

Physical Activity Participation in Regional Areas of Australia

A Critical Literature Review

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Abstract

Introduction

Despite the well-known benefits, physical inactivity is a global problem and is a clear contributor to chronic disease. Australians living in regional areas are not meeting the recommended physical activity guidelines and experience poorer health than those in metropolitan areas. This review aims to understand the barriers and opportunities for participation in physical activity in regional areas to provide evidence to inform public health interventions.

Methods

Using a systematic method, current international and national literature was selected for review. Databases selected included those covering health, sociology, physical activity and the environment. Studies selected for review all had a regional focus, were conducted in the past 10 years in Australia or similar countries. Following critical appraisal using the Critical Appraisal Skills Program, Quality Assessment Tool by National Heart, Lung and Blood Institute and Mixed Methods Appraisal tools, nine studies were included in the review.

Results/Discussion

Study findings in relation to barriers and enablers to physical activity were grouped using the SDoH framework. Findings highlighted evidence that socioeconomically disadvantaged groups in regional areas experience limited transport opportunities, there is a unique rural culture around physical activity participation, regional environment infrastructure plays a role in influencing physical activity levels and social connections are an important aspect of keeping regional people physically active. The main limitation of this review is that there has been little research conducted in regional areas in relation to physical activity participation. This meant that only 9 studies are included in this review.

Conclusions

Based on the findings of this review, a number of recommendations are provided regarding policy, physical activity initiatives and future research. In particular, the further development of the Victorian Public Health and Wellbeing Plan (2015–2019) to promote physical activity in regional areas.

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Chapter 1: Introduction and background

1.1 Health and physical activity

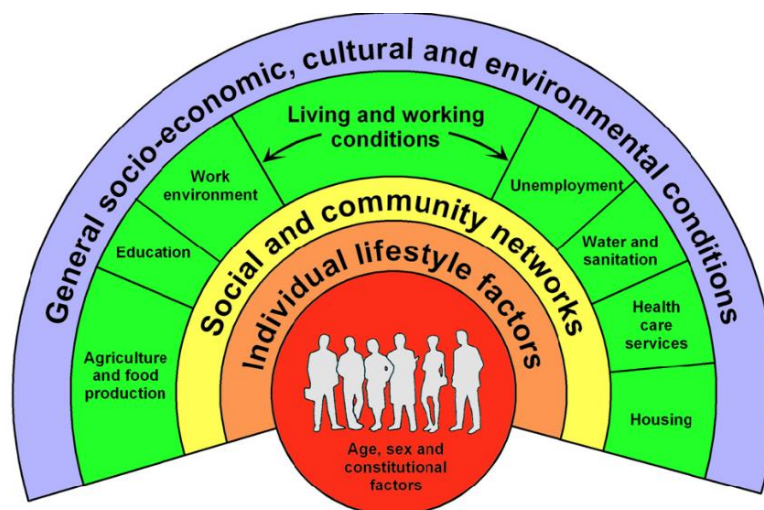
Physical activity has been shown to have a range of beneficial effects on health. It improves mental and physical health and reduces risk factors for poor health such as being overweight and developing chronic disease (Australian Institute of Health and Welfare (AIHW) 2016). Despite the well-known benefits, physical *inactivity* is a global problem and is a clear contributor to chronic disease and early death, placing a burden on health care systems (Karmeniemi, Lankila, Ikaheimo, Koivumaa-Honkanen and Korpelainen 2018). Less than fifty percent of adults in Australia are undertaking physical activity at levels recommended by the government (Cleland, Hughes, Thornton, Squibb, Venn and Ball 2015). Health expenditure in Australia increases each year, from \$95 billion in 2003 and 2004 to an estimated \$155 billion in 2013 and 2014 (AIHW 2016), with 2.6% of the total burden of disease in Australia due to physical inactivity (Department of Health 2016). Statistics from the AIHW show that in 2017 physical inactivity was the fourth leading cause of disease, responsible for around 8,600 deaths a year (AIHW data 2017 cited in National Rural Health Alliance (NRHA) 2011). Physical inactivity is thus a significant public health issue.

Australia's Physical Activity and Sedentary Behaviour Guidelines state that in order to gain health benefits, children should accumulate at least 60 minutes of moderate to vigorous intensity physical activity daily, and adults, 2 ½ to 5 hours of moderate intensity and 1 ¼ to 2 ½ hours of vigorous intensity physical activity each week (Commonwealth of Australia 2018). National physical activity data levels highlight that 52% of Australian adults were not sufficiently active in 2014 (AIHW 2017). Victorian physical activity levels follow a similar pattern, showing that 54% of all Victorians do not meet the guidelines (Victorian State Government 2016). Furthermore, it is alarming that compared with people in cities, people living in regional areas of Australia are 1.16 times more likely to be physically inactive (AIHW data 2017 cited in NRHA 2011). The correlation between low rates of physical activity and high rates of chronic disease in Australia is concerning. It is important to understand the barriers and opportunities for participation in physical activity, particularly in regional areas of Australia, in order to inform public health policy and practice in these communities (Bauman, Reis, Sallis, Wells, Loos and Martin 2012).

1.2 Barriers and opportunities to physical activity

An evidence-based understanding of why people are physically active or inactive can help to target known causes of inactivity, inform future epidemics of inactivity and contribute to more effective prevention of chronic disease (Bauman et al 2012). Research has shown that age, sex, income, education, social support, health status, self-efficacy and motivation are associated with physical activity participation (Bauman et al 2012). However, associations between these factors and physical activity is complex and vary at different levels, from the individual to environment (Bauman et al 2012). These factors are known as Social Determinants of Health (SDoH), conditions in which people grow, live, work, and age (CSDH 2008 cited in AIHW 2016). Dahlgren and Whitehead's (1991) model of SDoH outlines the multiple levels of influence on determinants (Figure 1).

Figure 1. Social Determinants of Health



Source: Dahlgren and Whitehead, 1991

Influences on physical activity can occur at all levels of Dahlgren and Whitehead's model. Socioeconomic conditions and related factors such as income, education and occupations have been recognised as an important determinant of health. These factors can influence attitudes, experience and exposure to physical activity participation (O'Donoghue, Kennedy, Puggina, Aleksovskaja, Buck, Burns, et al 2018).

The built environment refers to human made structures where people, live, work, and play. This includes neighbourhoods, roads, paths and transport systems. The quality of the built environment is a powerful determinant of health (Koehler, Latshae, Matte, Kass, Frumkin, Fox, Hobbs, Wills-Karp and Burke 2018). The built environment can influence physical activity levels, through for example, accessibility to services and transport systems (Karmeniemi, Lankila, Ikaheimo, Koivumaa-Honkanen and Korpelainen 2018), availability of infrastructure such as walking paths and traffic lights as well as neighbourhood safety and scenery (Frost, Goins, Hunter, Hooker, Bryant, Kruger and Pluto 2010). The association between the built environment and physical activity is complex but does suggest an opportunity to address the burden of chronic disease by improving modifiable aspects such as neighbourhoods, parks and active transport opportunities (Koehler et al 2018).

The extent of social connectedness and the degree to which individuals form close bonds with others has shown to be associated with lower morbidity and increased life expectancy (Kawachi et al 1997 cited in AIHW 2016). Social connection can provide sources of resilience against poor health which is critical to physical and mental wellbeing (AIHW 2016). While there have been a range of studies exploring how the SDOH impact on physical activity, given the higher rates of physical inactivity in regional areas, it is important to understand how they influence physical activity in these areas.

1.4 Regional areas: health and physical activity

Regional areas of Australia are defined as towns, small cities and areas that lie beyond the major capital cities (Regional Australia Institute 2017). Australians living in regional areas experience poorer health than their urban living counterparts (AIHW 2008). Disparities in health, among other lifestyle factors such as access to education, employment and services, are most evident by mortality rate differences. In 2009–2011, people living in remote areas of Australia had mortality rates 1.4 times higher than people living in cities (AIHW 2016).

People living in regional areas are significantly more likely to report lower physical activity levels than their counterparts living in major cities (AIHW 2008). The barriers to physical activity that people living in regional areas face have been shown to include having low socioeconomic status (SES), having limitations in availability and accessibility of places to be active, fewer parks and walkable destinations and car-centric roads (Walsh, Meye, Gamble, Patterson and Moore 2017). However, to date, research around physical activity has been centred on metropolitan areas and there is still little known about the reasons behind low physical activity participation regionally (Frost et al 2010).

As a result, many current Australian physical activity planning documents, such as the Active Victoria strategic framework for sport and recreation 2017 - 2021, the Heart Foundation's, Healthy and Active by Design framework and the Victorian Cycling Strategy 2018-28 take focus on metropolitan areas. A better understanding of regional areas, including their environmental, cultural and social factors can help in the development of effective interventions and public policy to support health in regional communities (Carroll et al 2014). More specifically, this review has been designed to inform health promotion work being undertaken in the Hume region of Victoria where the author is employed. In response to the need for more of the Hume region population to become physically active, 'active living' has been introduced as a health priority. This review seeks to not only identify barriers and opportunities to physical activity regionally, but also to help inform the future public health and wellbeing plans.

1.3 Study Rationale

The percentage of adults not meeting the recommended physical activity guidelines is higher among those living in regional areas (Cleland et al 2015). Developing appropriate public health strategies to increase physical activity in these areas requires an understanding of the factors that influence the commonly reported physical inactivity levels (Cleland et al 2015). While there is a relatively good understanding of the barriers and enablers of physical activity in metropolitan areas, there is less known in regional areas (Cleland et al 2015). This review aims to understand the barriers and opportunities for participation in physical activity in regional areas of Australia with the intention of providing evidence to inform public health interventions in regional areas.

1.4 Research Questions

Specifically, this review aims to address the following research questions:

1. What are the barriers to physical activity participation in regional Australia?
2. What are the opportunities to increase physical activity participation in regional Australia?

Chapter 2: Methodology

2.1 Search Criteria

To answer the research questions, what are the barriers to physical activity participation in regional Australia? and what are the opportunities to increase physical activity participation in regional Australia? current national and international literature was reviewed using a systematic approach.

An initial literature search was conducted through the EBSCOHost database accessed through the Deakin University online library. The databases selected included those covering health, sociology, environment and physical activity. Specifically, these were: Global Health, MEDLINE Complete, Environment Complete, Sport Discus, Urban Studies, Academic Search Complete, CINAHL Complete, Health Source, Informit, Psych Info, SocIndex.

To answer the research questions, the search terms outlined in Table 1 were used.

Table 1. Key Search Terms

Health	Physical Activity	Environment	General
"chronic diseases"	active	"region* area"	"public Policy"
"health outcoms"	uptake	Australia*	benefits
"physical health"	walking	built	"health promotion"
"mental health"	cycling	neighbourhood	Barriers
"Public health"	"active travel"	communit*	opportunities
"social connection"	sport	green space	behavo*
illness	recreation	connection	guidelines
lifestyle	play	nature	participation
	"physically active"	streets	
		playground	
		paths	
		"public space"	
		parks	
		infrastructure	

2.2 Inclusion and Exclusion Criteria

International and national literature was selected for review. International literature was only reviewed if research was in a country similar to Australia, in order to maintain relevance when making recommendations. All studies were required to have a regional focus. Only literature inclusive of the past ten years (2008-2018) and written in English was included.

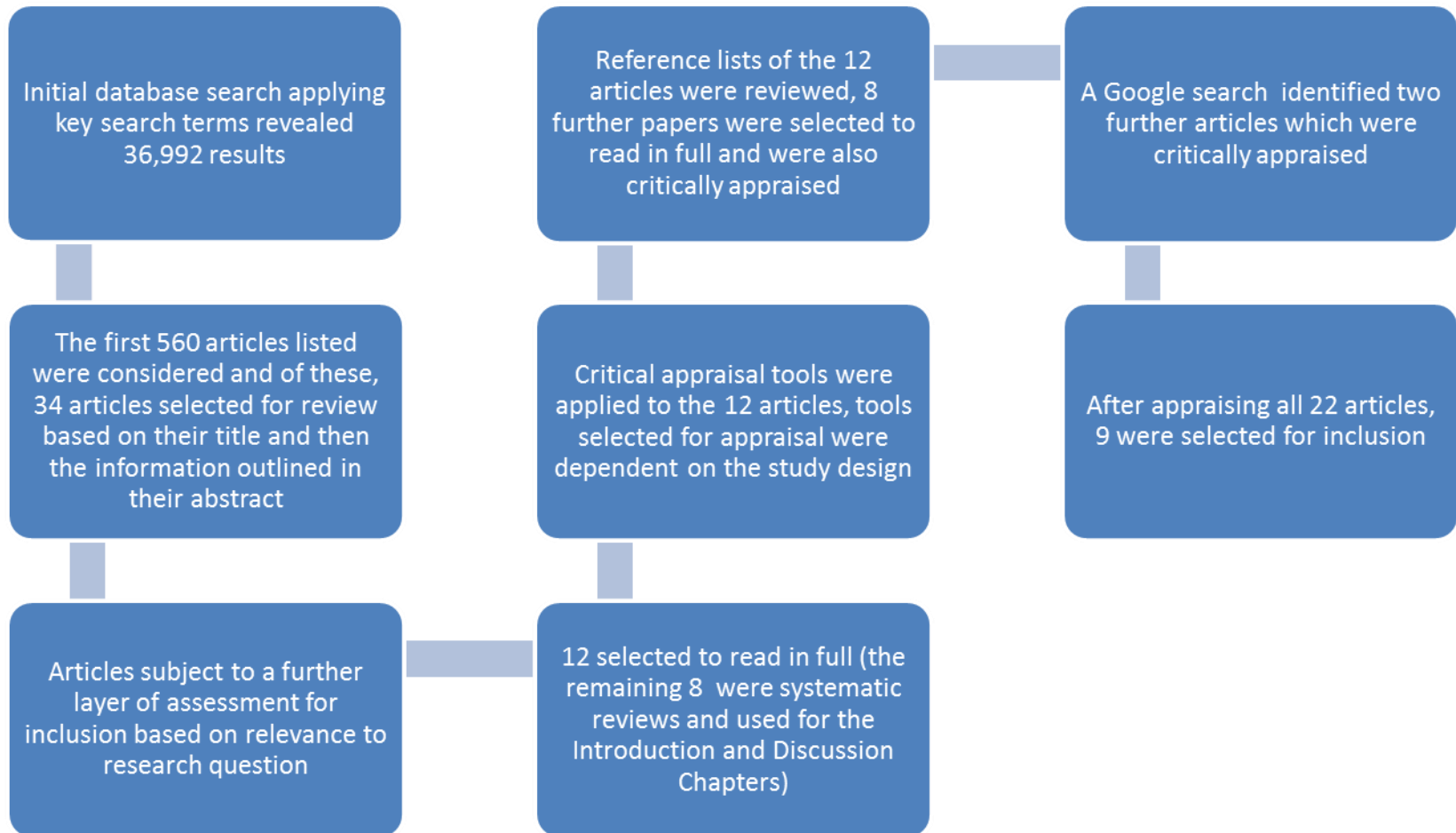
An initial search applying the key search terms in the listed databases revealed 36,992 results (Table 2). Of these 36,992 results, the first 560 articles listed were considered as after this point the relevance of the articles to the research question appeared to diminish. Of the 560 articles considered, 34 articles were selected for review based on their title and then the information outlined in their abstract.

Table 2. Research questions, search terms and results

Research Questions	Search Terms	Database	Results
What are the barriers to physical activity participation in regional Australia?	"physical activity" or exercise or "active travel" or sport or recreation or play or walking or cycling AND chronic diseases* or "health outcome*" or "mental health" or "social connect*" AND region* or communit* or "built environment" or neighbourhood or "public space" or infrastructure or playground or "green space"	Academic Complete	10,980
		MEDLINE Complete	10,266
		PsycINFO	8,797
		Global Health	3,642
		CINAHL Complete	3,300
		Informit	7
What are the opportunities to increase physical activity participation in regional Australia?			
An additional 10 articles were sourced through article reference lists and Google			

Literature found in background reading, reference lists and Google was also reviewed. Studies considered relevant to the research questions but not considered primary research were deemed appropriate for inclusion in the Introduction and Discussion Chapters of this review. Details of the inclusion and exclusion process are outlined in Figure 2.

Figure 2. Flowchart of literature search method



2.3 Critically appraising the literature

In order to determine whether the research was of sufficient quality to be able to be included in the review, critical appraisal tools were applied, as outlined below. Appendix 1 provides a summary of the articles critically appraised.

Three qualitative studies were assessed through application of the Critical Appraisal Skills Program (CASP) checklist for qualitative studies. The checklist is made up of ten questions divided into three sections including; A. Are the results valid? B. What are the results? and C. How will the results help locally? The questions were answered by selecting yes, no or can't tell (CASP 2017). Articles that scored yes to eight or more of the ten questions were considered of high enough quality and were included in the review.

The Quality Assessment Tool by National Heart, Lung and Blood Institute (NHLBI) was applied to four observational studies and one cross-sectional study. This tool is made up of 14 questions of which to select the responses, yes, no or other (NHLBI 2016). Articles that scored yes to seven or more of the fourteen questions were considered of high quality and were included in the review.

A Mixed Methods Appraisal Tool was used to appraise two articles. This tool has been designed for the appraisal of reviews that include qualitative, quantitative and mixed methods studies. The tool's two screening questions were applied to determine whether feasible to continue appraising and apply the mixed-methods questions, which could be answered yes, no or can't tell (Pluye et al 2011). Articles that scored yes to four or more of the five questions were considered of high quality and were included in the review.

2.3 Synthesising the results

After completing the critical appraisal stage, 9 articles were considered relevant and of high quality and therefore included the review. A systematic analysis was undertaken based on the SDoH framework (Dahlgren and Whitehead 1991). Findings from the articles were grouped in terms of the framework with the main findings relevant to the framework sitting under the levels of; 1. socioeconomic, cultural and environmental conditions, including infrastructure and 2. social and community networks. Applying this framework to establish these themes helped to create the key areas discussed in the Results Chapter.

Chapter 3: Results

Nine studies are included in the Results Chapter of this review. These are discussed in relation two levels of the SDoH model: 1. socio-economic, cultural and environmental conditions and 2. social and community networks (Dahlgren and Whitehead 1991). As several studies reviewed considered a socio-ecological approach in their research, and because there are common findings, many studies overlap into multiple themes. When a study is first introduced an outline is provided and from there on, only findings are discussed. Appendix 2 provides a summary of the articles reviewed.

3.1 Socio-economic, cultural and environmental conditions

There were seven studies that discussed the influence of socioeconomic, cultural and environmental conditions on physical activity participation in regional areas (Thornton, Crawford, Cleland, Timperio, Abbott and Ball 2012; Smith, Thomas and Batras 2016; Kegler, Swan, Alcantara, Feldman and Glanz, 2013; Chrisman, Nothwehr, Yang and Oleson 2015; Gustafson, McGladrey, Liu, Peritore, Webber, Butterworth, Vail 2015; Eley, Bush, and Brown 2014; Cleland, Hughes, Thornton, Squibb, Venn and Ball 2015). This theme has been divided into sub-themes for simplicity.

3.1a Socioeconomic conditions

Two studies reviewed discussed socio-economic conditions and physical activity participation (Thornton et al 2012; Smith, Thomas and Batras 2016).

Firstly, Thornton et al (2012) undertook a cross-sectional analysis of data that was collected in 2007 and 2008 as part of the Resilience for Eating and Activity Despite Inequality study. The aim of this study was to investigate whether the distribution and density of environmental amenities was related to physical activity (and eating behaviours). Further, it aimed to determine whether these differed between socioeconomically disadvantaged urban and rural areas. Data was sourced from 40 urban and 40 rural socioeconomically disadvantaged areas of Victoria, Australia that were randomly selected. Urban areas included Melbourne, Geelong, Warrnambool, Ballarat and Wodonga. Rural areas included towns with populations less than 1,200 people that were located within a 200km radius of these selected urban areas. Data on the spatial location of amenities was collated from online directories and was analysed in relation to the total land area and population numbers. Amenities regarding the physical activity aspect of the study included playgrounds, swimming pools, gym and leisure centres and public open spaces (Thornton et al 2012).

Results showed that compared to rural areas, a higher percentage of urban areas contained gym and leisure centres, however a lower percentage contained swimming pools. Urban areas also had a greater density of playgrounds and gym and leisure centres while rural areas had significantly more playgrounds and swimming pools according to their population number (Thornton et al 2012). Results suggest that despite rural areas being thought to constrain opportunities for physical activity (in comparison to urban environments), rural socioeconomically disadvantaged areas do have amenities that allow opportunities for physical activity participation. However, a lower spatial density in rural areas means greater travel distances may be required to access these amenities, particularly for those living outside regional town centres (Thornton et al 2012).

The authors noted that the study was strengthened by the examination of a range of environmental amenities however, also noted that additional aspects important for physical activity participation, such as sports clubs, were not included. The authors also state that the study was limited by the suburb boundaries that meant they may not have captured all amenities that residents within a suburb might access. The authors highlighted that future research should consider factors that influence individuals' transport options, such as access to public transport or owning a vehicle (Thornton et al 2012). Additional data on size and quality of amenities was also thought to be of value by the authors, highlighting a need for detailed environmental data that is not restricted to boundaries in order to thoroughly assess areas with limited access. According to Thornton et al (2012), the strength of the study lay in the comparisons between urban and rural environments, which is rare, providing valuable information for informing public health measures aimed at promoting physical activity participation and preventing chronic disease (Thornton et al 2012).

While Thornton et al (2012) assessed amenities in relation to physical activity in disadvantaged areas Smith, Thomas and Batras (2016) investigated specific barriers to physical activity participation in community groups that were considered 'underserved'. These included people who were socioeconomically disadvantaged, Indigenous, culturally diverse or had a disability. Smith, Thomas and Batras (2016) looked at the success of strategies implemented to overcome the barriers to low physical activity participation rates in these groups. The particular strategies were implemented through 22 community projects delivered over 3 years (between 2008 and 2011) across Victoria, Australia.

Strategies were implemented as part of the Vic Health Participation in Community Sport and Recreation Program. Sixty-two organisations were involved in delivery of the strategies which were designed specifically to increase the understanding of benefits, barriers and enablers of sport and active recreation among the priority groups and to increase participation by tackling the barriers they faced. The organisations involved in delivery of the strategies included State Sporting Associations, Regional Sporting Assemblies, state and regional community organisations and small community and recreation organisations in rural locations (Smith, Thomas and Batras 2016).

Each year, semi-structured interviews were undertaken with 50 to 60 physical activity providers and 30 to 40 project partners. Findings concerning two evaluation questions are discussed by Smith, Thomas and Batras (2016), these related to; 1. common barriers and enablers for physical activity for community members and organisations and 2. factors for success in sporting organisations and communities to make physical activity participation easier for the target groups. Results showed a similarity with study results found by Thornton et al (2012), in that access to facilities was found to be a barrier to physical activity participation, in this case it was for people with disabilities. Smith, Thomas and Batras (2016) found further consistencies in the main barriers to participation reported across strategies for the target groups. These other barriers were related to cost, transport, cultural differences and sporting club environments.

The strategies implemented in response to cost barriers included subsidies in cost of activities for participants, some projects taking a phased approach by offering activities free of charge followed by the introduction of a cost. However it was found that once a fee was applied participation rates diminished significantly. For organised sport, the cost of uniforms and equipment were reported as barriers. One strategy was to loan equipment to participants (purchased with funds from grants received by organisations), this improved participation in the short term however it was found that this support was limited to a small number of participants and that it was not realistic for them to purchase equipment once the loan life ceased (Smith, Thomas and Batras 2016). Transport as a barrier was found to relate to poor public transport opportunities, inability to drive, cost of driving, not owning a car and the long distance to travel to activities, the latter being particularly the case in rural areas and another finding that is consistent with Thornton et al (2012). Projects overcame these barriers by hosting activities in locations within walking distance of public transport, arranging transport, partnering with organisations to offer volunteer drivers and bus services. Volunteer drivers and bus services proved only a temporary solution in some communities but a sustainable strategy in others (Smith, Thomas and Batras 2016).

According to Smith, Thomas and Batras (2016), a potential limitation of the study was that survey respondents (activity providers and partners) may not have truthfully revealed the challenges faced in delivering the strategies, for example difficulty in engaging with their target group, as well as the level of success achieved by their strategies. It was stated that this may have been due to a fear of the impact on the decision whether to continue to fund the program despite confirmation that survey data was de-identified (Smith, Thomas and Batras 2016). The authors also acknowledged the limitation of not undertaking investigations through direct contact with activity participants. This may have gained insights into the impact of their barriers to participation and strategies to overcome these but the authors heard from project deliverers only (Smith, Thomas and Batras 2016). Further, the authors state that due to project funding ending, evaluation did not continue beyond the program being delivered, which meant sustainability of the strategies could not be determined (Smith, Thomas and Batras 2016).

In summary, the two studies highlight consistency in findings around access to facilities as a barrier to physical activity. This was the case particularly for disadvantaged populations groups and in disadvantaged rural regions because of both cost and the distance required to travel. Findings suggest that despite facilities being on offer in regional areas, socioeconomically disadvantaged groups experience limited transport opportunities to access them.

3.1b Cultural conditions

Three studies that included cultural conditions and physical activity participation in their research were identified (Chrisman et al 2015; Gustafson et al 2015; Eley, Bush, and Brown 2014).

Chrisman et al (2015) conducted a qualitative study to identify the language that rural adults used to define physical activity and related terms, activities rural adults engage in, and context-specific social and physical environmental factors that facilitate and inhibit physical activity participation amongst rural adults. Three focus groups were conducted with a total of nineteen residents, aged between twenty seven and seventy five years, from multiple towns in a rural Midwestern country, South Eastern Iowa in the United States. Group members were asked about their interpretations of definitions related to physical activity and to describe their neighbourhood and community. They were also asked about the activities they participate in, along with the characteristics of their neighbourhood and community that act as barriers and opportunities to these. These questions were designed to explore the relationship between the environment and behaviour (Chrisman et al 2015).

Group members defined physical activity as moving around during activities of daily living and exercise as structured activities that require more effort and sweating. The most commonly reported activities participated in were walking, gardening and cycling. In terms of opportunities for physical activity, social support was found to have a positive influence. For example, meeting and chatting with friends increased motivation for being active. Having a pet was also reported as a positive contributor to the likelihood of being active (Chrisman et al 2015).

Findings by Chrisman et al (2015) highlight the consideration of culture around language required in guiding future physical activity research in rural adults. They also suggested that social support for physical activity, along with resourcing may help to increase rates of physical activity levels in rural adults (Chrisman et al 2015). According to the authors, this study was limited by the small sample used along with the fact that diversity in age range meant that age specific information was not able to be identified. The authors acknowledged that participants were knowledgeable about their communities, resources and facilities and may have been more likely to use these than the general population. This makes it difficult to generalise results and apply them to both active and inactive populations. More focus groups, with a diverse range of participants, may have identified different themes (Chrisman et al 2015).

Gustafson et al (2015) also gained perspectives from community residents but used a mixed methods approach to gather data and aimed to guide the development of future interventions. The study involved community stakeholder meetings and surveys conducted with 756 residents of six counties in Kentucky that had obesity rates classified as greater than 40% and were therefore considered high priority areas for intervention. One objective of the study was to determine community members' utilisation of physical activity infrastructure and concern about physical inactivity. Findings were highlighted through themes relating to the common causes of obesity for all six counties. The first theme surrounded shared cultural factors that discouraged physical activity identified by participants, including lack of motivation and time, along with technology use as barriers. Secondly, structural barriers were noted to further exacerbate these cultural barriers in these rural areas such as the lack of safe infrastructure such as sidewalks and facilities like gyms.

Community assets were noted for reducing obesity (e.g., parks) but gaps in health literacy, knowledge and resources played a role in preventing community members from accessing existing physical activity infrastructure (Gustafson et al 2015). Using both quantitative and qualitative approaches to data collection was a positive aspect of the study.

However, as noted by the authors, the study was limited by the fact that participants involved were well engaged with physical activity and therefore more likely to recognise the availability of resources which could have distorted results (Gustafson et al 2015).

Likewise, Eley, Bush, and Brown (2014) conducted a mixed methods study involving interviews, surveys, consultations with stakeholders, an audit of infrastructure, and detailed observation. This took place in six diverse rural areas of Queensland, Australia. The aim of the study was to provide information to contribute to the development of future policy and strategy regarding physical activity in rural Queensland.

Surveys included questions about current levels of physical activity in relation to access to facilities and social support and environmental attributes. Consultation with stakeholders took place with representatives from government and non-government organisations, private businesses, health service providers and sporting clubs. Interviews were semi-structured and asked questions surrounding opportunities and barriers to physical activity and healthy lifestyles. The audits collected information regarding footpaths, street lighting, sport and recreation facilities such as skate paths, walking paths and amenities such as public toilets and water fountains. Further, they included detail on opportunities for formal and informal physical activity, access to facilities, sources of information about activities, supportive human resources, and the natural environment (Eley, Bush, and Brown 2014).

Results showed that half of the respondents were not meeting the Australian physical activity guidelines despite Queensland's rural communities offering access to a diverse range of structured and non-structured activities (Eley, Bush, and Brown 2014). Barriers to physical activity were reported to include climate, transport, the culture of exercise and community leadership. Specifically, a limited culture of physical activity was found. This aligns with the findings of Chrisman et al's study (2015), where physical activity was defined as 'exercise' and was clearly perceived differently to sport which was reportedly linked to socialisation and achievement. In terms of community leadership, it was evident that employers were not providing working environments supportive of physical activity opportunities.

The authors considered this an untapped opportunity for building a supportive culture of physical activity, particularly in rural workplaces with large numbers of employees such as local government, health and education services (Eley, Bush, and Brown 2014).

These cultural issues were identified as unique to the rural environment and were similar to those described by Gustafson et al (2015) in rural U.S which were identified as lack of time and motivation to commit to physical activity and inactivity as a result of technology use. Gustafson et al (2015) also suggested that rurally, these are social norms and, exacerbated by environmental barriers to physical activity, contribute to high obesity rates.

Eley, Bush, and Brown (2014) concluded that a one size fits all response to improving physical activity in rural areas will not be applicable to all circumstances. Results highlighted the unique characteristics of rural environments that affect participation in physical activity. Knowledge of these can help to inform promotion of healthy lifestyles in rural areas instead of replicating initiatives suited to metropolitan contexts (Eley et al 2014). The limitation of this study was this it was conducted in only one state of Australia.

In summary, findings from these three studies reflect a rural culture around physical activity participation and suggest this is a unique characteristic to be considered when designing interventions that influence physical activity in these populations.

3.1c Environmental conditions

Three studies that included environmental conditions in relation to physical activity participation in their research were identified (Cleland et al 2015; Chrisman et al 2015; Eley, Bush, and Brown 2014).

Cleland et al (2015) undertook a qualitative study by conducting semi-structured interviews with forty-nine adults from three regions of rural Tasmania, Australia. The study aimed to explore the environmental conditions that act as barriers or facilitators to physical activity participation among rural adults. Cleland et al (2015) found four key themes; functionality, diversity, spaces and places for all and realistic expectations.

Firstly, in regards to functionality, it was found that key features of walking and cycling networks that positively influenced physical activity were their connectivity with destinations, flat terrain, distance and safety. Meanwhile interruptions to infrastructure, such as path disconnections and poor lighting were considered barriers to physical activity and a modifiable aspect of the environment that could support more activity (Cleland et al 2015).

Secondly, diversity in opportunities to be physically active was reported as a strength of rural communities, specifically in regards to options available in natural settings. At the same time, lack of variety was reported as a barrier to being physically active.

Structured and organised activities along with more diverse sporting and recreational infrastructure were thought to be facilitators for participation, for example access to local a local tennis or netball court (Cleland et al 2015).

Thirdly, the importance of shared-use areas, for example environments accessible to families and dog owners, was highlighted as an important contributor to encouraging physical activity. Finally, the acceptance of environmental limitations to physical activity participation emerged as a key strength of rural communities. Realistic expectations were reported when it came to environmental limitations and rather than focussing on the lack of supporting infrastructure in rural areas, participants reported acceptance and even solutions to limitations. For example, one participant reported that instead of riding on a highway into town they put their bike into their car and drove somewhere to go for a ride (Cleland et al 2015). Aligning with this, Eley, Bush, and Brown (2014) found environmental limitations were accepted rather than residents focussing on the lack of supporting infrastructure in rural areas. While they noted desirability of connected paths for physical activity enhancement they did not see this as a barrier to their physical activity participation (Eley, Bush, and Brown 2014). For Eley, Bush, and Brown (2014) and for Cleland et al (2015) rural community resident outlooks tended to focus on the positives of their community.

According to Cleland et al (2015) their study results were limited by the small sample size and like Eley, Bush, and Brown (2014) was restricted to only one state of Australia. Also, participants may not have been representative of the general population, specifically because they were observed to have higher levels of education. As noted in the study conducted by Chrisman et al (2015) and Gustafson et al (2015), participants in Cleland et al's (2015) study who were more active, had more experience with the environment and therefore knowledge of facilities and infrastructure (Cleland et al 2015). Regardless, the authors argued that their study contributed to a gap in the field, stating that there are few qualitative studies that seek to understand the environmental influences on the physical activity levels of rural adults and that it provides important insights for directing quantitative studies in this area.

For Chrisman et al (2015), who conducted a qualitative study South Eastern Iowa to identify the language that rural adults used to define physical activity (see section 3.1b), the barriers to physical activity included narrow sidewalks, lack of facilities, unmaintained roads that made it difficult for cycling, and feeling self-conscious. In this study many people stated that they walked with others and that when doing this, narrow sidewalks were not accommodating. At a policy level, lack of community planning was identified as a potential limitation to the availability of parks and public facilities such as school spaces.

The authors argued that access to public facilities is not a finding previously discussed extensively but shows the need for policy level interventions to support shared use agreements between for example, local governments, schools and communities to support physical activity opportunities (Chrisman et al 2015). Interestingly, the importance of shared-use areas was also highlighted by Cleland et al (2015) as an important contributor to encouraging physically activity.

Like the study by Thornton et al (2012) regarding amenities, Eley, Bush, and Brown (2014) found that regional towns in Queensland were generally well-equipped with facilities (e.g., swimming pools, tennis courts, golf courses, skate parks) and in addition, in organised activities. Low traffic volume on roads and footpaths was reported, as well as the fact that people look out for each other and hence, personal safety was not reported as issue. Town layout had little impact on physical activity as towns were so small that facility locations were well concentrated. Connectivity was reported as desirable but not as a barrier to physical activity (Eley, Bush, and Brown 2014).

Eley, Bush, and Brown (2014) also found that there was no public transport available (e.g., no town or country bus or train services), meaning reliance on personal transport and travel was reported as a barrier to physical activity. This is a finding consistent with Smith, Thomas and Batras (2016) who found that transport was a barrier to activity due poor public transport opportunities, inability to drive, cost of driving, not owning a car and the long distance to travel to activities. The study by Smith, Thomas and Batras (2016) however, focused on disadvantaged groups while Eley, Bush, and Brown (2014) undertook a mixed methods study involving a more broad range of participants. This suggests that transport as a barrier in rural areas is not limited to disadvantaged groups but may be a barrier experienced by the whole of a regional community.

In summary, these studies highlight that the environment does play a role in influencing physical activity levels, from supportive infrastructure to access to facilities. However, while people in regional communities did acknowledge barriers in infrastructure (e.g., disconnected paths), they tended to have optimistic attitudes toward overcoming these. Another clear commonality in the studies was the support for shared use policies as an opportunity to promote physical activity.

3.2 Social and community networks

This level of the framework draws attention to relationships with family, friends and significant others within the local community and their influence on health (Dahlgren and Whitehead 1991). Three studies that included social and community networks in relation to physical activity participation in their research were identified (Kegler, Swan, Alcantara, Feldman and Glanz 2013; Carroll, Dollman and Daniel 2014; Ball, Abbott, Wilson and Sahlqvist 2017).

Kegler et al (2013) analysed existing cross-sectional survey data. Their aim was to examine how home and neighbourhood food and physical activity environments were associated with weight status among rural adults. Results showed that of the 513 adults surveyed, 76.4% of these were overweight or obese. Participants who were overweight or obese reported low levels of physical activity but there was no difference across weight status categories for neighbourhood walkability (i.e., weight was not linked to the reported walkability of a neighbourhood).

Evidence was found for SES being negatively related to neighbourhood walkability but positively related to neighbourhood cohesion. In line with this, Kegler et al (2013) suggest that people who were higher in SES lived in neighbourhoods with higher levels of social cohesion, had more equipment in the home and reported higher levels of self-efficacy to engage in physical activity. Neighbourhood walkability was positively related to family support for physical activity and self-efficacy for physical activity (Kegler et al 2013).

Kegler et al (2013) concluded that both home and neighbourhood environments may influence physical activity levels in rural adults through social support from family members and confidence in the ability to be physically active. Based on these results, Kegler et al (2013) propose that practitioners working in rural settings recognise the complexities surrounding physical activity participation. The authors recommended an approach that includes multilevel interventions, for example that build self-efficacy, include a home-based component to addresses physical and social factors, and target neighbourhood environments (Kegler et al 2013).

The authors highlighted the simultaneous focus on the home and neighbourhood environments in a rural setting as a key strength to their study and state that few studies have taken a focus on this. The authors noted that the study was limited by its cross-sectional design which prevents causal conclusion about the associations (Kegler et al 2013). Also, because the measures were self-reported the possibility of social desirability is present.

In addition, the authors noted that the study represented a convenience sample of individuals who were willing to participate (Kegler et al 2013).

Carroll, Dollman and Daniel (2014) also undertook a cross-sectional study to determine the correlates of physical activity, this time among men and women a rural agricultural area of the South Australian. Two hundred and ninety-nine randomly selected 19-65 year olds took part in surveys via phone which assessed factors regarding demography, psychological functioning, behaviour, social and cultural areas and physical environment.

A lack of time and already being active through work were reported as reasons for not meeting the physical activity guidelines (Carroll et al 2014). Results showed psychological and sociocultural variables were associated with physical activity for men. Reasons for activity were for health benefits and friendships, findings previously discussed by Chrisman (2014), Kegler et al (2013) and also below by Ball et al (2017).

Demographic, psychological and behavioural variables were associated with physical activity for women in Carroll et al's study (2014). The cohort of women more likely to be active were young, unemployed had higher self-efficacy and a physical activity routine. For both men and women, the built environment was not associated with physical activity. This is a contradictory finding to Cleland et al (2015) who found that key features of walking and cycling networks positively influenced physical activity, along with Chrisman et al (2015) who found that poor infrastructure, such as narrow paths and unmaintained roads, were a barrier to physical activity. However, Carroll et al (2014) noted that study factors, such as a homogenous physical environment among others, was the reason for this finding.

According to Carroll et al (2014), this study was limited by using data gathered from a cross-sectional design which meant a causal direction of outcomes could not be inferred. The authors also acknowledged that, because interviews were conducted by phone, those who did not have a listed number were not included, giving the potential for selection bias. Further, the authors stated that data was self-reported and therefore based on perceptions that may result from misinterpretation and social desirability (Carroll et al 2014).

Again, Ball et al (2017) undertook a cross-sectional study and similarly, examined the reach, retention, sociodemographic and health characteristics, physical activity levels and motivators of participants in Heart Foundation Walking groups. The walking groups were voluntarily led and aimed to provide a low cost, accessible approach to increasing physical activity among adults.

The walking groups took place across all geographic areas of Australia, including in remote and sparsely populated regions. Repeat cross-sectional analyses were undertaken using data collected from 22,416 participants aged 15 years and above. This data was taken from the Heart Foundation Walking registration database in December 2015, and from 4 participant surveys that included; 2400 people in 2010, 3274 people in 2011, 4158 in 2012 and 1890 people in 2015 (Ball et al 2017).

Results by Ball et al (2017) showed that, remote and sparsely populated regions were over-represented in those reporting high participation rates in the walking groups. These regions were noted by the authors to have limited access to physical activity programs and facilities. On average, walkers were aged 64 years and had participated in walking groups for 2.4 years, more than three quarters of the walkers were women. Around a quarter of the walkers lived alone and income distribution was skewed toward the low income categories. At three months the retention rates was 95%, at 6 months it was 88% and at 3 years, 36%. A small percentage (11) of discontinuation was reported being due to illness or death. Unsurprisingly, retention rate according to SES was higher in those from least disadvantaged areas. Walkers reported spending about 9 hours each week participating in physical activity generally and 4 hours per week walking. Evidently, approximately 70% of walkers were meeting the physical activity guidelines. The majority of walkers (over 75%) reported joining the program for health, fitness and weight loss reasons but that their major motivator for continuing to participate was the social aspect, particularly in women (Ball et al 2017). This finding is supported by Chrisman et al (2015) who found that many people walked with others and that socialising had a positive influence on physical activity participation.

The repeat cross-sectional survey design used by Ball et al (2017), along with no use of a control group, prevent the study from being able to provide strong conclusions regarding aspects contributing to positive reach and retention rates. Regardless, results highlight aspects of a successful model for increasing physical activity among adults and suggest important features of future programs. These include using a volunteer run model which increased community capacity and removing cost as a participation barrier (Ball et al 2017). The authors also suggested targeting regions that lack services or similar initiatives, using wide reaching promotional methods and facilitating social connection, an important factor to participant retention.

In summary, these studies demonstrate that social aspects are an important factor in physical activity participation, particularly in regional and rural areas. Both home and neighbourhood environments have the potential to influence physical activity levels in rural adults through, for example, social support from family members. While individuals appear initially to participate in physical activity for health reasons, social connection is a key motivator for continued involvement.

Chapter 4: Discussion

This literature review explored physical activity in regional areas of Australia with a focus on the barriers and opportunities to participation.

The key research questions were:

1. What are the barriers for physical activity participation in regional Australia?
2. What are the opportunities for physical activity participation in regional Australia?

This chapter outlines the key findings of the literature reviewed and discusses these in relation to existing literature regarding barriers and opportunities to physical activity. It also discusses findings in relation to a key public health driver for local government, namely, the Victorian Public Health and Wellbeing Plan (VPHWP) 2015–2019.

4.1 Regional and metropolitan areas: The difference

The health of people living in rural, regional and remote Australia is influenced by a range of complex factors. The notion that health is the product of the environment, society, economy and culture is well known (NRHA 2018). Compared with metropolitan areas, regional areas are shown to have lower physical activity participation levels and an overall level of poorer health (AIHW 2008), but much of the previous research in this area has focused on metropolitan settings (Frost et al 2010). Findings from this review are now discussed in relation to existing literature.

4.1a Socioeconomic conditions

Health behaviours are often geographically and socioeconomically patterned, with those living in regional areas (compared to metropolitan) and those of lower SES, being less likely to be physically active (Centre for Disease Control and Prevention, AIHW and Thornton, Bentley and Kavanagh cited in Thornton et al 2012). Two studies reviewed revealed this association (Thornton et al 2012; Smith, Thomas and Batras 2016). One key finding was that amenities in regional areas do exist but can be difficult to access due to a lower spatial density and transport difficulties experienced by socioeconomically disadvantaged groups. For example, often disadvantaged people may not be able afford a car and regional public transport services are limited meaning access impacts their physical activity participation (Smith, Thomas and Batras 2016). This finding is consistent with information outlined by the AIWH (2016) showing that Australians living in rural and remote areas have poorer access to, and use of, health services than people living in major cities.

Further, that, Australians living in rural and remote areas tend to have higher rates of disease and lower life expectancy, which may be a reflection of SES factors that are detrimental to health (AIWH 2016). Another key barrier to physical activity was found to be the costs associated with participation, for example, costs for membership and equipment for organised sport. While this was found regionally in the studies reviewed, the SDoH model by Dahlgren and Whitehead (1991) reinforces that SES and its negative association with health is not an issue that is isolated regional areas but found across multiple environments.

4.1b Rural culture

Findings of the studies reviewed reflect a rural culture around physical activity participation and suggest this is a unique characteristic to be considered when designing interventions that influence physical activity in these populations (Chrisman et al 2015; Gustafson et al 2015; Eley, Bush, and Brown 2014). This is a finding that has not been largely been covered in previous literature. Specifically, the language associated with physical activity, such as exercise 'being more effort', combined with lack of motivation and technology usage driving decisions not to participate, reveals new information about barriers specific to regional areas.

4.1c The environment

The studies reviewed highlight that the environment does play a role in influencing physical activity levels in regional settings (Chrisman et al 2015; Eley, Bush, and Brown 2014). This finding is supportive of previous studies that show greater accessibility to physical activity resources for urban residents when compared with rural environments (Frost et al 2010). Findings regarding barriers and opportunities in regional areas found in this review stretched from positive associations from supportive infrastructure, such pleasant aesthetics, to negative associations due to lack of path connectivity and facility access (Chrisman et al 2015; Eley, Bush, and Brown 2014). According to Frost et al (2010) pleasant aesthetics produce positive associations with physical activity in both urban and rural environments, facility access however, appears to be a barrier specific to regional environments (AIWH 2016). However, while people in regional communities do face infrastructure barriers, such as disconnected paths, they appear to have optimistic attitudes toward overcoming these (Eley, Bush, and Brown 2014; Cleland et al 2015). This resilience is potentially another factor that is unique to the culture of regional areas and may be important to draw on when considering future policy, initiatives and research.

4.1d Social networks

The studies reviewed highlight strong support for social interaction as a driver of physical activity participation and vice versa. Specifically, physical activity enhanced social connection (e.g., people being active in shared spaces) and social connection enhance continued physical activity participation (e.g., retention in memberships of walking groups) (Kegler et al 2013; Carroll, Dollman and Daniel 2014; Ball et al 2017). These findings are consistent with previous literature that shows that social support is positively associated with health (AIHW 2016).

4.2 Consideration of regional areas in public health and wellbeing planning

The above sections have identified the unique barriers and opportunities to physical activity in regional areas. The following section discusses this in relation to current local government policy. The VPHWP 2015–2019 outlines a vision for Victoria to be free of the avoidable burden of disease. The plan identifies Victoria’s public health and wellbeing needs based on health status data and establishes objectives and policy priorities for the promotion of public health and wellbeing. The plan specifies collaborative efforts for undertaking public health initiatives through, for example, a partnership approach between multiple sectors that influence SDoH such as planning, education, employment, transport and housing. The plan acknowledges that inequalities in health can lead to, or result from, determinants including housing, education, employment and transport accessibility (State of Victoria 2016).

Priority one of the VPHWP is titled ‘healthier eating and active living’. For physical activity, the aim is to reduce the prevalence of overweight, obesity and sedentary behaviour and increase physical activity and active transport. Strategies include active transport (e.g., walking or cycling to work), neighbourhood design that promotes activity and social connectedness and participation in sport and recreation. Outcomes of these strategies are measured by prevalence of physical activity along with overweight and obesity rates (State of Victoria, September, 2015). The aim is to, amongst others, see a 10% increase in sufficient physical activity prevalence of adults by 2025 (State of Victoria 2016).

Despite the VPHWP acknowledging the complexity of the SDoH and the disadvantages of rural areas, some strategies and outcome measures appear limited for supporting change in these areas. On one hand, actions listed in the VPHWP regarding a reduction in barriers to access and promotion of inclusive environments are supportive.

For example, the plan highlights the clear link between SES and poor health and therefore takes a focus on ensuring that improvements are realised for residents of rural Victoria (State of Victoria 2015). Also, based on the findings of this literature review regarding the importance of social connection for ongoing participation in physical activity, it is promising to see that strategic direction surrounds the importance of social networks in the VPHWP. As well as this, supporting key settings to promote opportunities for participation in physical activity, including employees, through implementing a healthy workplaces framework is a key action (State of Victoria 2016) highlighting that leadership is being shown, a key barrier to physical activity found in this review for regional areas (Eley, Bush, and Brown 2014).

However, for other strategies such as the development of new facilities and redevelopment of old facilities to be effective, the complexities experienced by disadvantaged regional dwellers discussed in this literature review must be considered. Furthermore, outcome measures regarding improvements in the prevalence of sufficient physical activity participation may be unrealistic without consideration of regional area complexities. For example, increased rates of active travel may not be practical in regional areas and increased involvement in organised sport may not be possible for disadvantaged groups.

Another VPHWP strategy includes the design of infrastructure in accordance with universal design principles in order to increase the proportion of Victorians able to use programs and infrastructure (State of Victoria 2016). The universal design aspect of this direction may well be a challenge for regional areas given the finding by Eley, Bush, and Brown (2014) that a one size fits all response to improving physical activity in rural areas will not be applicable to all circumstances. Further, the authors found that there are unique characteristics of rural environments that affect participation in physical activity and that knowledge of these differences inform health promotion measures in rural areas, as opposed to simply replicating initiatives suited to urban contexts (Eley, Bush, and Brown 2014). Overall, the differences between regional and metropolitan environments do not appear to be taken into account in the VPHWP enough to see change, regionally specific findings need to be included. This review provides a platform for further exploration of how future iterations of the plan might consider this.

4.4 Limitations

The main limitation of this review is that there has been little research conducted in regional areas in relation to physical activity participation. This meant that only nine studies are included in this review, with only five of these conducted in Australia.

Furthermore, there were limitations in study design. While critical appraisal results revealed that studies were generally of high quality, the cross-sectional design of studies meant there were limitations in drawing conclusions from the findings as they were only conducted once, capturing data over time would provide more valuable information. Further, recruitment of participants in the qualitative studies was voluntary and meant the samples may not have been representative of communities. Participants in these studies were well engaged and accessing facilities, services and infrastructure which meant they would have a different level of knowledge and experience to other groups in the community that may have lower physical activity participation rates and be able to provide valuable information about the reasons behind this.

Chapter 5: Conclusion and Recommendations

5.1 Conclusions

There are clear differences between regional and metropolitan environments regarding barriers and opportunities for participating in physical activity (Walsh et al 2017; Cleland et al 2015). Due to low participation levels in physical activity in regional areas, and poorer health outcomes more generally (AIHW 2008), it is essential that regional environments are understood and supported to become more conducive to health.

This review aimed to understand the barriers and opportunities for participation in physical activity in regional areas of Australia with the intention of providing evidence to inform public health interventions in regional areas. By focussing on the role of key determinants of health; socioeconomic, cultural, environmental conditions and social networks, this review identified barriers and opportunities. Firstly, it was identified that SES is associated with physical activity participation and overall health outcomes. For regional areas, findings were associated with limited access to facilities and transport (Thornton et al 2012; Smith, Thomas and Batras 2016). However, the SDoH model by Dahlgren and Whitehead (1991) shows that this is not barrier specific to regional environments but one that is found across many conditions in which conditions in which people grow, live, work, and age. Cultural characteristics of regional environments are however, unique to regional areas. These characteristics included perceptions around an effort of exercising as well as a lack of motivation to be active, as identified in several studies (Chrisman et al 2015; Gustafson et al 2015; Eley, Bush, and Brown 2014). Specific findings in relation to culture must be considered in future physical activity interventions.

Environmental conditions played a role in whether people in regional communities participated in physical activity. People were reportedly more likely to be active if they had access to connected walking and cycling paths, flat terrain, short distances to destinations and pleasant aesthetics. Meanwhile, people were more likely to be inactive if footpaths did not cater for them to be able to walk friends, there were interruptions to infrastructure (such as path disconnections) and poor lighting (Cleland et al 2015; Chrisman et al 2015; Eley, Bush, and Brown 2014). The interesting aspect about environmental conditions, and perhaps somewhat of a contradiction, is that there was resilience shown in relation to behaviours to overcome these barriers, again a unique cultural aspect of regional communities. Lastly, social networks were found to positively influence physical activity in regional areas. People were more likely to remain active if there was the opportunity for social connection, despite initially becoming active for health reasons (Ball, Abbott, Wilson and Sahlqvist 2017).

In light of these findings, it is evident that planning documents, such as the VPHWP, only somewhat address the complexities of regional areas. For example, the importance of social connection in encouraging physical activity participation is acknowledged and supported, however, it is concerning that a universal approach is taken for aspects such as infrastructure and that specific barriers, such as environmental factors, of regional areas are not addressed. It is therefore recommended, that the evidence gathered in this literature review regarding the influence of the SDoH in relation to physical activity participation in regional areas is considered, in order to inform both public health policy and interventions. Understanding the unique barriers and opportunities in regional settings provides much greater potential to support the public health issue of physical inactivity and contribute to the prevention of chronic disease, early deaths and the burden on health care systems in Australia.

5.2 Recommendations

Based on the findings of this review, recommendations are provided regarding policy, physical activity initiatives and future research.

5.2a Policy

The following recommendations relate to policy support for physical activity:

- Multi-sector collaboration in the development and delivery of key planning documents such as the VPWHP (e.g., input from health promotion, local government, planning, infrastructure and sport and recreation)
- Ensure regional areas are included in public transport and active transport policies, developments and upgrades
- Development of shared-use facilities (e.g., ensuring local government land, schools and community environments are accessible to all of community)

5.2b Physical Activity Initiatives

It is recommended that initiatives regarding physical activity in regional areas consider:

- Promoting the primary aim as social connection and secondary aim as physical activity in order to attract and retain participants
- Planning for and offering ongoing socioeconomic support for participation
- Taking a settings-based approach (e.g., delivering initiatives in workplaces, schools and communities) to support community leadership and a systematic approach to sharing health messages

- Undertaking multilevel interventions that, for example, build self-efficacy, include a home-based component and target neighbourhood environments

5.2c Future Research

It is recommended that future research regarding physical activity participation in regional areas takes a focus on:

- The unique culture identified in the literature review
- Limited access to facilities
- Resolving cost barriers to participation in organised sport

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Appendices

Appendix 1. Critically Appraising the Literature

Appendix 1a: Critical Appraisal Skills Programme (CASP) Checklist for Qualitative research (CASP 2016)	
1	Was there are clear statement of the aims of the research?
2	Is a qualitative methodology appropriate?
3	Was the research design appropriate to address the aims of the research?
4	Was the recruitment strategy appropriate to the aims of the research?
5	Was the data collected in a way that addressed the research issue?
6	Has the relationship between the participants been adequately considered?
7	Have ethical issues been taken into consideration?
8	Was the data analysis sufficiently rigorous?
9	Is there a clear statement of findings?
10	Is the research valuable?

Key
Y = Yes
N = No
CT = Can't Tell

Appendix 1b: Critical Appraisal Skills Programme (CASP) Checklist for Qualitative research (CASP UK 2016)											
Article	1	2	3	4	5	6	7	8	9	10	Score
Cleland, V, Hughes C, Thornton L, Squibb, K, Venn, A, and Ball K, 2015, Environmental barriers and enablers to physical activity participation among rural adults: a qualitative study	Y	Y	Y	Y	Y	CT	CT	Y	Y	Y	8/10
Chrisman, M, Nothwehr, F, Yang, G, Oleson, J, 2015, Environmental Influences on Physical Activity in Rural Midwestern Adults: A Qualitative Approach	Y	Y	Y	Y	CT	Y	Y	Y	Y	Y	9/10
Smith, B, Thomas, M, and Batras, D, 2015, Overcoming disparities in organized physical activity: findings from Australian community strategies	Y	Y	Y	Y	Y	CT	Y	Y	Y	Y	8/10

Appendix 1c: The Quality Assessment Tool by National Heart, Lung and Blood Institute (NHLBI 2016)	
1	Was the research question or objective in this paper clearly stated?
2	Was the study population clearly specified and defined?
3	Was the participation rate of eligible persons at least 50%?
4	Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study pre-specified and applied uniformly to all participants?
5	Was a sample size justification, power description, or variance and effect estimates provided?
6	For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?
7	Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?
8	For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?
9	Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
10	Was the exposure(s) assessed more than once over time?
11	Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
12	Were the outcome assessors blinded to the exposure status of participants?
13	Was loss to follow-up after baseline 20% or less?
14	Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?

Key
Y = Yes
N = No
Other CD = Cannot Determine NR = Not reported NA = Applicable

Appendix 1d: The Quality Assessment Tool by National Heart, Lung and Blood Institute (NHLBI 2016)															
Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies															
Article	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Score
Carroll, S, Dollman, J and Daniel, M, 2014, Sex-specific correlates of adult physical activity in rural Australian community	Y	Y	N	Y	N	N	Y	Y	Y	N	Y	CD	NR	N	7/14
Thornton, L, Crawford, D, Cleland, V, Timperio, A, Abbott, G, and Ball, K, 2012, Do food and physical activity environments vary between disadvantaged urban and rural areas? Findings from the READI Study,	Y	Y	NA	Y	N	NA	Y	Y	Y	N	Y	NA	Y	N	8/14
Kegler, M, Swan, D, Alcantara, I, Feldman, L, and Glanz, K, 2013, The Influence of Rural Home and Neighborhood Environments on Healthy Eating, Physical Activity, and Weight, Prevention Science	Y	Y	NA	Y	Y	NR	Y	Y	Y	Y	Y	Y	NR	Y	11/14
Ball, K, Abbott, G, Wilson, M, Chisholm, M, Sahlqvist, S, 2017, How to get a nation walking: reach, retention, participant characteristics and program implications of Heart Foundation Walking, a nationwide Australian community-based walking program, International Journal of Behavioural Nutrition and Physical Activity	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	NR	12/14

Appendix 1e: Mixed Methods Appraisal Tool (Pluye et al 2011).	
1	Are there clear qualitative and quantitative research questions (or objectives*), or a clear mixed methods question (or objective*)?
2	Do the collected data allow address the research question (objective)? E.g., consider whether the follow-up period is long enough for the outcome to occur (for longitudinal studies or study components).
3	Is the mixed methods research design relevant to address the qualitative and quantitative research questions (or objectives), or the qualitative and quantitative aspects of the mixed methods question (or objective)?
4	Is the integration of qualitative and quantitative data (or results*) relevant to address the research question (objective)?
5	Is appropriate consideration given to the limitations associated with this integration, e.g., the divergence of qualitative and quantitative data (or results*) in a triangulation design?

Key
Y = Yes
N = No
CT = Can't Tell

Appendix 1f: Mixed Methods Appraisal Tool (Pluye et al 2011)						
Article	1	2	3	4	5	Score
Gustafson, A, McGladrey, M, Liu, E, Peritore, N, Webber, K, Butterworth, B and Vail, A, 2015, Examining Key Stakeholder and Community Residents Understanding of Environmental Influences to Inform Place-Based Interventions to Reduce Obesity in Rural Communities, Kentucky 2015	Y	Y	Y	Y	CT	4/5
Eley, R, Bush, R and Brown, W, 2014, Opportunities, Barrier and Constraints to Physical Activity in Rural Queensland, Australia	Y	Y	Y	Y	CT	4/5

Appendix 2: Key Studies Summary

Article	Research Type	Demographics	Research Aim	Key Findings	Limitations
<p>Cleland, V, Hughes C, Thornton L, Squibb, K, Venn, A, and Ball K, 2015, Environmental barriers and enablers to physical activity participation among rural adults: a qualitative study</p>	<p>Qualitative study: semi-structured interviews digitally recorded, transcribed and analysed thematically</p>	<p>49 adults</p>	<p>To explore the environmental factors that act as barriers or facilitators to physical activity participation among rural adults.</p>	<p>Four key themes highlighted in results: functionality, diversity of opportunities, places for all, realistic expectations.</p> <p>Insights into environmental factors that can be targeted to support regional adults to be more physically active</p>	<p>Small sample size and restricted to only one state of Australia.</p> <p>Volunteers that participated may not have been representative of the general population, specifically because they were observed to have higher levels of education.</p>
<p>Gustafson, A, McGladrey, M, Liu, E, Peritore, N, Webber, K, Butterworth, B and Vail, A, 2015, Examining Key Stakeholder and Community Residents Understanding of Environmental Influences to Inform Place-Based Interventions to Reduce Obesity in Rural Communities, Kentucky 2015</p>	<p>Qualitative study: random telephone survey</p>	<p>756 people</p>	<p>To (1) use the collective impact model to elicit perceptions of county-specific factors influencing obesity rates; (2) determine association between food venues and concern about obesity and (3) determine community members’ utilization of physical activity infrastructure and concern about physical inactivity.</p>	<p>Shared cultural factors discourage physical activity (e.g., lack of time motivation, too much technology use) in regional areas</p> <p>Structural barriers (e.g., lack of safe facilities) to physical activity found</p> <p>Community assets noted for reducing obesity (e.g., parks) but gaps in healthy literacy and resources prevent access to infrastructure.</p>	<p>Participants involved were well engaged with physical activity and therefore more likely to recognise the availability of resources.</p>

<p>Eley, R, Bush, R and Brown, W, 2014, Opportunities, Barrier and Constraints to Physical Activity in Rural Queensland, Australia</p>	<p>Mixed-methods: 100 interviews, 300 surveys, facility audits, detailed observation</p>	<p>Six diverse rural areas of Queensland, Australia</p>	<p>To provide information to contribute to the development of future policy and strategy applicable to rural Queensland</p>	<p>Regional towns generally well-equipped in facilities (e.g., pool, tennis court, golf course, skate park) and organised activities.</p> <p>No public transport available so there is a reliance on personal transport and travel is barrier to physical activity.</p> <p>Town layout has little impact on physical activity as they are so small that facilities are concentrated. Connectivity desirable but not a barrier.</p> <p>Limited culture of physical activity, workplaces are not taking steps to incorporate into work environment</p> <p>Recommended that local councils are a needed player but not engaged in all of the six shires.</p>	<p>Sample restricted to only one state of Australia.</p>
<p>Carroll, S, Dollman, J and Daniel, M, 2014, Sex-specific correlates of adult physical activity in rural Australian community</p>	<p>Cross-sectional study</p>	<p>299 randomly selected 19-65 year olds</p>	<p>To determine the correlates of physical activity among men and women of the South Australian Riverland region</p>	<p>Reasons for activity were for health benefits and friendships. Lack of time and already being active through work were reasons for not meeting the physical activity guidelines.</p>	<p>Using data gather from a cross-sectional design meant a causal direction of outcomes cannot be inferred.</p> <p>Because interviews were conducted by phone, those who</p>

				<p>Demographic, psychological and behavioural variables associated with physical activity for women. Women more likely to be active were young, unemployed, had higher self-efficacy and a physical activity routine.</p> <p>For both men and women, the built environment was not associated with physical activity, the researchers noted study factors, such as homogenous physical environment among others, as reason for this.</p>	<p>did not have a listed number were not included giving the potential for selection bias.</p> <p>Data was self-reported and therefore based on perceptions that may result from misinterpretation of social desirability.</p>
<p>Chrisman, M, Nothwehr, F, Yang, G, Oleson, J, 2015, Environmental Influences on Physical Activity in Rural Midwestern Adults: A Qualitative Approach</p>	<p>Qualitative study: Three focus groups</p>	<p>Total of 19 participants in three focus groups; one mixed-gender, one male only, and one female only.</p>	<p>To use focus group methods to identify the language that rural adults used to define physical activity and related terms, the activities this population engages in, and to explore the context-specific social and physical environmental factors that facilitate and inhibit their physical activity.</p>	<p>Social support found to influence physical activity levels; meeting and chatting with friends increased motivation for being active.</p> <p>Neighbourhood streets, sidewalks and trails provided access for walking and biking. Implied that having nearby destinations influenced walking.</p> <p>Barriers were reported as narrow sidewalks, lack of facilities, unmaintained roads and feeling self-</p>	<p>Small sample along with the fact that diversity in age range meant that age specific information was not able to be identified.</p> <p>Participants were knowledgeable about their communities, resources and facilities and may have been more likely to use these than the general population. This makes it difficult to generalise results and apply them to both</p>

				conscious. Lack of community planning is a potential limitation to number of parks and facilities available.	active and inactive populations. More focus groups, with a diverse range of participants, may identify different themes.
Thornton, L, Crawford, D, Cleland, V, Timperio, A, Abbott, G, and Ball, K, 2012, Do food and physical activity environments vary between disadvantaged urban and rural areas? Findings from the READI Study	Cross-sectional study: analysis of environmental data collected in 2007-08 as part of the Resilience for Eating and Activity Despite Inequality (READI) study	Data was sourced from 40 urban and 40 rural socioeconomically disadvantaged areas of Victoria	To investigate whether the presence and density of environmental amenities related to physical activity and eating behaviours differs between socioeconomically disadvantaged urban and rural areas in Victoria, Australia.	Despite rural areas being thought to have less opportunities (than urban environments) to engage in healthy behaviours, findings suggest that socioeconomically disadvantaged areas to have amenities that allow opportunities for physical activity participation. However, greater travel distance may be required to get there.	Additional aspects important for physical activity participation, such as sports clubs, were not included. Suburb boundaries meant all amenities that residents within a suburb might access may not have captured.
Kegler, M, Swan, D, Alcantara, I, Feldman, L, and Glanz, K, 2013, The Influence of Rural Home and Neighborhood Environments on Healthy Eating, Physical Activity, and Weight, Prevention Science	Cross-sectional study: analysis of existing survey data	Statistical analyses were conducted using survey data from 513 African American adults	To examine how home and neighbourhood food and physical activity environments were associated with weight status among rural-dwelling adults.	Home and neighbourhood environments may influence physical activity levels in rural adults through social support from family members and self-efficacy levels	Cross-sectional design prevents causal conclusion about the associations

<p>Ball, K, Abbott, G, Wilson, M, Chisholm, M, Sahlqvist, S, 2017, How to get a nation walking: reach, retention, participant characteristics and program implications of Heart Foundation Walking, a nationwide Australian community-based walking program, International Journal of Behavioural Nutrition and Physical Activity</p>	<p>Cross sectional study: repeat cross-sectional analyses of data from walking group participants</p>	<p>Data collected from 22,416 participants registered with the Heart Foundation Walking database</p>	<p>To examine the reach, retention, sociodemographic and health characteristics, physical activity levels and motivators of participants in Heart Foundation Walking groups</p>	<p>Remote and sparsely populated regions were over-represented in those reporting high participation rates in the walking groups. These regions were noted by the authors to have limited access to physical activity programs and facilities.</p> <p>Approximately 70% of walkers were meeting the physical activity guidelines. Over 75% reported joining the program for health, fitness and weight loss reasons but that their major motivator for continuing to participate was the social aspect.</p>	<p>The repeat cross-sectional survey design along with no use of a control group prevent the study from being able to provide strong conclusions regarding reach and retention rates.</p>
<p>Smith, B, Thomas, M, and Batras, D, 2015, Overcoming disparities in organized physical activity: findings from Australian community strategies</p>	<p>Qualitative study: semi-structured interviews</p>	<p>Interviews were undertaken with 50-60 physical activity providers and 30-40 project partners</p>	<p>To investigate barriers to physical activity participation in community groups considered 'underserved' (people who were socioeconomically disadvantaged, Indigenous, culturally diverse or had a disability).</p>	<p>Access to facilities was found to be a barrier to physical activity participation, in this case it was for people with disabilities. Other barriers were related to cost, transport, cultural differences and sporting club environments.</p>	<p>Survey respondents may not have truthfully revealed the challenges faced in delivering the strategies due to a fear of the impact on funding.</p> <p>No direct contact with activity participants to gain insights into the impact of their barriers to participation and strategies to overcome these but hearing from project deliverers only.</p>

