian population and recognises that groups and individuals differ according to ethnicity, language, race, religion and spirituality; it is used to describe groups that differ from the English speaking majority (non-CALD).² In most culturally pluralist industrialised countries,

inequalities exist in risk factors associated with poor physical and mental health outcomes, and families from CALD backgrounds are among the most affected.^{3,4} Despite the evidence that regular physical activity (PA) is associated with several health benefits, there is evidence that youth from CALD communities have less likelihood of engaging in sufficient PA to confer these benefits.^{5,6} Data to inform a conceptual framework to increase the participation of CALD communities in PA and decrease sedentary behaviours (SBs) are urgently needed.

The many documented health benefits of PA for children and adolescents⁷ are commonly examined through risks associated with

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