Community participation and the risks of social isolation for older adults

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SUMMARY

As the age of the population continues to increase, facilitating community participation to improve quality of life and support healthy ageing is integral. To ensure the benefits of community participation are translated into healthcare services, improved understanding of the physical and social activities that older adults engage in is required. Further understanding of preferred locations and activities participated in will assist the detection of those at increased risk of social isolation and poorer health. By determining how older adults participate in their communities, recommendations can be made to guide future services and clinical interventions conducive to healthy ageing.

This research aims to improve understanding of community participation and the influencing physical and social factors. Social interactions are deemed integral to keeping older adults motivated, engaged in activities, reducing levels of social isolation and loneliness. The combination of physical activity with social interaction often motivates older adults to continue to actively participate in their communities. This research investigates what community participation looks like for older adults and observes changes in health-related quality of life, sleep quality, social isolation, and loneliness following times of social isolation such as hospital admission, and social distancing introduced to manage the COVID-19 global pandemic.

The main contributions to knowledge from the research presented in this thesis are:

- measuring community participation using combined mixed methods (GPS, accelerometry and activity diaries) was feasible with a group of community dwelling older adults
- mixed methods provided different information and perspectives of community participation that can be used to support individualised interventions
- community participation is an important consideration for healthy ageing, yet is often overlooked by supportive services and healthcare clinicians who could potentially assist older adults overcome the barriers to participation, and
- services and interventions should consider maximising opportunity, confidence, and mobility for older adults to participate in physical activity out of home, and meaningful individualised activities that maximise PA and social interaction when older adults are unable to get out of home.

DECLARATION

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text. I declare that no editor has been used in the writing of this thesis.

Signed

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PUBLICATIONS ARISING FROM THIS RESEARCH

Refereed manuscripts

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Conference Abstracts

Gough C, George S, Maeder A, Lewis LK (2019), Community participation, physical activity, loneliness and health related quality of life in older adults: an observational study, International Society of Behavioural Nutrition and Physical Activity (ISBNPA) Annual Meeting, Prague 4-7 June 2019.

Gough C, George S, Maeder A, Lewis LK (2019), Community participation, physical activity, loneliness and health related quality of life in older adults: an observational study, Australian Academy of Science, Redefining Healthy Ageing Together, Theo Murphy Australian Frontiers of Science, SAHMRI, Adelaide, 8-9 April 2019.

Gough C, George S, Maeder A, Lewis LK (2018) Monitoring the location of physical activity and community participation in an older population. A scoping review, SA Gerontology Conference, Adelaide, 13 July 2018.

Gough C, George S, Maeder A, Lewis LK (2018) Monitoring the location of physical activity and community participation in an older population. A scoping review. International Society of Behavioural Nutrition and Physical Activity (ISBNPA) Annual Meeting, Hong Kong, 3-6 June 2018.

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LIST OF DEFINITIONS AND ABBREVIATIONS

Definitions

Community participation is engagement in activities occurring outside the home that are complex in nature, social and nondomestic (Chang et al., 2013)

Physical activity is any bodily movement produced by skeletal muscles that requires energy expenditure (WHO, 2018)

Social isolation is as an objective lack of relationships and social interaction (Coyle & Dugan, 2012)

Social participation is *'a person's involvement in social activities that provide social interactions within his/her community or society*.' (Levasseur et al., 2010, pp. 2148)

Loneliness is a subjective and distressing feeling (Coyle & Dugan, 2012)

Global positioning system is a satellite navigation system used to determine the ground position of an object (Gao, 2017)

An **Accelerometer** is a device used to assess physical activity using acceleration and energy consumption data (Nagayoshi et al., 2019)

Health related quality of life is the state of complete physical, mental, and social well-being, and not merely the absence of disease of infirmity (Morar et al., 2013)

Resilience is defined as '*the process of adapting well in the face of adversity'* (American Psychological Association, 2015, pp.1)

Abbreviations

ADL	Activities of daily living
AQOL-8D	Assessment of Quality of Life-8 Dimension scale
BMI	Body mass index
CTCP	Community transition care program
GIS	Geographic Information Systems
GPS	Global Positioning System
HRQOL	Health related quality of life
IRSAD	Index of Relative socio-economic advantage and disadvantage
LSNS-6	Lubben Social Network Scale
MVPA	Moderate to vigorous physical activity
PA	Physical activity
PSQI	Pittsburgh Sleep Quality Index
QOL	Quality of life
SALHN	Southern Adelaide Local Health Network
SMMSE	Standardised Mini Mental State Examination
TCP	Transition Care Program

CHAPTER 1: **INTRODUCTION**

1.1 Introduction

Healthcare systems worldwide are under increasing pressure to care for older people, as the age of the population continues to rise (United Nations, 2015). Globally, one billion people are aged 60 years and over, with 142 million older adults unable to independently meet basic living needs (World Health Organisation (WHO), 2021a). In conjunction, ageing and age-related morbidities will continue to increase future healthcare costs (Harris & Sharma, 2018), as older adults present more frequently to healthcare services and hospitals requiring care (Australian Bureau of Statistics (ABS), 2020). Those who are unable to carry out activities of daily living (ADL) require support to allow them to perform their daily activities and subsequently the demand for supportive services and residential aged care continues to increase (Australian Institute of Health and Welfare (AIHW), 2019).

Despite an increase in life expectancy, healthy ageing is not guaranteed for older adults (Beard et al., 2016), thus promoting active and healthy lifestyles has become a priority worldwide to prevent lifestyle related chronic disease. Community participation is an important component of healthy ageing, consisting of both physical and social activities (Chang et al., 2013). Yet to date, the community participation of older adults remains relatively unexplored.

1.2 Rationale for thesis

The health benefits of community participation for older adults are well recognised and increasing in relevance as our population continues to increase in age. Older adults are not guaranteed good health as they age, and although *ageing in place* is key to current ageing policy promoting older adults to remain in their own homes, enabling some older adults to actively participate in their communities, often social isolation is still experienced. These concepts will be substantiated in the review chapters of this thesis.

Our knowledge of older adult's community participation and the activities and locations they choose for participation is limited and reliant on self-reported outcome measures. To date, quantitative evidence of what community participation involves for older adults remains sparse. Knowledge about which activities older adults participate in, and where they choose to be active both physically and socially could inform future interventions to reduce the risks of social isolation for older adults. Accurate measures that are feasible with older adults, as well as an understanding of the barriers and facilitators older adults experience when trying to participate in their communities is required to understand community participation in this age group. This information will help in the design of proactive preventative interventions that promote community participation with the aim to reduce social isolation for older adults. Effective interventions could reduce the

dependence on healthcare services for older adults by developing the skills older adults require to adapt their community participation and thrive in the latter years of life.

The vulnerability of older people often makes them more susceptible to reduced community participation and social isolation. Events such as hospital admission, death of a spouse, or the more unique experience of enforced social isolation due to COVID-19 enhance the risks of reduced community participation and social isolation, and subsequent negative health consequences for this population. Older adults regularly experience social isolation and physical restrictions due to more common events such as health conditions, flu seasons, environmental restrictions, such as the weather, and more personal psychological challenges such as depression, that prevent them from participating in their communities. These circumstances and the subsequent impacts they have on older people require investigation to provide insights for future health care with the aim to mitigate the potential negative health effects due to reduced community participation, social isolation and loneliness which often ensues. Further research that provides a holistic picture of community participation for both healthy community dwelling older adults and more vulnerable populations are required to inform future practice.

1.3 **Research Objectives**

The aims of this program of research were to:

- provide a holistic picture of community participation for community dwelling older adults in times of health and vulnerability
- identify the barriers and facilitators that older adults experience when attempting to participate in their communities (physically and socially)
- identify innovative and feasible methods of measuring community participation with older adults
- characterise older adults' community participation, physical activity (PA), social activity and their health-related factors (health related quality of life, sleep quality and loneliness) and-
- summarise quantitative and qualitative findings to provide recommendations aimed to improve the community participation of older adults in community and clinical settings.

1.4 **Structure of Thesis**

This thesis is divided into 10 chapters. Chapters 1 and 2 provide background to the thesis with the introduction and literature review. Chapters 3,4,5,7 and 8 report on research that has been published in peer reviewed journals or is currently under review for publication. Chapter 6 is

currently being adapted for publication and observes the changes in community participation during COVID-19 lockdown and social distancing. Chapter 9 provides a discussion for the overall thesis and Chapter 10 highlights the implications for future services, research, and clinical practice that support older adults at times where they are at risk of reduced community participation and social isolation.

Chapter 1 introduces the thesis, provides the research aims and summarises the rationale for the program of research. The overarching theme of this thesis is older adults' engagement in community participation, specifically the locations visited, and the physical and social activities participated in. The research aims to provide a picture of community participation for community dwelling older adults.

Chapter 2 provides a thorough literature review which introduces the main themes carried through this thesis. This chapter provides important background information from the literature to provide context for the program of research.

Chapter 3 is titled *'Social isolation, loneliness, and physical activity in older adults: a scoping review.'* This review explores the associations between social isolation, loneliness and physical activity in older adults and the outcome measures used and is currently under review for publication.

Chapter 4 is titled *'Location monitoring of physical activity and participation in community dwelling older people: a scoping review'* which scopes the existing literature pertaining to the use of GPS to identify the locations of community participation and PA. This chapter identifies the barriers and facilitators that older adults experience when attempting to participate in their community. This scoping review is published in the *Disability and Rehabilitation* journal.

Chapter 5 is titled *'Community participation of community dwelling older adults: a cross-sectional study'*. This chapter reports observations of the community participation of community dwelling older adults in Adelaide, South Australia. Combined innovative methodologies of GPS, accelerometry, and self-reported diaries are implemented to provide a detailed holistic picture of community participation, in relation to PA, social interaction, health related quality of life (HRQOL), sleep quality and loneliness. This chapter is published in *BMC Public Health.*

Chapter 6 is titled '*Community participation of community dwelling older adults: physical and social activities during and following COVID-19 social isolation.*' This chapter reports changes in the community participation, PA, social interaction, HRQOL, sleep quality and levels of loneliness during COVID-19 restrictions.

Chapter 7 is titled '*Integrating community participation in the transition of older adults from hospital to home: a scoping review,*' and scopes the literature to determine how community participation is

integrated in transition care services worldwide. This research highlights the barriers and facilitators that older adults experience when attempting to reintegrate into their communities. This chapter is published in the *Disability and Rehabilitation* journal.

Chapter 8 is titled '*Transition from hospital to home during COVID-19: A case report from an Australian transition care program*,' and reports on the experience of an older female who transitioned home with supportive services from hospital prior to and during the COVID-19 global pandemic. This case study is published in *The Allied Health Scholar* journal*.*

Chapter 9 provides an overall discussion of the main findings of this program of research and acknowledges the limitations that may have impacted the results and generalisability of findings. Areas that warrant further research to expand our understanding of community participation are identified and discussed.

Chapter 10 relates the main findings of this thesis to clinical practice. Recommendations for future management of times of transition and social distancing where older adults may be more susceptible to social isolation are discussed. Considerations for healthcare clinicians and future service providers are highlighted.

CHAPTER 2: **LITERATURE REVIEW**

2.1 About this chapter:

This literature review introduces the key themes explored in this body of research, providing context and relevance for ageing populations worldwide and in Australia. The definitions of social isolation and social participation are provided, with circumstances that may cause social isolation, such as transitioning home from hospital and COVID-19 management introduced. This literature review streamlines the definition of community participation and highlights the importance of physical and social participation for older adults, whilst identifying barriers and facilitators that influence activities and the negative health outcomes of sedentary behaviours. Plausible outcome measures of community participation are reviewed and related to relevant health measures such as HRQOL and sleep quality.

2.2 Ageing

The World Health Organisation (WHO) recognise that every person worldwide should have the opportunity to lead a long and healthy life (WHO, 2015b). With the continued advancement in healthcare and an increased awareness of how to practice self-care (Rowe & Kahn, 1998), the population continues to increase in age. Worldwide, the number of older adults aged 60 years and over is set to reach 2.1 billion by the year 2050 (United Nations, 2019). Increasing age has previously been met with ageist views, with older adults viewed as sick, frail, weak, unhappy, and unable to function physically and/or cognitively, limiting their value and contribution to society (Calasanti, 2016; Rowe & Kahn, 1998). These negative stereotypes of ageing are gradually changing and have shifted towards a more positive definition of '*successful ageing*' whereby community involvement, PA, and mental health are paramount (Calasanti, 2016; Strawbridge et al., 1996). Rowe and Kahn (1998) suggest that successful ageing depends on the individual, their choices, behaviours, and the ability to maintain three key behaviours. The first, low risk of disease, the second, high levels of mental and physical function, and the third an active engagement with life.

The ability to actively engage with life and the community becomes harder with age due to increased frailty and reduced mobility (Chang et al., 2013). On a biological level, ageing is referred to as a time of senescence, or a '*deteriorative state*,' whereby the ability to tolerate stress is reduced, often resulting in reduced organ function and increased vulnerability to disease (Rowe & Kahn, 1998). Increased vulnerability combined with lifestyle choices such as poor diet or lack of exercise often results in chronic diseases such as heart disease and diabetes (AIHW, 2018). Interventions to prevent and treat chronic disease have become a focus of governments and researchers worldwide to reduce demands on healthcare services, and subsequently promote healthy ageing (Couzner et al., 2013; O'Loughlin et al., 2017). Therefore, understanding how Australian's are ageing is an important consideration to provide context for this research.

2.2.1 Ageing in Australia

The number of Australians aged 65 years and over accounted for 15% of the population in 2017 (3.8 million people) (AIHW, 2018). This number is expected to continue to rise, and by 2057 it is predicted that 22% of the population (8.8 million) will be in this age group (AIHW, 2018). As a result, age related healthcare costs are expected to increase from $18 billion in 1996, to $24 billion in 2051, mainly due to the rise in number of older adults (Department of Health and Aged Care, 1999). In 2021, Australia's healthcare was ranked 32nd in the world by the WHO (WHO, 2021b), and 17th in the 2015 Global Age Watch Index Rankings (Global AgeWatch, 2015) which demonstrates the need for improved healthcare for older Australians.

The ABS define individuals aged 65 years and over as older adults, with the range of 50 years and over applied to identify older Indigenous Australians (AIHW, 2018). Although life expectancy is increasing, there is no guarantee of a good quality of life (QOL) or healthy ageing into the latter years (Beard et al., 2016; Sho-Jen et al., 2013). For older Australian adults, lifestyle related chronic diseases are the main causes of illness, disability, and death (Australian Government Department of Health, 2019). Older Australians commonly report multiple conditions, with one in three Australians aged 65 years and over reporting three or more chronic diseases (2014-2015) (Australian Government Department of Health, 2019). Most common chronic conditions include coronary heart disease, high blood pressure, arthritis, diabetes, and kidney disease (AIHW, 2018). These long-term conditions impact on the QOL of older adults as they age and influence the activities that they can participate in (O'Loughlin et al., 2017). Older adults have been found to participate in fewer meaningful activities, which could be a result of chronic health conditions, but may be more likely due to the significant life changes experienced with increasing age such as retirement and bereavement (Eendebak & WHO, 2015). As a result, many older adults prefer to 'age in place' and remain living in the communities where they have social connections (Olsberg & Winters, 2005).

2.2.2 Ageing in place

Most older adults prefer to remain living in their own homes as they increase in age. Remaining at home enables older adults to choose the activities they participate in and maintain control over their daily lives (Fricke & Unsworth, 2001; Stones & Gullifer, 2014). 'Ageing in place,' as it is referred to in the literature (Chapman, 1994), has the potential to support older people to remain in their homes, at a lower cost than moving into a residential care facility whilst maintaining social and community connections (Horner & Boldy, 2008). Ageing in familiar settings has been found to provoke feelings of satisfaction and contentedness for older adults (Stones & Gullifer, 2014). As a result, the Australian federal government has been funding services to enable older adults to remain at home for as long as possible since the 1990s (Stones & Gullifer, 2014), with older adults reporting that remaining at home, participating in usual activities, and maintaining established social networks are important to their QOL and wellbeing (Horner & Boldy, 2008). Conversely,

moving into residential care facilities has become a '*last resort*,' as participation in the community outside of facilities and choices in daily routines are often restricted. As many older adults prefer to live in their own homes for longer, the dependency on supportive services has increased as older people remain at home with higher levels of disability. Despite being the preferred option for many, ageing in place can cause older adults to become inactive both physically and socially and has the potential to increase the risk of social isolation and loneliness particularly for individuals who live alone (Coyle & Dugan, 2012)

2.3 Social isolation and loneliness

The social networks of older adults become smaller with increasing age, stemming from significant life events such as retirement or loss of a spouse which increases the risk of social isolation and loneliness (Yeh & Lo, 2004; Ong et al., 2016). Despite the terms of social isolation and loneliness being used interchangeably, they represent different concepts (Gardiner et al., 2018). Social isolation is characterised by the absence of social activities and defined as an '*objective lack of relationships and social interaction*' (Coyle & Dugan, 2012, pp. 1347). Adults who age in place without supportive social networks, are therefore at risk of being socially isolated from society. In contrast, loneliness is a '*subjective and distressing feeling*' which describes the difference between social interactions experienced by an individual and those that are desired (Coyle & Dugan, 2012, pp. 1347; Ong et al., 2016). High levels of social isolation and loneliness have been linked to poorer outcomes such as reduced sleep quality (Coyle & Dugan, 2012), cognitive function (Wilson et al., 2007), increased blood pressure and depression (Cacioppo et al., 2010; Hawkley et al., 2010). These negative health outcomes can significantly impact healthcare systems, with nine percent of Australian adults aged 75 years and over showing signs of social isolation and 19 percent reporting loneliness (Mance, 2018). Despite the risks associated with social isolation, such as a 50 percent increase in developing dementia (National Academies of Sciences et al., 2020), social isolation is not routinely assessed in primary care and can often go undetected (Nicholson, 2012).

With the continuing increase in age of the population, levels of social isolation and loneliness are expected to increase, especially for older adults living alone (Coyle & Dugan, 2012). Previous interventions to combat and prevent social isolation and loneliness in older adults have included, group activities, use of technology and neighbourhood programs, with mixed results (Cotterell et al., 2018). Group activities such as fitness groups have been found to be useful for some older adults (Franke et al., 2021), but do not reduce levels of social isolation or loneliness for all, making large scale standardised interventions difficult (Fakoya et al., 2020). Cotterell et al., (2018) recommend a more proactive approach, moving away from cure to prevention of social isolation and loneliness, as social components of activity are important for keeping older adults motivated and engaged (Cotterell et al., 2018; Yarcheski et al., 2004). The idea that social isolation and

loneliness can reduce engagement in activity (Özkan Tuncay et al., 2018) and therefore increase the risk and severity of chronic disease requires further investigation. Numerous interventions that use PA to reduce levels of social isolation and loneliness have been trialled (Shvedko et al., 2018). Yet the effects social isolation and loneliness have on participation in PA are less clear and require further investigation to develop proactive interventions.

2.3.1 Examples of social isolation

Social isolation can stem from and be exacerbated by personal life changing events such as retirement, bereavement, hospitalisation, the transition home from hospital, or society-imposed restrictions such as the management of the COVID-19 pandemic that may increase the risk of social isolation (Kaye & Singer, 2019). These events require consideration, to determine how older adults interact socially during these events and whether they require ongoing support to maintain social interactions.

2.3.1.1 Personal social isolation

Over the last few decades, the number of people living alone has increased substantially, reducing the incidental social interactions that could be experienced at home with a spouse or housemate (Kaye & Singer, 2019; Ross & Jang, 2000). With increasing age, social networks often reduce in size following the passing of family and friends, reducing the opportunities for social interaction. Social relationships are important to minimise levels of stress and maximise feelings of support and trust (Kaye & Singer, 2019). Yet, following critical life transformations such as retirement, death of a spouse, divorce, health crisis and/or children moving out of home, social isolation may occur (Kaye & Singer, 2019; Nicholson, 2010). Changes in salary and socioeconomical status may also affect an individual's ability to participate in activities and can lead to social exclusions, often heightened following retirement (Ross & Jang, 2000). Social isolation can be of greater risk to older adults living in rural locations, those who feel unsafe in the neighbourhood in which they live (de Koning et al., 2020; Nicholson, 2010; Ross & Jang, 2000), and individuals who lack social support (Shvedko et al., 2018). These factors, combined with co-morbidities such as reduced hearing, visual impairments, functional disability and urinary incontinence often cause older adults to avoid social interactions and socially isolate themselves from those around them (Nicholson, 2010).

2.3.1.2 Hospital admission

Older adults who are admitted to hospital are often recommended to rest in bed have reduced mobility compared with their normal routines. Hospital admission and extended stays are associated with reduced mobility and capacity to complete ADLs on discharge (Brown et al., 2004; Challis et al., 2014). Reduced functional ability can reduce participation in the community following discharge, as individuals are unable to return to activities that were previously meaningful. Whilst in hospital, older adults experience disruption to their normal lives and personal time, events are cancelled and they are unable to control how they spend their day (Holloway et al., 1997).

Attempting to be social whilst in hospital was reported as being difficult for people who were less mobile and individuals isolated in private rooms who found it difficult to get to know others, thus, hospital stay is associated with feelings of anxiety, loneliness, and depression for older adults with some feeling like they are imprisoned, waiting to be let out so they can go home and return to their previous life (Holloway et al., 1997). Conversely, some older adults have described hospital stay as enjoyable as it provides social interactions that they would not have experienced at home, becoming socially isolated at home can result in frequent and unnecessary hospitalisations (Longman et al., 2013). Thus, highlighting the importance of preventing social isolation for older adults who are ageing in place at home without supportive services or social networks.

2.3.1.3 Transition care

Transition care provides services to support older people as they transition from hospital to home. Transition Care Programs (TCPs) were introduced in 2004 by the Australian Government and State Territory Governments to reduce hospital readmissions and reduce the associated costs. A TCP provides an individualised package of services to eligible older adults in the weeks following hospital discharge. The aim of TCPs is to improve levels of independence and functioning to reduce the number of older adults entering residential care prematurely, or being readmitted to hospital (Australian Government Department of Health, 2021; AIHW, 2012). Transition care services can include low intensity physiotherapy and occupational therapy, nursing support with personal care and hygiene, and assistance with everyday tasks such as domestic activities and shopping (Giles & Australian Department of Health, 2008). Significant government funding is required to provide these services, with an estimated $397 million providing care for 25,113 recipients in 2017/2018. Service summaries suggest that over half of TCP recipients return to live in their own homes in the community, with as many as 15% reporting no ongoing supportive services (AIHW, 2012). However, readmission rates are high with 22% of clients readmitted to hospital (2010/11) (AIHW, 2012) which raises concern for the effectiveness of TCP services to reintegrate older adults back into their communities.

The TCP has been reviewed by stakeholders as a high quality, positive program inclusive of multidisciplinary expertise (Australain Government Department of Health, 2019). However, the experiences of older adults returning home from hospital are often less positive, with feelings of '*shock*,' social isolation, loneliness and frustration at reduced functional ability experienced by many (Martinsen et al., 2015). Decreased function has not only been found to prevent older adults from mobilising as they used to, but also restricts them from attending social activities (Martinsen et al., 2015). Previous studies have identified a lack of individualised assessment in TCP's has resulted in low levels of social interaction and feelings of abandonment for older adults (Reay et al., 2015). With higher adverse outcomes for individuals with difficulties walking, mild cognitive impairments and those living alone following hospital discharge (Provencher et al., 2020). Despite increasing awareness of the benefits of community participation for older adults, and findings that

community participation interventions are cost effective (Turcotte et al., 2018), there is limited evidence to determine how older adults reintegrate into the community following hospital discharge. Measures of community participation in this population could provide an overview of what community participation looks like for older adults who require support to return to independent living in their own homes, guiding future services and interventions.

2.3.1.4 COVID-19

The first case of COVID-19, an infection triggered by the SARS-CoV-2 virus was detected in 2019 (Koley & Dhole, 2020) and declared a global pandemic by the WHO in March 2020. Management of the COVID-19 global pandemic provides an example of enforced social isolation on a global scale, with social distancing and social isolation measures enforced to reduce the transmission of the virus. Largely, this approach was successful in reducing transmission in Australia, however, the effects of social distancing on older adults who are already at increased risk of social isolation is unknown. Older adults are at a greater risk of disease as ageing causes a loss of strength in body organs such as the kidney, heart and the lungs, which causes a decline in immune function (Rowe & Slo, 1998). Accordingly, older adults and those with co-morbidities were classified as '*vulnerable*,' with early evidence demonstrating higher levels of mortality in older adults who contracted the COVID-19 virus (Shahid et al., 2020; Yanez et al., 2020). Older adults in Australia and across the world were advised by governments to remain at home, with recreational facilities forced to close and public social events cancelled (Australian Government Department of Health, 2020). Disruptions in social activities were felt by those who were unable to attend their community centres, gyms, and places of worship but more concerningly would have impacted those without family support networks who were reliant of supportive services (Armitage & Nellums, 2020), potentially increasing health risks for already vulnerable older adults.

Despite predictions that levels of social isolation and loneliness during the COVID-19 pandemic would increase for older adults, the impacts are relatively unknown (Roy et al., 2020). To date, there is limited evidence to determine how older adults responded to social distancing restrictions and how these restrictions impacted on their normal routines and community participation. Research is required to understand the effects of social distancing on older adults with particular focus on levels of social isolation and loneliness, which could inform management of events that require social distancing. Management to mitigate negative health consequences may require large scale interventions to manage events such as a global pandemic, targeted management of states or territories for an extreme flu season, or at an individual level from events such as an extended hospital stay or bereavement.

2.4 **Loneliness**

Increasing loneliness was a concern for all age groups during the COVID-19 pandemic, despite increased connection using digital technology, levels of loneliness appear to be increasing

(Cacioppo et al., 2015). Feeling lonely, does not necessarily mean being alone, as some individuals have reported feeling lonely whilst out in a crowd or with a spouse (Cacioppo et al., 2009). To maintain good physical and mental health, people require social relationships and interactions that are meaningful to them, often motivated by feelings of belonging to social groups and being valued by others (Heinrich & Gullone, 2006). Experiencing loneliness is more common in the latter years of life, with reduced opportunities for social interactions and can have a detrimental effect on health such as; elevated blood pressure (Hawkley et al., 2010), cardiovascular disease, depressive symptoms and mortality (Leigh-Hunt et al., 2017). Loneliness can be prevented by frequent and active social participation.

2.5 Social participation

Engaging in social activities is central to the promotion of healthy ageing, and to prevent social isolation, loneliness and the associated health risks for older adults (Dare et al., 2018). The experience of physical decline experienced during the ageing process is said to be eclipsed by the happiness provided by human interaction with relationships cultivated over time (Wykle, 2004). By maintaining social activities and relationships with others, life has a sense of purpose and meaning, important for long-term wellbeing (Rowe & Kahn, 1998). Social participation can be described as '*a person's involvement in activities that provide interaction with others in society or the community*' (Levasseur et al., 2010, pp. 2148). These interactions often become more difficult with increasing age, because of lifechanging events (Dare et al., 2018). Older adults encounter fewer social settings, making them reliant on community resources and organized activities to experience social interactions (van Den Berg et al., 2015). Understanding how and where older people choose to be socially active is important for community participation, developing patient-centred health systems and the design of successful interventions that promote social interactions for older adults (George et al., 2015).

2.6 Community participation

Continuing an engagement with life by maintaining social relationships and performing productive activities has been deemed integral to successful ageing (Rowe & Kahn, 1998). In previous research, the term '*community participation*' is widely used, however variations of what community participation entails is ambiguous in the literature. Bracht & Tsouros (1990) interchange between the terms '*community participation*' and '*citizen participation*,' which are defined as the *'voluntary, social process of taking part in formal or informal activities, programs or discussions about a planned change or improvement in community life, services and/or resources'* (Bracht & Tsouros, 1990, pp. 201). Other definitions interpret the words separately, with '*community*' referring to people grouped by geographical location or common interests and '*participation*' meaning to take part or be actively involved (Boyce & Lysack, 2000). The activities described in community participation are often clearer to understand, and are inclusive of meeting with family or friends,

taking part in recreational activities, working, volunteering and cultural or social activities (Theis & Furner, 2011; Vaughan, 2016). This body of research defines community participation as *'engagement in activities occurring outside the home that are complex in nature, social and nondomestic'* (Chang et al., 2013, pp. 772).

Despite the array of definitions and terminology, the importance of community participation for older adults maintaining social connections and ageing in health has gained increasing evidence. Community participation in later life has been identified as a substitute for paid employment, providing a sense of purpose, social connections, and feelings of belonging for older adults (Berry et al., 2007; Dare et al., 2018). Higher levels of community participation have been linked with improved QOL, social function, and overall health (Huebner et al., 2003). With a lack of community participation related to reduced function, depression, morbidity, mortality and often social isolation and loneliness (Huebner et al., 2003). This highlights the importance of maintaining an active lifestyle, inclusive of social interactions, to positively influence the psychological health of older adults (Shankar et al., 2011). Qualitative findings suggest that older adults living with disability, deemed community participation *'as a continuation of a lifelong process of self-determination'*, not something that was a new concept that came with increasing age (Raymond et al., 2014). Demonstrating that these issues are not limited to older adults but to anyone who experiences factors that reduce their ability to participate in the community.

2.6.1 Healthy ageing and physical activity in the community

Actively participating in the community is important to maintain cognition and the ability to participate in the community in later life, with the preservation of physical function and physical fitness integral to participation (Aird & Buys, 2015). With increasing age, community, and residential areas, where participation mostly occurs, become more important in supporting healthy ageing. Healthy ageing is defined as, *'the process of developing and maintaining functional ability that enables wellbeing in older age'* (WHO, 2015b). For older adults, PA can dramatically increase levels of physical fitness, increases muscle size, strength and balance which can reduce the risk of falls (Sherrington et al., 2019). Regular PA is also prescribed as a prevention and treatment for chronic disease (Nunan et al., 2013). The WHO recommends that *'communities should assist residents not merely adapt to ageing but support them to thrive in later years optimizing opportunities for participation'* (WHO, 2015a). Therefore, understanding the locations older adults choose to be active in, and the barriers they face is important, as community participation and outdoor mobility in which PA is linked depend on the built environments around them (Aird & Buys, 2015; Raymond et al., 2014; WHO, 2015a) (Further introduction of PA specific to older adults is provided in 2.6.4).

2.6.2 Barriers and facilitators to community participation

As adults age, the environment built around them consisting of buildings and infrastructure becomes more important (Petrovic et al., 2017). These factors can impact on functional measures such as walkability (Carlson et al., 2012) and can subsequently act as barriers and/or facilitators to older adults' participation in the community (Gao, 2017; Webber & Porter, 2009). For older people, ease of access such as kerb ramps, street crossings, lighting and parking are important to maintain their independence (Rosenberg et al., 2013), this may become increasingly important as confidence in driving has been found to reduce with age (George et al., 2006). Subsequently, adaptations such as driving during the day when there is little traffic can lead to some older people to cease driving altogether and not return to activities that were previously meaningful to them. In conjunction, environments that cause safety concerns for older adults can reduce their enthusiasm to leave the house (Zeitler et al., 2012). When feeling safe, older people are more willing to be active, preferring locations where they can participate in physical, social, and daily activities in one location (Franke et al., 2017). For older people, the built environment is important to facilitate regular activities and allow individuals to actively engage in their community (Vaughan, 2016). These activities are integral to successful ageing and require adaptation for older adults to maintain them (Franke et al., 2017). Further understanding is required to assist researchers, policy makers and clinicians to consider the environmental barriers and facilitators that affect the ability of older adults to actively participate in their communities (Aird & Buys, 2015).

2.6.3 Sedentary behaviours

Sedentary behaviour can be described as any waking behaviour inclusive of sitting, reclining, or lying posture that requires low levels of energy expenditure (≤1.5 metabolic equivalents (METs) (Tremblay et al., 2017). Older Australians are advised to reduce the amount of time spent sitting down and break up sedentary activities as often as possible (Australian Government Department of Health, 2021). Sedentary behaviours present their own health risks for older adults, as time spent sedentary means reduced engagement in PA (Harvey et al., 2015). Sedentary behaviours are associated with obesity, type 2 diabetes, cardiovascular conditions and depression (Hajduk & Chaudhry, 2016; Hu et al., 2003; Vandelanotte et al., 2009; Vancampfort et al., 2020), and often require long-term management from health care services. Sedentary time for older adults has been demonstrated to be high, with some individuals spending more than 8 hours a day sedentary (Harvey et al., 2015) and concerningly, Espinel et al., (2014) reported a third of older Australians (sample size n = 992) spent more than 10 hours sedentary each day.

Older Australian's have been found to spend extended periods watching television (Reid et al., 2017). Watching television is a sedentary behaviour that is related to increased mortality, with previous research reporting that reducing viewing time from five or more hours a day to three to four hours a day reduced mortality risk by 15 percent over a 10-year period (Keadle et al., 2015). Higher amounts of sitting time have been linked to lower physical HRQOL in Australian adults (Rebar et al., 2014), and at a functional level, studies have reported that knee extension strength

was greater in older adults who reported consistently low time watching television which is important for the maintenance of physical function (Reid et al., 2017). Overall, higher sedentary times are related to poorer health and increased disability (Espinel et al., 2014), an increased understanding of sedentary behaviour in older adults and targeted interventions are therefore required to prevent poorer health outcomes.

2.6.4 Physical activity

For older adults, continued PA is important to maintain functional ability to be able to participate in the community. The ability to maintain balance, walk upstairs and use public transport are necessary for attending recreational and social events. Physical activity is defined by the WHO as *'any bodily movement produced by skeletal muscles that requires energy expenditure'* (WHO, 2018). Being physically active has many health benefits for older adults, such as preventing heart disease, diabetes, lowering blood pressure and risks of cardiovascular disease (Sho-Jen et al., 2013). Rowe and Kahn (1998) suggest that maintaining physical fitness is the most important thing older people can do to remain healthy. Despite the benefits of PA being well publicised, often levels of PA are lower than recommended (AIHW, 2000). Thirty minutes of moderate intensity PA five times a week or twenty minutes of vigorous activity completed per week is recommended for older adults with the Australian department of health recommending 30 minutes of PA every day (Australian Government Department of Health, 2014; Nelson et al., 2007; Surgeon General et al., 1996). Specific fitness, strength, flexibility and balance activities are also recommended for older Australians (Australian Government Department of Health, 2021) with a move towards 24-hour movement guidelines inclusive of sleep recommendations apparent. Despite clear guidelines, the 2020 report on Australia's health found that 55% of adults did not participate in sufficient minutes of PA (AIHW, 2020). As PA is recommended to both prevent and treat chronic conditions (Nelson et al., 2007) low levels of PA are concerning. Meta-analyses have demonstrated that interventions to increase levels of PA for community dwelling adults can be effective, however further research into the mode of delivery and outcome measures used is required (Chase, 2015). Therefore, appropriate measures of PA are required to fully understand the physical components of community participation for older adults.

2.7 Measures of Community participation and related factors

Detailed and accurate measures of community participation are required to understand how older adults participate physically and socially in their communities (Law, 2002; Chang et al., 2013). Previously, self-reported measures have been used to measure community participation, these measures rely on memory recall which may have limitations with older populations (Brusilovskiy et al., 2016; Slootmaker et al., 2009). Self-reported outcome measures often lack objectivity and have been used to analyse a specific activity, rather than daily activity patterns (Law, 2002). Self-reported instruments are considered as potentially having social desirability bias, with respondents

more likely to provide the '*correct*' or '*healthiest*' answers to a question such as over-reporting PA, and underreporting weight status (Slootmaker et al., 2009; Shephard, 2003). These measures can be susceptible to bias, depending on the clarity of instructions and the individual completing the report (Shephard, 2003). However, self-reported measures can provide the rich context of community activities including details of specific activities participated in and social interactions. The inclusion of questions such as, *do you choose to take part in social activities?* and *have you been to a public event?'* enhance understanding of community activities participated in (Chang, 2013). Despite an array of devices available measuring step counts and activity levels, the evidence for the locations older adults access to participate in their communities, using objective tools such as Global Positioning Systems (GPS) remains sparse (Li et al., 2005). This body of research will focus on the use of GPS with older populations and the benefits it may have for measuring community participation.

2.7.1 The Global Positioning System

The GPS is a satellite navigation system used to determine the ground position of an object, providing detailed co-ordinates, and was developed by the United States Department of Defence in the 1960s (Gao, 2017; Loveday et al., 2015). As the application of technology in the promotion of PA and health monitoring continues to increase (Gao, 2017), there is the potential to move away from subjective questionnaires and use device-based objective measures of community participation (George & Gough, 2018). GPS is capable of numerous functions and is a simple and affordable method of detecting the location of people in real time using mobile devices inclusive of geolocational sensors related to mapping technologies (Lupton, 2017; Spencer, 2003). These devices have been found to be more accurate than self-reported diaries in recording location (Badland et al., 2010; Duncan & Mummery, 2007; Fillekes et al., 2019). GPS could be a useful tool to determine the specific location of community participation and facilities used by older adults participating both physically and socially in the community.

The use of GPS is yet to be standardised in terms of outcome measures, device type and data analysis (Kerr et al., 2011). Previous research has measured activity spaces using GPS on smartphones (Cornwell & Cagney, 2017), how the weather affects walking and cycling (Prins & van Lenthe, 2015) and use of public transport using GPS (Aird & Buys, 2015). The accuracy of devices and monitoring periods required to provide a picture of community participation are unclear. It is suspected that data collection may be inhibited by signal loss (caused by metals and high-rise buildings) and may result in data loss. Thus, standardised methods for the use of GPS in research are required (Kerr et al., 2011).

Despite methodological concerns, GPS has emerged as a useful tool for tracking both mobility and participation in healthy and disabled populations (Brusilovskiy et al., 2016). However, to date GPS research has focused on adolescents, individuals who have experienced brain injuries, amputees

(Hordacre et al., 2014; Jayaraman et al., 2014), stroke (Evans et al., 2012) and those living with dementia (Shoval et al., 2008). Compliance levels have therefore been variable, and it remains unclear to what extent GPS has been used to measure community participation with community dwelling older adults (Evans et al., 2012).

2.7.2 Measures of physical activity

The outcome measures used to analyse PA are important to motivate older adults and demonstrate the benefits of participating in PA interventions. Physical activity questionnaires are commonly used, as they are cheap and quick to complete (Slootmaker et al., 2009). However, the data collected from these questionnaires can have recall bias (Innerd et al., 2015; Shephard, 2003), as they are dependent on the perceptions of older adults, with overestimation of PA common (Slootmaker et al., 2009). More accurate measures of PA are required to fully understand the activity patterns of older adults. Accelerometers have been found to provide accurate objective data of daily activities; however, they do not provide qualitative data of the activities individuals are participating in (Slootmaker et al., 2009). To fully understand the community participation of older adults, standardised outcome measures are required that consider both the qualitative and quantitative perspectives.

2.7.3 GPS and accelerometry combined

The use of GPS has the potential for many outcomes and has been used as an objective measure of community participation by recording the number of outings from home (George et al. 2019; Hordacre et al., 2014). Accelerometers measure body movement in real-time, specifically the intensity, frequency, duration, and total volume of activity (Strath et al., 2005). The combination of GPS and accelerometry has improved the estimation of energy expenditure related to PA, as the gradient of landscape and speed of movement can be considered (Nguyen et al., 2013). GPS combined with accelerometry can detail minutes of PA and detect the specific location of the activity (Meyer & Gullota, 2012).

Figure 2.1 GPS device (Qstarz BT1000XT) and accelerometer (GeneActiv)

Previous research has successfully combined GPS with accelerometry allowing for the assessment of indoor and outdoor levels of PA, which reflects the unstructured activity participated in on a normal day (Nguyen et al., 2013). These combined methods have also enabled

researchers to detect that adults perform 40% of PA outdoors, within 800m of their homes (Hillsdon et al., 2015). Combining measures of location using GPS and PA using accelerometers could therefore enhance our understanding of community participation for older adults. The accuracy of devices that combine the two technologies (such as mobile phones) to date is unknown and wearing two separate monitoring devices has been the preferred method for researchers (Figure 2.1). The combination of these measures could improve our understanding of location and levels of PA; however, these measures do not provide the context of activities being participated in, or social interactions experienced, which are required to fully understand community participation.

2.7.4 Combined mixed methods

Previous research has acknowledged that combining GPS and accelerometry with self-reported measures has the potential to provide knowledge of how individuals interact with locations and what effects this can have on long term wellbeing (Hand et al., 2018). Despite the bias that can affect subjective measures, self-reported diaries can provide context and details of the specific activity undertaken, whilst elaborating on the social interactions experienced that can provide a holistic picture of community participation. Mixed methods can facilitate the integration of quantitative findings such as number of trips out and locations with the voice of the subject, providing the reasoning and context of community participation in all its complexity (Creswell & Plano Clark, 2017). The feasibility and applicability of using mixed methodological approaches with older adults to develop a detailed understanding of community participation to inform practice, requires further investigation.

2.8 Measures of health

Measuring health outcomes with older adults is important to determine the effects of care and intervention. Measurement of HRQOL, sleep quality, social isolation and loneliness have been identified as important for use with older adults and should be considered in conjunction with community participation.

2.8.1 Health related quality of life

Health related quality of life is a clinical measure that represents more than merely mental health and happiness, it is a broader description of the quality of life inclusive of psycho-social health experienced by an individual (Richardson, Sinha, et al., 2014). HRQOL is linked to levels of chronic disease and indicates how an individual perceives their own health (Guyatt et al., 1993). The HRQOL of older people has previously been perceived as irreversibly poor (Crotty et al., 2014). Yet there has been a shift towards research and interventions that can reduce the risk of declining physical function, that can improve HRQOL for older populations. Increasing times of leisure and

PA have been found to improve HRQOL for older adults who have functional limitations (Thompson et al., 2012).

There are numerous instruments that have been used to measure HRQOL (Bowling, 2005), they often consist of health-related questions that are weighted to determine the health status across different utilities such as function, mental health and independent living (Maxwell et al., 2016). These measures are used clinically to determine the outcomes of services provided and interventions with the ageing population (Bowling, 2005) and are deemed to be valid and reliable measures (Richardson, Iezzi, et al., 2014). Despite an array of research articles reporting the effects of PA on HRQOL for community dwelling older adults (Abdelbasset et al., 2019; Wanderley et al., 2011), the association between community participation and HRQOL is less clear and warrants further investigation.

2.8.2 Sleep quality

Despite the need for sleep not changing with age, many older adults experience difficulties sleeping. This may be due to medical conditions, illnesses, life changes such as bereavement, reduced social interactions, environmental changes, such as moving into supported accommodation and or effects of taking numerous medications (Neikrug & Ancoli-Israel, 2010). Older Australians sleep quality does not appear to change significantly with age (Gordon et al., 2019). However, insufficient levels of sleep have been linked to higher BMI, weight gain, obesity and diabetes, thus sleep may be related to the increase in levels of chronic disease reported and is an important outcome measure of community health (Buxton & Marcelli, 2010; Cappuccio et al., 2010).

2.8.3 Social isolation and loneliness

A recent review of the literature suggests that outcome measurements of social isolation are variable and not routinely used with older adults (Pohl, 2019), and measures of older adult's loneliness appears to include substantial heterogeneity across different countries (Newmyer et al., 2020). This makes choosing an appropriate, validated measure for use with older adults difficult and warrants further understanding to ensure research and clinical services can regularly measures levels of social isolation and loneliness to inform interventions.

2.9 Summary

Low levels of community participation are associated with increased mortality and social isolation for older people, potentially increasing the risk of mental health conditions such as dementia, physical decline, and falls (Robins, Hill, et al., 2018). Community participation is a key component to healthy ageing (Johnson & Mutchler, 2014), yet as people age the effects of ageing such as reduced mobility and frailty make community participation difficult (Chang et al., 2013). To provide environments, services and interventions that promote community participation and assist older

adults navigate the barriers to participation, further understanding of how to measure community participation and the associated factors of PA and social interactions, and the feasibility and applicability of mixed methodological approaches are required. Therefore, this thesis will present a body of research that considers community participation for community dwelling older adults, the associations with measures of health and the changes in participation following events where older adults are vulnerable to social isolation and loneliness.

CHAPTER 3:   **SOCIAL ISOLATION, LONELINESS AND PHYSICAL ACTIVITY IN OLDER ADULTS: A SCOPING REVIEW**

3.1 About this chapter:

This chapter reviews the literature investigating the questions, *'What are the associations between social isolation, loneliness, and physical activity in older adults?',* and *'what measures of social isolation and loneliness are used with older adults?'* Preliminary scoping of the available evidence base identifies numerous interventions using PA to reduce social isolation and loneliness. However, conversely, it is unclear whether social isolation and loneliness are associated with participation in PA. These enquiries are deemed important to fully inform the methodologies for future research and to understand the complexity of community participation in an older population. This chapter was submitted to the *Health and Social Care in the community* journal on the 20th of April 2021 and is currently under review.

3.2 Research objectives

The aims of Chapter 3 were to:

- investigate the associations between social isolation and PA, and loneliness and PA in older adults, and-
- determine which measures of social isolation and loneliness were used with older adults

3.3 Background

Despite social isolation and loneliness being interrelated, they describe different concepts as discussed in 2.3. Older adults have an increased risk of social isolation and loneliness stemming from life events such as transitioning into retirement (Yeh & Lo, 2004), with high levels of social isolation and loneliness linked to poor health outcomes including reduced sleep quality (Coyle & Dugan, 2012), increased blood pressure (Hawkley et al., 2010), impaired cognitive function (Wilson et al., 2007) and depression (Cacioppo et al., 2010). Recent research reports 8 percent of adults aged 75 years and over demonstrated signs of social isolation, with 19 percent reporting loneliness, thus raising the question '*is Australia experiencing an epidemic of loneliness?'* (Mance, 2018).

Social isolation and loneliness are suspected of reducing engagement in PA (Özkan Tuncay et al., 2018; Yarcheski et al., 2004), this makes older adults more susceptible to chronic diseases such as coronary heart disease (CHD), type II diabetes, dementia and Alzheimer's disease (Nelson et al., 2007; Piercy et al., 2018; Surgeon General et al., 1996; Reiner et al., 2013). The factors that determine community participation of older adults are not yet fully understood (Pritchard et al., 2015). However, levels of PA and the preservation of functional mobility is vital for participation in community activities (Aird & Buys, 2015). Reduced levels of PA may also

contribute to decreased social interaction, as social components of PA are often identified as factors that motivate and engage older adults in physical activities, which in-turn can benefit their mental health (Özkan Tuncay et al., 2018; Yarcheski et al., 2004). Therefore, to facilitate healthy ageing, it is increasingly important to understand how older adults participate in physical activities and whether social isolation and feelings of loneliness are related to community participation (Rifkin, 2014).

There is a plethora of research available that attempts to use PA interventions to reduce levels of social isolation and loneliness in older adults (Shvedko et al., 2018). However, due to the heterogeneity in methodologies and outcome measures used (Smith et al., 2017), we know little about the relationship between social isolation, loneliness and PA. Therefore, this scoping review investigated the associations between social isolation and PA, and loneliness and PA in older adults. With the secondary aim intended to inform research methodologies by determining which outcome measures of social isolation and loneliness were used with older adults.

3.4   **Methods**

This review was informed by the guidelines of Arksey and O'Malley (Arksey & O'Malley, 2005) and updated PRISMA extension for scoping reviews to determine the availability of current evidence (Tricco et al., 2018). The review was prospectively registered with the Open Science Framework as '*Social isolation and physical activity in older adults: A scoping review*' (https://osf.io/d8p2c).

3.4.1   **Search methods**

A search strategy was developed using search terms relating to older adults, PA, social isolation, and loneliness. The strategy was peer reviewed by an academic librarian, with the final electronic search completed in May 2020 in six electronic databases (MEDLINE, EMBASE, CINAHL, Cochrane Library CENTRAL, Scopus and Ageline). Citations were exported into Covidence software (Covidence, 2018). Wherever possible, both subject heading and keyword searches were completed. The search strategy from one database is included in Table 3.1. All searches were limited to the English language with articles published prior to 2009 excluded to ensure the latest methodologies were identified.

Table 3.1 Search strategy (Medline)

Older adults		Physical activity		Social isolation/ loneliness	
Subject headings	**Keywords**	**Subject headings**	**Keywords**	**Subject headings**	**Keywords**
Aged/ OR aged 80 and over/ OR frail elderly/	Elder* OR senior* OR geriatric* or gerontolog* OR retire* OR old* OR old* person* OR old* people* OR old*.tw,kf	Exercise/ OR physical activity/ Exercise Tolerance/ OR exp Exercise/ OR Exercise therapy	Physic* active* OR physic* fit* OR exercise*.tw,kf.	Social isolation/ OR social alienation/ OR Loneliness	Social* adj3 alienat* OR isolate* OR solitude OR loneliness.ti,kf

(Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R)) *truncation symbol, terms in title and abstract (tw), terms in the title (ti), word in author provided keyword (kf).

3.4.2 Screening

Following the removal of duplicates, two rounds of screening were performed by two reviewers independently. The first round screened titles and abstracts against the pre-defined eligibility criteria and the second screened full texts. A third reviewer was available to resolve conflicts but was not required as the initial screening followed strict pre-defined inclusion/exclusion criteria. Where the abstract was unavailable, or there was uncertainly, the full text was obtained for full review.

3.4.3 Eligibility criteria

The population of interest was community dwelling, ambulant, older adults aged 60 years and over. Primary studies with original data were included with reference lists of relevant systematic reviews screened to identify additional relevant articles. Articles written in the English language that reported associations or correlations of social isolation or loneliness with PA were included. Studies with a mean age below 60 years, including non-community dwelling (residing in residential care facilities), terminally ill, non-ambulant participants, or older adults diagnosed with dementia or psychosis were excluded, as were studies published prior to 2009, dissertations, conference abstracts and proceedings.

3.4.4 Data extraction

A spreadsheet was developed in Microsoft Excel for data entry and management. Data extraction was carried out by two researchers, where each of the researchers independently extracted data for half of the studies, checked data extraction of the other reviewer's half for accuracy, and resolved any discrepancies together. Extraction contained study characteristics including publication year, country, study design, study aims, population, age group, measure of PA, measures of social isolation or loneliness and main findings.

3.5 **Results**

The initial search identified 2,611 citations, following the screening process 19 studies were included in the final review. Exclusions are detailed in Figure 3.1. and summaries of included studies provided in Appendix 1**.** Study populations were recruited across 14 countries, with England (n = 4) (de Koning et al., 2020; Kobayashi & Steptoe, 2018; Schrempft et al., 2019; Shankar et al., 2011), Australia (n = 3)(Nagarajan et al., 2020; Robins, Brown, et al., 2018; Robins, Hill, et al., 2018), USA (n=2) (Buchman et al., 2010; Kowitt et al., 2020), China (n=2) (Chen et al., 2015; Luo & Waite, 2014), Germany (n=2) (Herbolsheimer et al., 2017; Herbolsheimer et al., 2018), and Ireland (n = 2) (McKee et al., 2015; Ward et al., 2020) represented in multiple studies. Included studies were published over a 10-year period ranging from 2010 to 2020, with over half published in the last two years (2018-2020). The majority of studies were cross sectional (n = 12)(Buchman et al., 2010; Chen et al., 2015; de Koning et al., 2020; Herbolsheimer et al., 2017; Kowitt et al., 2020; McKee et al., 2015; Netz et al, 2012; Robins, Hill, et al, 2018; Schrempft et al., 2019; Shankar et al., 2011; Vancampfort et al., 2019; Ward et al., 2020), and longitudinal (n = 5) (Boekhout et al., 2019; Herbolsheimer et al, 2018; Kobayashi & Steptoe, 2018; Luo & Waite, 2014; Newall et al., 2013), with one cohort study (n = 1) (Robins, Brown, et al, 2018) and a single prospective cohort study (n = 1) (Nagarajan et al., 2020). Only one study was an intervention study using longitudinal single group pre-test-post-test design (Boekhout et al., 2019). Overall, four of the included studies reported using mixed methods (Herbolsheimer et al., 2018; Netz et al., 2012; Robins, Brown, et al., 2018; Robins, Hill, et al., 2018).
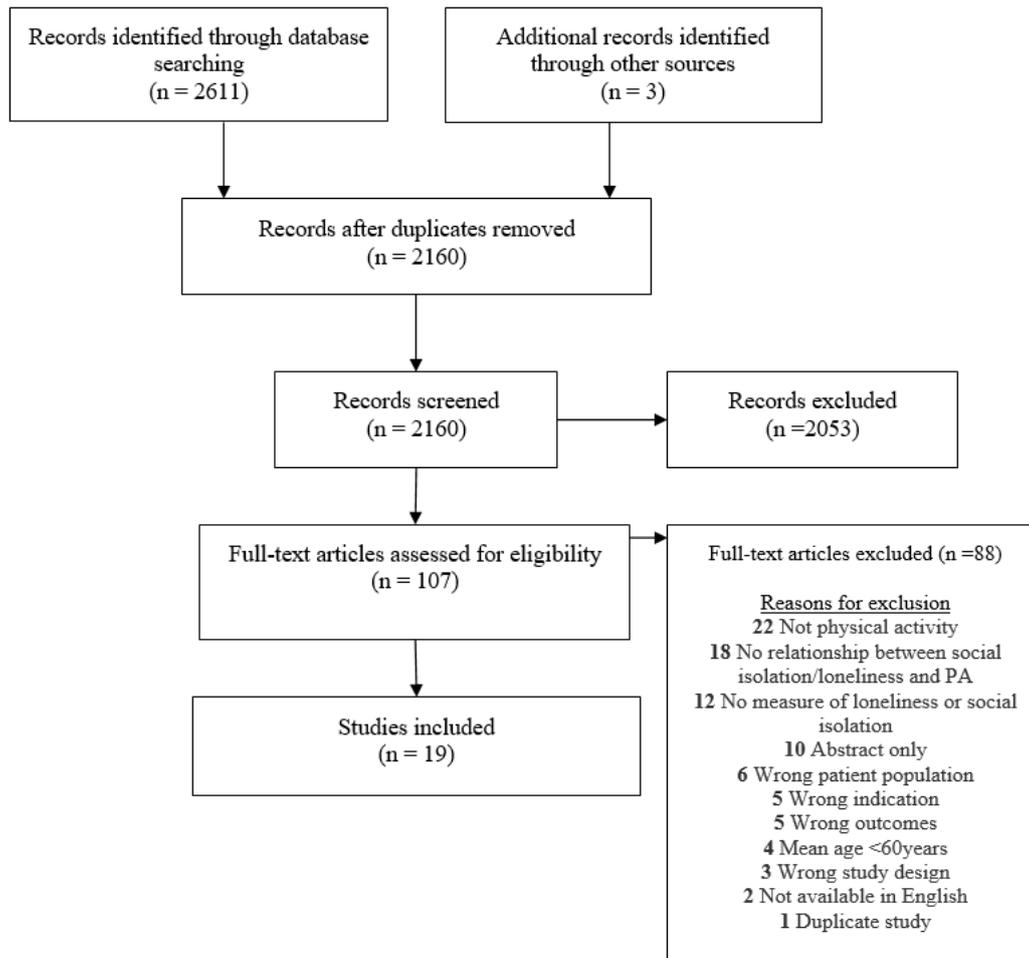
Figure 3.1 Screening process flow chart

3.5.1 **Participants**

Studies included community dwelling older adults with sample sizes ranging from 112 (de Koning et al., 2020) to 34,129 (Vancampfort et al., 2019), and mean ages ranging from 68 (Kowitt et al., 2020) to 83 years (Newall et al., 2013), with the oldest participant 99 years old (Chen et al., 2015). All included studies recruited community dwelling older adults, with varied health status, living arrangements and ethnicity. One study reported on community dwelling older adults living alone (Chen et al., 2015), with another reporting on those living in rural villages (de Koning et al., 2020). Individuals with physical impairments were compared with non-impaired individuals (Boekhout et al., 2019), and individuals discharged home following an extended hospital stay (Nagarajan et al., 2020). One study recruited Chinese older adults, and another Israeli citizens from both Jewish and Arab sectors (Luo & Waite, 2014; Netz et al., 2012).

3.5.2 Association between social isolation and PA

Associations between social isolation and PA were reported in nine studies (Table 3.2). The associations between social isolation and PA in the included studies were significantly inverse in seven studies (Herbolsheimer et al., 2018; Nagarajan et al., 2020; Robins, Brown, et al., 2018; Robins, Hill, et al., 2018; Schrempft et al., 2019) suggesting that higher levels of PA correlated with lower levels of social isolation.

Socially isolated older adults were less likely than non-isolated participants to consistently report engaging in moderate vigorous physical activity (MVPA) at least once a week (41% vs. 53%; p <.0001), and reported lower weekly MVPA (RR = 0.77; 95% CI: 0.68–0.87) (Kobayashi & Steptoe, 2018). Generally, lower levels of PA were associated with increased levels of perceived social isolation (Herbolsheimer et al., 2017). Lower levels of indoor PA were significantly associated with social isolation from family (-4.5 minutes: p = 0.014) (Herbolsheimer et al., 2017), and lower levels of outdoor PA were significantly associated with isolation from friends and neighbours (−4.5 minutes; p = 0.012) (Herbolsheimer et al., 2017). Out of home PA had a significantly inverse relationship with social isolation (β = − 0.14, 95% CI − .01 to − 0.27) (Herbolsheimer et al., 2018) as well as with house-hold based PA (Robins, Brown, et al., 2018). Higher levels of recreational PA were correlated with lower social isolation in one study (Nagarajan et al., 2020) but not in another (Robins, Hill, et al., 2018). Two studies reported that individuals with higher levels of MVPA experienced less feelings of social isolation and loneliness, although findings were not statistically significant (de Koning et al., 2020; Kobayashi & Steptoe, 2018). Socially isolated older adults, classified by a score of less than 12 on the Lubben Social Network Scale (LSNS-6) (Lubben et al., 2006), were found to be less active (−7.8 minutes; p = .007) compared to non-isolated persons, although this association was disregarded after adjusting for covariates (Herbolsheimer et al., 2017). Of the nine studies that investigated social isolation and PA, seven (78%) found a significant inverse relationship.

3.5.3 Associations between loneliness and PA

Fourteen of the included studies reported associations between loneliness and PA (Table 3.3). Twelve studies reported inverse associations between loneliness and PA (higher levels of loneliness correlated with lower PA), this association was significant in nine studies (Boekhout et al., 2019; Kobayashi & Steptoe, 2018; Kowitt et al., 2020; Luo & Waite, 2014; McKee et al., 2015; Netz et al., 2012; Schrempft et al., 2019; Shankar et al., 2011; Ward et al., 2020). One study reported a significant inverse association between increased levels of loneliness and perceived PA (Newall et al., 2013). Three studies reported non-significant inverse associations between loneliness and PA (Buchman et al., 2010; de Koning et al., 2020; Schrempft et al., 2019), and one study found no association (Chen et al., 2015). Of the 14 studies that investigated loneliness and PA, 10 (71%) found a significant inverse relationship.

Table 3.2 Associations between social isolation and physical activity

Author (year)	Sample size	Reported levels of social isolation (mean (SD) unless reported otherwise)	Associations between social isolation and physical activity
de Koning et al. (2020)	N = 112	69.6% of sample socially isolated from family, 34.8% from friends and 16.1% from neighbours	In adjusted regression models, none of the PA variables decreased the likelihood from family, friends or neighbours (p<0.003). Participation in light, MVPA and total PA reduced social isolation from friends, neighbours and family however, none achieved statistical significance at the p<0.05 level
Herbolsheimer et al., (2017)	N =1,162	18.4% of sample were socially isolated	Low levels of PA were associated with perceived social isolation. Low indoor PA was associated with being socially isolated from family and low outdoor PA was associated with being socially isolated from friends and neighbours (−4.5 minutes; p = .012). Socially isolated older adults were physically inactive (−7.8 minutes; p = .007) compared to non-isolated persons. However, the association disappeared after adjusting for covariates
Herbolsheimer et al., (2018)	N = 293	Social isolation from family 6.4 (3.0) and friends 7.1 (3.5) at baseline	A significant inverse association between out-of-home PA (minutes per day) and social isolation from friends and neighbours T0 (r = − .13; p = .013) but no relationship to isolation from the family T0 (r = -.03; p = .622). Out of home PA was significantly inversely related to social isolation at T0 (β = − .14, 95% CI − .01 to − .27) There were no significant correlations between indoor PA and social isolation
Kobayashi & Steptoe, (2018)	N = 3,392	13% of sample socially isolated	In unadjusted chi squared analyses, socially isolated participants were less likely to consistently report engaging in MVPA at least once weekly (41% vs. 53%; p <.0001). After adjusting for age and sex, social isolation (high vs. low) was associated with reduced likelihoods of engaging in weekly MVPA (RR = 0.77; 95% CI: 0.68–0.87)
Nagarajan et al., (2020)	N = 311	Friendship score 21 (42) at baseline, scores ranged from 0 to 24.	Significant relationship between Phone FITT recreational and Friendship scale at 3 months (0.05 (0.001, 0.09) p = 0.043*) (Higher levels of PA associated with less social isolation)
Robins, Brown, et al., (2018)	N = 311	28 participants socially isolated at baseline (Friendship score <16) 21.05 (4.17)	Reduced social isolation between baseline and six months was significantly associated with increased household-based PA (p = 0.03)
Robins, Hill, et al., (2018)	N = 244	20. 2% (n = 5) of participants were socially isolated and 6% very isolated (n = 15)	Physical activity was not associated with social isolation at 3 months (p = 0.13), or at 6 months (p = 0.09). Reduced social isolation was associated with increases in home-based PA in this multivariable analysis with an odds ratio of 1.03 (CI D 1.01, 1.04, p value D 0.002), recreational PA was not significant with an odds ratio of 1.00 (CI D 0.99, 1.03, p-value D 0.455)
Schrempft et al., (2019)	N = 267	107 participants were socially isolated	The analysis of total activity counts showed a significant inverse association with social isolation (β = − 0.172; − 0.061) (p = 0.005). The analyses of light and moderate/ vigorous PA showed inverse associations with social isolation (β = − 0.143; − 0.116) (the latter was borderline significant)
Shankar et al., (2011)	N = 8,688	Social isolation 1.6 (1.4)	Social isolation independently associated with a greater likelihood of reporting low PA (1.08 (1.04 to 1.13)) p < .001

(Phone FITT, self-reported validated measure).

Table 3.3 Associations between loneliness and physical activity

Author	Sample size	Reported levels of loneliness (mean (SD) unless reported otherwise)	Associations between loneliness and physical activity
Boekhout et al., (2019)	N = 575	Physically impaired group loneliness levels were 3.10 (2.01), nonimpaired group loneliness was 2.13 (2.04)	A significant inverse association was found between PA and loneliness; when PA increased, a decrease in loneliness was observed. Improvements in moderate to vigorous PA were associated with decreases in loneliness (B = −0.09, SE = 0.04, p = .020)
Buchman et al., (2010)	N = 245	Baseline loneliness 2.26 (0.65) Scores ranged from 1.0 to 4.6	There was an inverse non-significant association between PA and loneliness (-0.04)
Chen et al., (2015)	N = 521	A total of 15.4% (n = 80) of participants reported low loneliness, 58.9% (n = 307) moderate loneliness and 25.7% (n = 134) reported a moderately high level. No participants reported high levels of loneliness.	There was no significant difference in reported loneliness between the groups with different PA levels (p > 0.05)
de Koning et al., (2020)	N = 112	39.3% of participants were lonely (UCLA scale) 24.1% reported loneliness using single question (19.6% some of the time, 4.5% often)	Inverse correlations indicated PA reduced the levels of loneliness, although did not achieve statistical significance at the p<0.05 level
Kobayashi & Steptoe, (2018)	N = 3,392	16% of participants (n = 560) had a high degree of loneliness	In unadjusted chi-squared analyses, adults 'high' in loneliness were less likely than those 'low' in loneliness to consistently report engaging in weekly MVPA (40% vs. 54%; p <.0001)
Kowitt et al., (2020)	N = 3,392	6.2 (2.7) participants were lonely	Loneliness inversely correlated with PA -0.17, significant to <0.001
Luo & Waite, (2014)	N = 14,072	Loneliness (0-4) levels at baseline in 2002 0.95% (0.98), in 2005, 0.98 (1.02) and in 2008, 1.00% (1.02)	Both the 3-year lagged effect of loneliness on physical exercise and the 3-year lagged effect of physical exercise on loneliness are inverse and significant. Chi-square (54) = 91.853 (p<.01)
McKee et al., (2015)	N = 596	79% of participants reported being rarely lonely	Significant inverse association between PA and loneliness (p <0.001)
Netz et al., (2012)	N = 1,663	42.5% of men were lonely, 44.6% of women were lonely	The rate of feeling lonely was significantly lower in the sufficiently active group as compared to the insufficiently active group (p< 0.05; in most comparisons p< 0.01) and as compared to the inactive group (p< 0.05).
Newall et al., (2013)	N = 228	Loneliness levels were 2.05 (2.30)	Greater loneliness was associated with lower perceived PA (β .19, p < .01). Loneliness was not significantly associated with mean everyday PA (β .001, p > .05) (measured with ActiGraphs).
Schrempft et al., (2019)	N = 267	Isolated group loneliness 1.47 (0.6), not isolated loneliness 1.38 (0.5)	The analysis of total activity counts showed a significant inverse association with loneliness, but this was no longer significant when covariates were added (β -0.130, p = 0.028). Sedentary, light, and moderate/vigorous PA were not associated with loneliness.
Shankar et al., (2011)	N = 8,688	Loneliness 4.2 (1.4)	Increasing loneliness was associated with a greater likelihood of being physically inactive. Loneliness was significantly correlated with being Inactive only (95% CI) 1.08 (1.04 to 1.13) p < .001

Vancampfort et al., (2019)	N = 34,129	Loneliness levels in: China 5.5, Ghana 10.7, India 17.8, Mexico 15.3, Russia 10.9, South Africa 9.9.	Prevalence of loneliness and not meeting the PA recommendation ranged from 5.5% (China) to 17.8% (India) and 20.2% (Russia) to 50.9% (South Africa), respectively. In all countries, the prevalence of loneliness was higher among those not meeting the physical activity recommendation, although this difference was not statistically significant in Mexico and South Africa.
Ward et al., (2020)	N = 10,540	UCLA 1.5 (1.4, 1.6)	There was an inverse correlation (RS = −.26, p < .001) between loneliness and PA with lower levels of PA observed among those who scored higher on the UCLA Loneliness Scale.

(University of California, Los Angeles (UCLA) scale. Note Buchman et al. measures both social isolation and loneliness but does not report an association between social isolation and PA, therefore is only included in table 3.3 (Phone FITT, self-reported validated measure).

3.5.4 Measures of social isolation and loneliness

Of the included studies, 10 measured social isolation, 14 measured loneliness and five measured both (Table 3.4). The measures of social isolation included questionnaires developed for individual studies (n = 3)(Kobayashi & Steptoe, 2018; Schrempft et al., 2019; Shankar et al., 2011), the Friendship scale (n = 3)(Nagarajan et al., 2020; Robins, Brown, et al., 2018; Robins, Hill, et al., 2018), six-item Lubben Social Network Scale (n = 3)(Herbolsheimer et al., 2017; Herbolsheimer et al., 2018; Robins, Brown, et al., 2018) and questions from the social capital module (n = 1) (de Koning et al., 2020) (one study reported two measures of social isolation (Robins, Brown, et al., 2018)).

Loneliness was measured using the Revised University of California, Los Angeles (UCLA) loneliness scale (n = 3)(Kobayashi & Steptoe, 2018; Schrempft et al., 2019; Shankar et al., 2011), UCLA loneliness scale (n = 2)(de Koning et al., 2020; McKee et al., 2015), de Jong Gierveld Loneliness scale (n = 2)(Boekhout et al., 2019; Newall et al., 2013), non-validated questions (n = 2)(Luo & Waite, 2014; Vancampfort et al., 2019), short 5-item of the UCLA loneliness scale (n = 1)(Ward et al., 2020), single item of the UCLA loneliness scale (n = 1)(de Koning et al., 2020), modified de Jong Gierveld Loneliness scale (n = 1)(Buchman et al., 2010), four items from the Strong Ties scale (n = 1)(Kowitt et al., 2020), Kamphuis 11-item loneliness scale (n = 1)(Newall et al., 2013) and a single question from the 20-item Centre for Epidemiologic Studies Depression Scale (n = 1)(Netz et al., 2012) (one study reported two measures of loneliness (Newall et al., 2013)).

3.5.5 Measures of PA

Fifteen different measures of PA were reported, with five studies using more than one measurement tool (de Koning et al., 2020; Herbolsheimer et al., 2017; Herbolsheimer et al., 2018; Robins, Hill, et al., 2018; Schrempft et al., 2019). Standardised measures as well as subjective measures such as diaries were used alone and in combination to measure a variety of physical activities (Table 3.4). Six studies measured weekly MVPA with five using self-reported measures (Boekhout et al., 2019; Buchman et al., 2010; Kobayashi & Steptoe, 2018; Vancampfort et al., 2019; Ward et al., 2020) and one accelerometry (de Koning et al., 2020). Three studies reported household activity (PA conducted during household chores) and recreation based activities (i.e. strengthening exercises, walking and swimming) (Nagarajan et al., 2020; Robins, Brown, et al., 2018; Robins, Hill, et al., 2018), with specific activities such as walking reported three times (Chen et al., 2015; Herbolsheimer et al., 2017; Herbolsheimer et al., 2018). Others classified participants as inactive, insufficiently active or active (Kowitt et al., 2020), and identified low, medium or high PA (McKee et al., 2015). The average time devoted to activities in a week was reported once (Netz et al., 2012), as were perceived PA and mean everyday PA scores (Newall et al., 2013), 24-hour activity (Schrempft et al., 2019) leisure time and occupational PA (Shankar et al., 2011) and regularity of PA (Luo & Waite, 2014).

Table 3.4 Outcome measures of social isolation, loneliness and physical activity used in included studies

Author (year)	Social isolation measure	Loneliness measure	Physical activity measure and activity type
Boekhout et al., (2019)	_	6 item de Jong Gierveld Loneliness Scale	Short Questionnaire to Assess Health-Enhancing Physical Activity (SQUASH) (Measured self-reported minutes of weekly MVPA)
Buchman et al., (2010)	Two measures of social engagement were used as indicators of social isolation i.e. being alone	Modified version of the de Jong-Gierveld Loneliness Scale	Physical activity was assessed using questions adapted from the 1985 National Health Interview Survey. (Measured minutes spent engaged in each activity were expressed as hours of activity/week).
Chen et al., (2015)	-	University of California Los Angeles' Loneliness Scale, version 3 (RULS-3)	Self-reported frequency of engaging in walking outside the home for any reason; moderate leisure time activities, such as carrying light loads and bicycling at a regular pace; and strenuous leisure time activities or heavy housework, such as jogging and scrubbing floors, was used to measure PA.
de Koning et al., (2020)	Three single item variables were constructed using questions from the social capital module.	Single item measure of loneliness and the 3-item UCLA loneliness scale	Waist-mounted ActiGraph (GT3X; ActiGraph, LLC, Pensacola, FL) accelerometers were worn for 7 consecutive days during waking hours (not in water). Activities were recorded in a self-reported diary. (Measured light PA, MVPA and total PA)
Herbolsheimer et al., (2017)	Perceptions of social isolation: LSNS-6	-	A Uni-axial accelerometer (activPAL, PAL Technologies Ltd., Glasgow, UK) measured daily walking duration. An outdoor activity diary supplemented accelerometer estimates to distinguish outdoor from indoor PA.
Herbolsheimer et al., (2018)	Two subscales of the LSNS-6	-	An accelerometer (activPAL, PAL Technologies Ltd., Glasgow, UK) measured all lower body movements such as walking. An outdoor activity diary supplemented the accelerometer
Kobayashi & Steptoe, (2018)	A five-item index of social isolation	Three item short form of the Revised University of California Los Angeles Loneliness scale (UCLA)	MVPA was assessed in an interview, where participants were questioned about the frequencies with which they participated in mild, moderate, and vigorous physical activities.
Kowitt et al., (2020)	-	4 items from the Strong Ties Scale	PA was assessed using items from the 2001-2009 Behavioural Risk Factor Surveillance System (BRFSS) which classifies individuals as inactive, insufficiently active, or active.
Luo & Waite, (2014)	-	A single question asking how often the respondent felt lonely and isolated.	Respondents were asked whether they regularly participate in physical exercise.
McKee et al., (2015)	-	Loneliness UCLA scale	International Physical Activity Questionnaire (IPAQ) short form (Measured PA in metabolic equivalents to calculate low, medium, and high levels of PA)
Nagarajan et al., (2020)	Friendship Scale	-	Phone FITT (self-reported validated measure) (Measured household activity and recreation-based activity)
Netz et al., (2012)	-	A single question from the 20-item Center Epidemiologic Studies Depression Scale	Participants were asked to report the frequency and average time (in minutes) per session they devoted to activities within a week: In addition, they were asked whether the activity made them breathe harder or 'puff and pant'.

Newall et al., (2013)	-	de Jong Gierveld Loneliness Scale and Kamphuis (1985) 11-item loneliness scale	ActiGraphs were worn for 24 hours (Data were used to report mean everyday PA scores). Perceived PA reported (compared to others their own age)
Robins, Brown, et al., (2018)	Friendship Scale and six-item LSNS-6	-	Self-reported PA levels were evaluated using phone FITT physical activity questionnaire (Measures of household-based PA and recreational-based PA reported)
Robins, Hill, et al., (2018)	Friendship Scale	-	Phone FITT for physical activity participation (Measures of household based physical activity and recreational-based PA)
Schrempft et al., (2019)	A social isolation index	Revised UCLA loneliness scale	Triaxial accelerometer (GeneActiv) worn for 8 consecutive days (Measured 24-hour activity)
Shankar et al., (2011)	A social isolation index	Revised UCLA loneliness scale	An adaptation of the Whitehall II study, inclusive of leisure time and occupational physical activity measures (self-reported).
Vancampfort et al., (2019)	_	A single question 'Did you feel lonely for much of the day yesterday?'	Global Physical Activity Questionnaire (Measured weekly MVPA)
Ward et al., (2020)	_	Short 5-item version of the UCLA loneliness scale	Brief version of the International Physical Activity Questionnaire (IPAQ) (Measured minutes of physical activity per week MVPA)

(Short Questionnaire to Assess Health-Enhancing Physical Activity (SQUASH), Lubben Social Network Scale (LSNS-6), University of California, Los Angeles (UCLA) scale, Phone FITT, self-reported validated measure, International Physical Activity Questionnaire (IPAQ)).

3.6 **Discussion**

This scoping review aimed to investigate the associations between social isolation and PA, and loneliness and PA, whilst identifying appropriate outcome measures used with older adults. The review findings suggest there is an inverse association between both social isolation and PA, and loneliness and PA. This implies that higher levels of social isolation and loneliness were associated with lower levels of PA. Included studies were published across 14 countries, implementing a variety of methods and outcome measures, with over half of the studies published in the last two years, indicating the rapidly expanding evidence and focus on this research area. Research in this area is likely to increase due to the COVID-19 global pandemic.

3.6.1 **Associations between social isolation and PA**

Evidence from the included studies suggested that social isolation is associated with reduced levels of PA. However, this evidence is based on only nine studies and there is a need to further review the emerging evidence to confirm these observations. Previous research has reported mixed associations between social isolation and PA, with several studies finding no association. This could be due to the definition of social isolation being inclusive of '*participation in social activities*' (Shankar et al., 2011, pp. 377), this may be interpreted as requiring an '*active*' social activity. To include less active social activities in the measurement of social participation, de Koning et al., (2020) measured social contact frequency, and accelerometry rather than self-reported diaries to measure PA. The authors found an inverse correlation between social isolation and PA; however, this was not statistically significant. Despite the use of common definitions of social isolation in the included studies, there is not a consistent definition across the literature. The candidate recommends that the definition of social participation as '*a person's involvement in social activities that provide social interactions within his/her community or society*' (Levasseur et al., 2010), should be considered to streamline future research.

3.6.2 **Associations between loneliness and PA**

Most included studies reported inverse associations between loneliness and PA, suggesting that participants with higher levels of loneliness demonstrated lower levels of PA. Only one study reported no association between the constructs (Chen et al., 2015) which could be due to low levels of loneliness reported. The inverse association between loneliness and PA appeared more conclusive than that of social isolation and PA. This could be due to the higher number of studies reporting these associations, or because the definition of loneliness is more standardised and easier for participants to recognise. In contrast, social isolation includes multiple constructs such as isolation from neighbourhood, friends and family, which may make identifying associations with PA more difficult (Cotterell et al., 2018).

3.6.3 Outcome measures of social isolation, loneliness, and PA

Numerous outcome measures of social isolation and loneliness were used in the included studies, making comparison difficult. There is currently no consensus in the literature for the '*best*' or '*gold standard*' methodologies for the measurement of social isolation and loneliness. Accurate measures of social isolation are important for older adults as they may influence the way they participate in activities and respond to interventions (Graeme, 2006). However, measures such as the LSNS-6 used in the included studies, were designed for research and might be unsuitable for community use, or in healthcare settings (Cotterell et al., 2018). Therefore, multi-component measures of social isolation for older adults suitable for both research and clinical settings are required.

Previous reviews have identified single-item questionnaires as the most used measures of loneliness. However, these measures are suspected to under-report loneliness due to the stigma related with being identified as lonely (Ong et al., 2016). As identified in this review, use of multidimensional scales such as the UCLA loneliness scale and de Jong Gierveld loneliness scale are popular in research and do not make reference to loneliness or '*being lonely*' (Ong et al., 2016). This may result in a more accurate measurement of loneliness levels and provide more conclusive evidence.

As per previous reviews, outcome measures of PA, and the specific activities measured in older adults varied across the included studies (Taraldsen et al., 2012). Although the articles provided insights into the activity levels of older adults, the variability of types of activity reported makes direct comparisons and generalisations difficult. Despite consumer wearables and accelerometers being deemed valid and reliable with older adults (Straiton et al., 2018), only five of the included studies used accelerometry to measure PA. For the measurement of PA, the gold standard is direct observation, which is intrusive, time consuming and costly. Accelerometers have been used to measure activity levels, but do not provide context or type of PA, which is likely important in the relationships between activity, loneliness, and social isolation. All other measures in the included studies were self-reported, these measures have been found to over-report PA (Shephard, 2003) and therefore may have a significant impact on the associations with social isolation and loneliness especially where levels of PA were low. Previous research suggests that older adults prioritise social tasks over all others, (Heatwole Shank & Cutchin, 2016) and are motivated by group activities. Measuring different types of PA is therefore integral to understanding the associations between social isolation, loneliness, and PA. Objective and accelerometer-derived measures are useful, however combined with subjective methods such as activity diaries, a detail rich picture of PA in this age group can be obtained (Hordacre et al., 2014).

A variety of study designs were implemented in the included articles, with four reporting mixed methods. The benefits of mixed methods must be acknowledged. Newall and Menec (2019)

suggested that despite being separate constructs, exploring social isolation and loneliness in combination could provide insights into the experiences of older adults particularly useful for the development of interventions. Articles that used mixed methods were able to provide the context and quality of social interactions which are important in understanding social isolation and loneliness in this population.

3.7 Conclusion

This scoping review identified articles that explored the associations between social isolation and PA, and loneliness and PA in community dwelling older adults. Despite a lack of homogenous methods and outcome measures, the findings suggest that there is an inverse relationship between loneliness and PA. Associations between social isolation and PA are inconclusive due to varied definitions and variable components contributing to social isolation. Streamlined methods using multidimensional scales and mixed methods are required to conclusively detect levels of social isolation and loneliness in older adults and highlight their associations with PA. Standardised measures may be effective to direct interventions and measure the effectiveness of interventions, whilst relating these concepts to community participation. The focus on social isolation and loneliness and the effects they have on participating in PA need to be clearly defined and routinely measured using mixed methodologies to inform future interventions and healthy ageing.

CHAPTER 4:   **LOCATION MONITORING OF PHYSICAL ACTIVITY AND PARTICIPATION IN COMMUNITY DWELLING OLDER PEOPLE**

4.1 About this chapter:

The purpose of this chapter was to scope the existing literature to identify the extent to which GPS monitoring had been used with an older population. To inform methodologies and determine whether use of GPS would assist in the measurement of community participation with older adults. The search strategy was focussed on the questions; '*What studies have monitored the location of PA in an older population?*' and '*What devices have they used?*' The barriers and facilitators to community participation and PA experienced by older adults were identified and discussed. The results of this scoping review have been published as; *Gough, C., Weber, H., George, S., Maeder, A., & Lewis, L. (2021). Location monitoring of physical activity and participation in community dwelling older people: A scoping review. Disability and Rehabilitation, 43(2), 270-283* (Appendix 2).

4.2 Research objectives

The aims of Chapter 4 were to:

- determine the extent that GPS has been used to measure PA and community participation in an older population
- to review the type of devices used to track location and methods of data analysis, and-
- identify specific facilitators and barriers preventing older people from engaging in PA and participating in their community.

4.3 Background

With increasing age, participating in the community physically and socially becomes more difficult. The environmental features of a community therefore become an important consideration, as the built environment can be integral to the facilitation of PA and community participation, or act to as a barrier to disconnect or isolate individuals from the community around them (Gao, 2017; Webber & Porter, 2009). Much of the evidence regarding the built environment and PA focuses on the general population and lacks quantitative data regarding where older people participate in activity and why they choose specific locations (Li et al., 2005). For older people, easily accessible, safe environments that incorporate social interaction are required to increase PA and community participation. In Australia, location is particularly important to consider, as the environment varies from bustling cities to remote mining towns (O'Loughlin et al., 2017), and the destinations that encourage older adults to be active appear to facilitate social interaction (Nathan et al, 2012). To enable participation in such activities, it is necessary for policies to prioritise healthy ageing (Eendebak & WHO, 2015), with a focus on providing environments and locations that facilitate and support older people to remain active (WHO, 2002).

Therefore, the primary aim of this scoping review was to determine the extent that GPS devices have been used to measure community participation in an older population. With the secondary

aims to, review the type of devices used to track location and methods of data analysis, and to identify specific facilitators and barriers preventing older people from engaging in PA and participating in their community.

4.4 Methods

4.4.1 Design

A scoping review was conducted to determine the scope of current evidence. This scoping review followed the guidelines recommended by Arksey and O'Malley (2005) and the updated PRISMA extension for scoping reviews (Tricco et al., 2018). The purpose of this review was to summarise the existing literature and identify gaps for future research. This review was prospectively registered with JBI Database of Systematic Reviews and Implementation Reports (Joanna Briggs Institute, 2018) as *Location monitoring of physical activity and participation in community dwelling older people: a comprehensive systematic review.*

4.4.2 Search methods

A rigorous search strategy was developed with an experienced academic librarian. The electronic search was completed in February 2019 using four electronic databases (MEDLINE, EMBASE, CINAHL and Cochrane Library CENTRAL). Citations were exported into Covidence software (*Covidence (Computer program)*, 2018). Reference lists of all relevant articles were screened to identify any additional articles.

The search strategy was focussed on the question; *'What studies have monitored the location of physical activity in an older population?'* with the secondary enquiry *'What devices have they used?'* Where possible, both subject heading and keyword searches were completed. The search from one database is included in Table 4.1. With all searches limited to the English language.

Table 4.1 Search Parameters for the Medline database

Older people		Location		Physical activity	
Subject headings	Keywords	Subject headings	Keywords	Subject headings	Keywords
Age/ OR aged 80 and over/ OR frail elderly/	Elder* OR senior* OR geriatric* or gerontolog* OR retire* OR old* OR old* person* OR old* people* OR old*.tw,kf	Environment design/ OR geographic information systems/ OR social environment/ OR monitoring ambulatory/	Geographic information system* OR global positioning system* OR activity location* OR GPS OR built environment.tw,kf	Walking/ OR running/	Physical activity OR exercise OR walking OR running OR activity OR participation.tw,kf

(Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R)) *truncation symbol

4.4.3 Screening

Following the removal of duplicates, two reviewers independently completed the screening process (the candidate and colleague from Flinders University). There were two rounds of screening. The first round involved the screening of titles and abstracts against the pre-defined eligibility criteria, and the second round involved screening of the full texts. Screening was carried out independently, following strict inclusion and exclusion criteria. A third independent reviewer was available to resolve conflicts but was not used. Where the abstract was unavailable, or ambiguity existed, the full text was obtained for further review.

4.4.4 Eligibility criteria

The population of interest was inclusive of adults living independently in the community over the age of 50. To account for the progression of ageing and declining levels of health, studies with a mean age over 50 years were included. Studies were required to report on community participation and/or PA inclusive of both physical and social activity. To be included, studies had to include a quantitative measure of location (GPS). As the focus of the review was to scope the available literature regarding methods and types of devices used to measure location and participation, articles describing study protocols which otherwise met the review inclusion were included.

Studies with a mean population age under 50 years and/or living in supportive facilities or aged care facilities were excluded due to the restriction on independent access to locations. Studies that identified location using only subjective measures such as diary entries, questionnaires or interview data were excluded. Specific use of GPS as a safety tool for wandering adults and to monitor a specific location (i.e. - a single park space) were excluded due to the restriction on location. Studies that used GPS and/or geographic information system (GIS) to monitor specific locations, rather than the people accessing them were also excluded. Studies that focussed on the acceptance of GPS, compared devices, or used a predetermined walking course were excluded. Conference abstracts were excluded from the review.

4.4.5 Critical appraisal

Scoping review guidelines by Arksey and O'Malley (2005) were followed, therefore, critical appraisal of the included studies was not completed.

4.4.6 Data extraction

A spreadsheet was developed using Microsoft Excel for data entry and management. Data were extracted from the included full text studies by the candidate. The country of study, population recruited, activity and participation type, study aims, outcome measures, devices used, monitoring period, barriers, facilitators, qualitative measures, methods, result and limitations were extracted.

4.5 **Results**

The initial search identified 4,988 studies, following the screening process 45 studies were included in the final review. Exclusions are detailed in Figure 4.1 and summaries of the included studies is provided in Table 4.2 Summary of included studies. The majority of included studies were mixed methods (n = 17), 13 used purely quantitative data and three used qualitative methods (these studies used GPS to produce maps for interview purposes but did not report on the GPS data).

The majority of studies (n = 27) contained primary original data and 19 studies reported on pre-existing datasets. The SenTra project accounted for eight of the included studies (Kaspar et al., 2015; Shoval et al., 2008; Wahl et al., 2013; Werner et al., 2012; Wettstein, Wahl, & Diehl, 2014; Wettstein, Wahl, Shoval, et al., 2014; Wettstein, Wahl, Shoval, Auslander, et al., 2015; Wettstein, Wahl, Shoval, Oswald, et al., 2015), two studies used data from the Elderly and their Neighbourhood (ELANE) study (Jansen et al., 2015; Prins et al., 2014), two studies used Walk the Talk (WTT) data (Franke et al., 2017; Hirsch et al., 2016), two studies used the same population data (Zandieh et al., 2017; Zandieh et al., 2016), and single studies used data from the Neighbourhood Walking in Rotterdam Older Adults study (Prins et al., 2014), Peer Empowerment Program 4 Physical Activity (PEP4PA) data (Rich et al., 2017), data from a larger research project (Vine et al., 2014), subgroup of Record GPS study (Yan Kestens et al., 2016) and the Mobility, Activity and Social Interaction Study (MOASIS) (Fillekes et al., 2019). Search results were inclusive of case studies (n = 6), cross sectional studies (n = 7) and observational studies (n = 3). There were two randomised controlled trials (RCTs) (Harada et al., 2017; Rosenberg et al., 2017) and two protocols (Yan Kestens et al., 2016; Rich et al., 2017) included in the review. The results included one effectiveness trial that implemented peer-led walking with and without continued support as an intervention (Rich et al., 2017). Figure 4.2 demonstrates the increasing trend in the use of GPS for research. The majority of included studies were published between 2013 and 2018 (n = 35).

Twelve countries were represented in the review, with the USA responsible for the largest number of studies (n = 13), followed by Canada (n = 7). Five studies were based in Australia, three studies based in the Netherlands and three in the UK, two were based in Germany and France (n = 2). There were single studies representing Greece (n = 1), Japan (n =1) Switzerland (n = 1) and Israel (n = 1). With collaboration across Germany and Israel (n = 5) and Canada, France, and Luxembourg (n = 1).
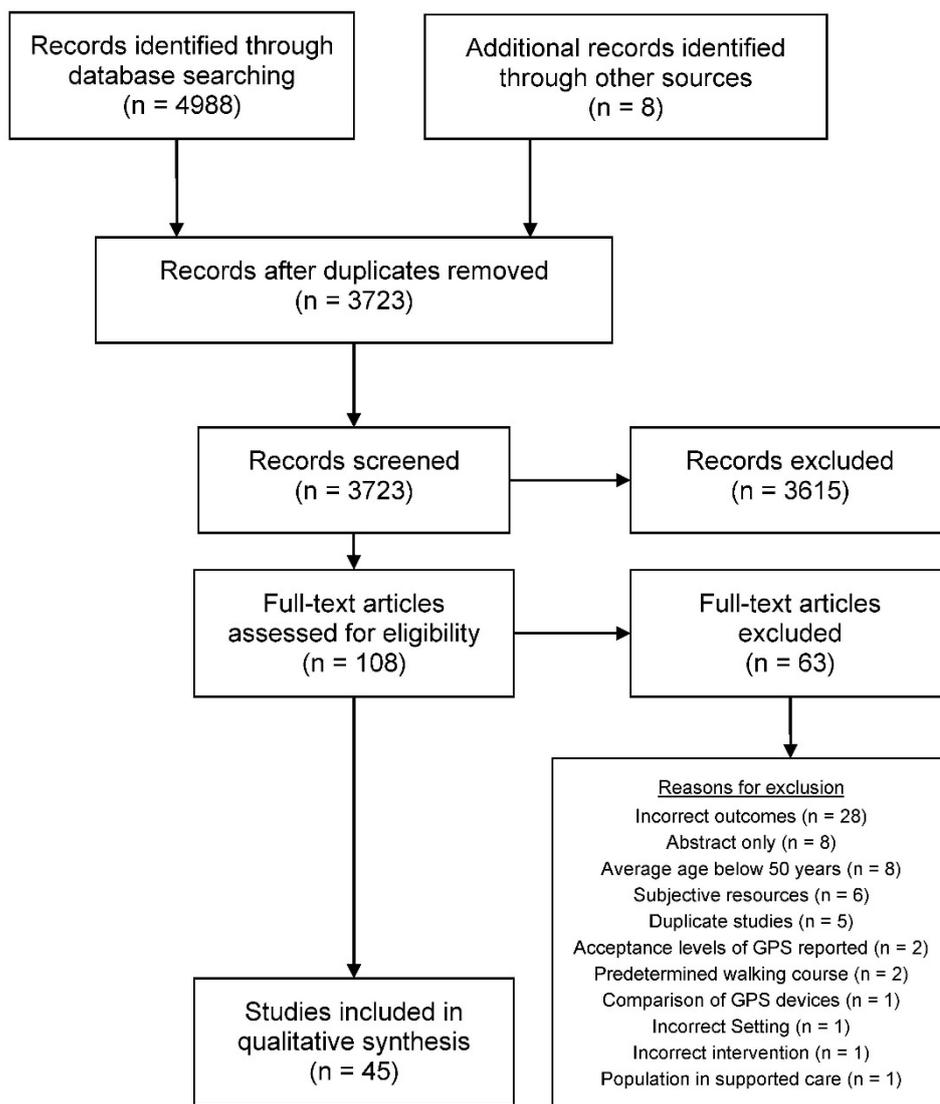
Figure 4.1 Screening process flow chart

Table 4.2 Summary of included studies

Author (year)	Country	Study design	Participants	Device used	Measure of PA and community participation	Time monitored	Main findings
Aird & Buys, (2015)	Australia	Mixed methods	N = 48, mean age 72.02 (8.46), 24 males convenience sample living in inner city suburbs and rural Brisbane.	Not specified	GPS, travel diary, survey data and interviews.	7 days	Self- ratings of 'being active' were found to positively correlate with the number of days older people spent away from home but unrelated to travelling by active means.
Barclay et al., (2018)	Canada	Pilot RCT	N = 9, mean age 77 (3) GO OUT GROUP, 74 (8) interactive workshop only group, infrequent outdoor walkers in Winnipeg, Canada.	Qstarz BT-Q1000XT	Activity monitor, GPS, aerobic capacity, physical activity, participation, mood and HRQL and qualitative interviews.	8 days	Participants did not identify problems with using the GPS and activity monitors. An analysis method combining accelerometry and GPS to determine outdoor walking was developed for an older adult population who infrequently walked outdoors.
Boissy et al., (2018)	Canada	Exploratory cross-sectional design	N = 54 (after quality control), mean age 66 (7), range 55 to 85, healthy community dwelling older adults.	Qstarz BT-Q1000XT and WIMuGPS-Wireless Inertial Measurement unity with GPS.	GPS, accelerometry, self-reported questionnaire.	14 days	Under free-living conditions in health older adults, location, activity and community mobility outcomes vary across individuals and certain personal variables have potential mitigating effects on these variables (ie age, income and living situation). There was a significant (yet small) relationship between self-reported life space and Maximal distance of destinations, distance in a vehicle, ellipse area and ellipse maximal distance.
Cornwell & Cagney, (2017)	USA	Mixed methods	N = 60, aged 55+, convenience sampling from four senior centres.	Find my iPhone application	GPS location capture and ecological momentary assessments (EMAs on iPhone).	7 days	Older adults in the sample spent nearly 40% of their time outside of residential tracts.
Evans et al., (2012)	USA	Case study	N = 1, 56 year old male, right pontine stroke.	Device model not specified (GPS unit. Data Logger, GlobalSat)	GPS and accelerometry.	7 days (repeated 5 times over 1 year)	Subject was sedentary 91-96% of the time monitored. Target visits and trips did not change over a year period and compliance wearing GPS device was variable.
Fillekes et al., (2019)	Switzerland	Mixed methods	N = 27 (from MOASIS project), mean age 72.3,	Custom built uTrail Fastrax	GPS, accelerometry and self-reported measures.	30 days	For life-space, the overall accuracy (of self-reported and sensor derived indicators) is rather high, with 58% of the person-days

			range 67-81, healthy community dwelling adults)	GPS antenna module (UC530) combined GPS and accelerometer device.			having a completely overlapping self-reported and sensor based indicators. This suggests that the life-space questionnaire may be substituted by GPS assessments, if reliable GPS is available.
Franke et al., (2017)	Canada	Grounded visualisation approach	N = 2, 68 year old male and 77 year old female with low income (WTT study).	Qstarz BT-Q1000X	GPS data used to capture the destinations travelled to and routes taken. With in-depth interviews.	7 days (across 3 years 2013, 2014 and 2015)	Although step counts reduced with age, the locations visited did not change. Participants adapted their activities to visit familiar locations further away from home.
Gell et al., (2015)	USA	Cross-sectional observational study	N = 28, 50+ years (50-86) 75% female, 86% white, with mobility disability.	Qstarz BT-Q1000XT	GPS and geographic information system (GIS), (measures of walk score, population density, street connectivity, crime rates and slope within home neighbourhood).	3 days (1 weekend day)	Only nine participants took active trips from home. Walking in the home neighbourhood was significantly associated with GIS derived measures. Preliminary evidence that more walkable environments promote active mobility for mid-life and older adults with mobility disability.
Gluck et al., (2017)	Australia	Prospective cohort study	N = 50, mean age 52(2), 33 male. ICU care for at least 48 hours.	Smartphone data.	Step count from subject's smart phone (and self-reported), questionnaires, GPS data and interviews with participant and surrogate-decision makers.	28 days (prior to admission)	Lack of agreement between surrogate decision makers when estimating activity levels prior to hospitalisation. Obtaining premorbid physical activity data from smartphones was feasible in approximately 50% of the patients sampled.
Hand et al., (2018)	Canada	Qualitative-geospatial approach	N = 13, mean age 75.9 (8.28), 11 females, Caucasian with good or excellent health.	Not specified	Narrative interview, go-along interview, GPS tracking, activity/travel diary and follow up interview.	4 days (2 week days and 2 weekend days).	The maps and numerical data enabled researchers to construct further understanding about the activities, and ways that older adults interlink with neighbourhood features.
Harada et al., (2017)	Japan	RCT	N = 192, mean age 76.2 (4.1), 56.3% male. Cognitively impaired, without mobility issues.	Globalsat DG-200 datalogger	Accelerometry (Steps per day), GPS (outdoor time) and geographic information system (GIS).	14 days	Outdoor time was significantly related to steps per day, cardiovascular fitness and depression scores. Average outdoor time was 3 hours 37 minutes and 6654.6 steps per day.
Heatwole Shank & Cutchin, (2016)	USA	Multiple-case study design (grounded theory analysis).	N = 12, mean age 78 (8.16), 8 females, living in their own home, varying levels of health.	Not specified	GPS (community activities and navigation), interviews and naturalistic observations.	10-14 days	Liveability for older adults is not experienced with availability of amenities but involves active and ongoing negotiation of physical and social dimensions of their communities.
Heatwole Shank & Pesgraves, (2018)	USA	Case study	N = 2, husband aged 86, wife aged 80, Caucasian, long	Not specified	GPS, activity logs, interviews and well-being measures.	14 days (repeated 3 x over 16months)	Findings suggest that joint community navigation is multidimensional and may buffer individual functional losses as well as

			married community-dwelling couple.				maximize perception of and performance in meaningful activities.
Hillsdon et al., (2015)	UK	Mixed methods	N = 195, mean age 52, living in private homes across NW England.	Qstarz BT-Q1000XT	GPS, accelerometry (locations of PA undertaken outdoors linked to measures of the neighbourhood and distance from home) and interviews.	7 days	Males travelled for LMVPA outside of their neighbourhoods more than females. With 60.5% of PA undertaken outside of home neighbourhood.
Hirsch et al., (2016)	Canada	Cross- sectional study	N = 77, 65+ years, 81.8% white, 66.2% females with low income (WTT study).	Qstarz BT-Q1000XT	GPS, accelerometry and travel diaries.	7 days	Of the 77 participants only 14 met the recommendations for daily step counts for older adults.
Hordacre et al., (2014)	Australia	Observational	N = 47, mean age 59.7 years (range 19-98), 78% male, transtibial amputees.	Qstarz BT-Q1000XT	Accelerometry and GPS (number of trips away from home).	7 days	GPS and accelerometry techniques can be used with transtibial amputees.
James et al., (2017)	USA	Observational	N = 360, mean age 55.3 (10.2), 78% white, women living at home, independently mobile.	Qstarz BT-Q1000X	Accelerometry, GPS and GIS data.	7 days	Higher levels of physical activity occurred in areas with higher greenness and higher walkability. Findings suggest that planning and design policies should focus on these environments to optimize opportunities for physical activity.
Jansen et al., (2015)	Netherlands	Cross-sectional study	N = 84, aged 65 to 89, non-frail 74, frail 10 (11.9%), 46.4% female, community dwelling (ELANE study)	Qstarz BT-Q1000X and BT-Q1000XT	GPS (at home and not at home), accelerometry and interviews.	7 days	Reported the sample was sedentary for 84.7% of each day. 9.8 minutes per week spent in moderate to vigorous activity. None of the subjects met the WHO recommendations of 150 weekly minutes of moderate-to-vigorous PA.
Jayaraman et al., (2014)	USA	Case study	N = 1, 76 year old African American female, transfemoral amputee.	Qstarz BT-Q1000XT	GPS and Step monitor (Steps in and out of home, time spent on social and community trips).	1 month	Average step count of 244 steps per day. Participant left home on 4/20 week days and 6/9 weekend days. Information from the GPS and step monitor provided quantitative details on the steps in and out of home.
Kaspar et al., (2015)	Germany	Protocol	N = 141, mean age 70.1 (5.2), 16 early AD, 30 MCI, 95 CH, 58.9% males (SenTra project).	GPS tracking kit	GPS (overall time spent out of home per day), daily diary (day to day mobility).	28 days	No substantial connection was found between mood and exertion of out of home mobility activities.
Kestens et al., (2016)	Canada, France and Luxembourg	Mixed methods	65+ no cognitive impairments, not living in long term care (CURHA project).	Qstarz BT-Q1000X	Accelerometry, travel diary and interviews (GPS formed map based questionnaires).	7 days	Detailed protocol: Use of a novel mutltisensor device for collection of location and physical activity data.

Kestens et al., (2016)	France	Mixed methods	N = 234, mean age 57.8 years (11.6). Male 62.8%. (RECORD study).	Qstarz BT-Q1000X	GPS, accelerometry and interviews.	7 days	Missing data from 34.7- 21.2% of the possible time, reports 97.4% accuracy. Limited by loss of data.
Le Faucheur et al., (2008)	France	Observational study	N = 24, 48 to 67 years, 6 females, with PAD.	Garmin GPS (60)	GPS, maximal walking distance (MWD) with interviews.	45 minutes	GPS is a potentially innovative way to study the walking capacity of patients with PAD.
Li et al., (2017)	USA	Mixed methods	N = 97, 49 white and 44 black women over 65 years, living independently	Not specified	GPS, accelerometry and activity diary	7 days	Black females were more likely to perform PA indoors when away from home. With senior centres being the most frequently visited PA places for Blacks (74%) and the streets being accessed by 90% of Whites.
Prins et al., (2014)	Netherlands	Cross sectional study	N = 156, community dwelling 65+ (ELANE study)	Qstarz BT-Q1000X	Accelerometry, number of trips (GPS), percentage of trips walked and cycles.	7 days	Elderly over 75 walked further than those under 75 in this sample.
Prins & van Lenthe, (2015)	Netherlands	Cross sectional study	N = 43, aged 55+, 47.5% male, community dwelling.	Qstarz BT-Q1000XT	GPS to determine walking and cycling based on speed.	7 days	Increased temperature resulted in increased cycling, women cycled less when there was rain, men cycled more when there was rain.
Rich et al., (2017)	USA	Protocol (Hybrid type II implementation-effectiveness design)	N = 408 (proposed)	Qstarz BT-Q1000XT	GPS, accelerometry and pedometers (Intensity and location of PA).	7 days	Detailed protocol of a proposed peer-led physical activity intervention.
Rosenberg et al., (2017)	USA	RCT	N = 219, age range 67-100, women only, mean age 83.8 (Study 2), 91.3% white.	Qstarz BT1000X	GPS (outdoor minutes) and accelerometry.	6 days (Repeated at 6 and 12 months)	Found high levels of concurrent validity with GPS for sedentary, vehicle and walking time.
Rosenberg et al., (2013)	USA	Qualitative interviews	N = 30, mean age 67, Individuals with mobility disability, predominantly white women.	Qstarz BT-Q1000XT	In- depth interviews and GPS used to form maps for interviewing.	3 days (2 weekdays)	Findings were consistent with previous research, prominent building themes such as role of street crossings, kerb ramps, sidewalks, weather, lighting aesthetics, parking, traffic, and amenities such as places to rest and shelter emerged.
Shoval et al., (2008)	Germany & Israel	Protocol	N = 360, 65+ demented persons, MCI persons and CH controls.	GPS tracking kit	GPS, questionnaires and interviews.	4 weeks (in 3 waves 1 year apart).	Detailed protocols for 5 year project.
Theou et al., (2012)	Greece	Mixed methods	N = 50, age range 63-90 years, convenience sample of community dwelling Greek women.	Garmin Forerunner 405 GPS watch	Accelerometer step counts, GPS (activity location) and Minnesota Leisure time Activity Questionnaire (short version).	10 hours	PA assessment tools, when used in combination, provide important information about the PA accumulation of older women across levels of frailty

Tung et al., (2014)	Canada	Mixed methods	N = 19, mean age 70.7 (2.2), mild to moderate AD. 33 healthy controls, age 74.0 (1.2).	GPS receiver on smartphone (VALMA)	GPS (area, perimeter, mean distance from home and time away from home) and step count.	3 days	GPS- derived area, perimeter and mean distance from home were smaller in the AD group when compared to the control group.
Vine et al., (2014)	Australia	Case study	N = 12 (6 men), aged 55+, healthy, living in the community.	Not specified	Diaries, in-depth interviews, GPS and geographical information systems mapping (GIS).	7 days	Social networks in community territories were found to be of particular importance to participants in terms of well-being, support, social inclusion and cohesion. Inclusive of the building of residence and area immediately surrounding the building.
Wahl et al., (2013)	Germany & Israel	Mixed methods	N = 222, aged 59-91, 146 healthy and 76 with MCI (SenTra project).	GPS tracking kit	Out of home behaviour assessed using questionnaires and GPS (time out of home; number of nodes visited).	28 days	Cognitive resources were more closely linked with out of home behaviour that motivational resources.
Webber & Porter, (2009)	Canada	Exploratory study	N = 20, mean age 74.4 (4.2), convenience sample.	Garmin Forerunner 205 GPS watch	Accelerometry, GPS and diary used to document trips away from home.	1 day	Concludes that further improvement is needed to use GPS and accelerometry technologies to gather functional everyday human movement behaviour between indoor and outdoor environments.
Werner et al., (2012)	Israel	Mixed methods	N = 76 community-dwelling dyads (care recipients, caregivers and potential caregivers), Care-recipients mean age 77.7 (6.46), 36 male, 26 controls, 34 MCI and 16 with mild dementia (SenTra project).	GPS tracking kit	GPS (average time spent out of day, number of nodes visited, walking distance and speed) and daily activity logs.	28 days	Greater mobility was related to lower burden for caregivers with recipients with mild dementia. Mild dementia group increased burden was reported with decreased time spent out of home.
Wettstein, Wahl & Diehl et al., (2014)	Germany	Mixed methods	N = 100, mean age 70.8 (4.1), 59 males, CH individuals (SenTra project).	GPS tracking kit	GPS (out of home mobility) and questionnaires (out of home mobility).	28 days	Significant intercorrelations were found between the indicators of out-of-home activity, with correlations ranging from r = 0.20 (number of cognitively demanding activities with number of physically demanding activities) to r = 0.29 (number of physically demanding activities with number of other activities).
Wettstein, Wahl, Shoval, et al., (2014)	Germany & Israel	Mixed methods	N = 257, mean age 72.9 (6.4), 146 CH, 76 MCI and 35 ESD (SenTra project).	GPS tracking kit	GPS (out of home mobility) and activity list of 23 out of home activities and 9-item Environmental Mastery	28 days	Results suggest that out of home behaviours are both a resource and challenge for cognitively impaired older adults, interventions should take these findings into consideration.

					subscale of Psychological Well-being Questionnaire.		
Wettstein, Wahl, Shoval, & Auslander, et al., (2015)	Germany & Israel	Mixed methods	N = 257, mean age 72.9 (6.4), 146 CH, 76 MCI and 35 ESD (SenTra project).	GPS tracking kit	GPS (out of home mobility) and activity list of 23 out of home activities and 9-item Environmental Mastery subscale of Psychological Well-being Questionnaire.	28 days	Identified three mobility types, mobility restricted, outdoor orientated and walkers which could be predicted on socio-demographic indicators, activity, health and cognitive impairment.
Wettstein, Wahl, Shoval, Oswald, et al., (2015)	Germany & Israel	Mixed methods	N = 257, mean age 72.9 (6.4), 146 CH, 76 MCI and 35 ESD (SenTra project).	GPS tracking kit	GPS (out of home mobility) and activity list of 23 out of home activities and 9-item Environmental Mastery subscale of Psychological Well-being Questionnaire.	28 days	Predicting cognitive impairment status by out-of-home behavior and a range of confounders by means of multinomial logistic regression revealed that only cognitively demanding activities showed at least a marginally significant difference between MCI and CH and were highly significant between AD and CH.
Yen et al., (2013)	USA	Mixed methods	N = 40, mean age 69, healthy participants.	Qstarz BT-Q1000X	GPS (track travel patterns, mode, path and destination) and surveys (purpose of travel).	7 days (in fall and winter)	GPS data showed a mean of four trips per day with a mean distance of 7.6km. Older adults commonly made trips for volunteering, work and visiting friends.
Zandieh et al., (2017)	UK	Cross sectional study	N = 173, 65+, convenience sample, CH, independently mobile.	i-gotU GT-600	GPS, GIS, Questionnaires and walking interviews.	3-8 days (mean 4.95)	Participants from high-deprivation areas walk outside home less than their peers from low-deprivation areas. It demonstrated that inequalities in neighbourhood land-use intensity might influence disparities in participants' outdoor walking levels between these areas.
Zandieh et al., (2016)	UK	Cross sectional study	N = 173, 65+, convenience sample, CH, independently mobile.	i-gotU GT-600	GPS, questionnaires and walking interviews.	3-8 days (mean 4.95)	Perceived neighbourhood safety, quietness and aesthetics were positively related to total outdoor walking levels.
Zeitler et al., (2012)	Australia	Qualitative research design	N = 13, 57 to 87 year age range, 8 males, living in low density suburban areas of Brisbane.	GPS Trip Recorder Model: 747A+, TranSystem Inc, Hsinchu, Taiwan, 2010	GPS (maps for interview), travel diaries, brief questionnaires and semi structured interviews.	7 days	Reported 5 of 13 subjects did not participate in active transport. Suburban Brisbane low density areas- impractical for active transport for older people, public transport impractical and low density environments are likely to create car dependency in older age.
Zhu et al., (2013)	USA	Case study	N = 10, mean age 68, range 60-82, 4 males, community based living in	GeoLogger GPS tracking devices	GPS, accelerometry and pedometers.	21 days	No statistical difference in walking behaviour was found between neighbourhoods (Walkable = 6710 ± 2781, non-walkable = 7096 ± 4674).

			walkable and non-walkable neighbourhoods.				

(Mean age (SD), HRQOL (Health related quality of life), GIS (geographical information systems), PAD (Peripheral arterial disease), CH (cognitively healthy), MCI (mild cognitive impairment), ESD (early stage dementia), AD (Alzheimer's disease), MOASIS study (Mobility, Activity and Social Interaction Study), RECORD study (Residential Environment and Coronary heart Disease), ELANE (Elderly and their Neighbourhood study), CURHA project (Contrasted Urban settings for Healthy Aging), WTT (Walk the Talk study) and SenTra project (The Use of Advanced Tracking Technologies for the Analysis of Mobility in Alzheimer's Disease and Related Cognitive Diseases).
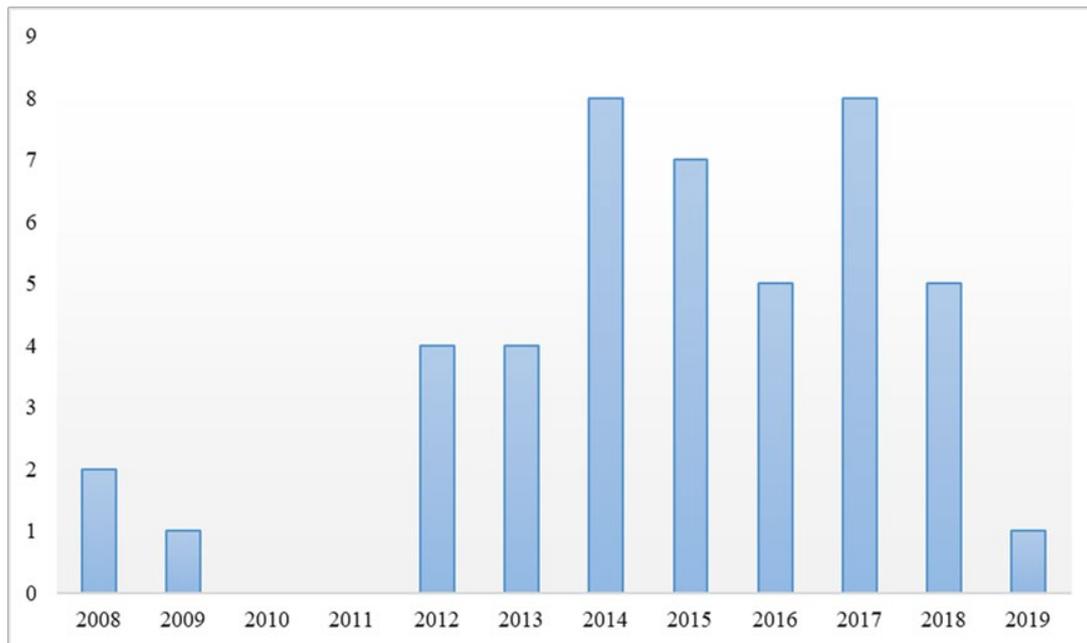
Figure 4.2 publication records

4.5.1 Participants

The majority of participants in the included studies were healthy (n = 23), there were ten studies that recruited individuals with cognitive impairments and other studies monitored populations with a low income (n = 2) (Franke et al., 2017; Hirsch et al., 2016), mobility disability (n = 2)(Gell et al., 2015; Rosenberg et al., 2013) and amputees (n = 2)(Hordacre et al., 2014; Jayaraman et al., 2014). One study focused on a population with peripheral artery disease (Le Faucheur et al., 2008), stroke (Evans et al., 2012) and ICU admitted patients by accessing data prior to admission on their smartphone (Gluck et al., 2016). Sample sizes varied from a single participant (Evans et al., 2012; Jayaraman et al., 2014) to 360 (Shoval et al., 2008). The ages of participants included in the studies varied with means ranging from 52 years (Gluck et al., 2016) up to 83.8 years (Rosenberg et al., 2017).

4.5.2 GPS devices

There were 14 different types of GPS device used (Table 4.3), with Qstarz BT- Q1000T and Q1000XT used in almost half of the studies (n = 19). The SenTra project used a GPS tracking kit which accounted for eight studies, with a further seven studies not reporting details of the devices used. Apps and software were used on mobile phones (n = 5), and consumer watches (n = 3) to track location. Two studies report the feasibility of using GPS and accelerometer devices (Hordacre et al., 2014; Webber & Porter, 2009), one reports accuracy of GPS and accelerometry in combination (Rosenberg et al., 2017) and a single study reports the accuracy of GPS (Y. Kestens et al., 2016).

Table 4.3 Summary of GPS devices used in the included studies

GPS device	Number of studies
Qstarz BT- Q1000XT	11
Qstarz BT- Q1000X	8
GPS tracking kit*	8
Not specified	7
i-gotU GT-600	2
Smartphone data	2
Find my iPhone application	1
Garmin Forerunner 405 GPS watch	1
Garmin Forerunner 205 GPS watch	1
Garmin GPS (60)	1
GeoLogger GPS tracking device	1
Globalsat DG 200 datalogger	1
GPS Trip Recorder Model 747A+	1
uTrail Fastrax	1
WIMuGPS	1

4.5.3 GPS outcomes

GPS was used for a variety of different outcomes (n = 24), with included studies often using GPS measures for more than one outcome (Table 4.4). The most commonly reported outcomes were location (specific), total time spent out of home, and the creation of maps to inform subjective interviews.

Table 4.4 GPS outcomes in the included studies

GPS outcomes	Number of studies
Location (specific)	12
Total time spent out of home	12
Map for subjective interviews	8
Activity/Life space	6
Time spent actively travelling (walking and cycling)	8
Number of active trips taken	5
Routes taken (travel patterns)	4
Number of nodes visited	4
Total distance travelled (walking)	4
Feasibility/accuracy of GPS	2
Maximal walking distance	1
Distance from home	1
Number of community visits	1
Number of days out of home	1
Percentage time spent outside residential buffers*	1
Speed	1
Time spent travelling by motor vehicle	2
Average distance travelled per day	1
Active time ratio	1

Ellipse area and maximum distance	1
Location of bouts of activity	1
Maximal distance of destinations	1
Percent volume contour (PVC)**	1
Time at home ratio	1

(*Residential buffers- 0.5 and 1 mile circular buffers around home address. **PVC-Percent volume contour).

4.5.4 Tracking period

The GPS tracking periods varied across studies, and ranged considerably from 45 minutes (Le Faucheur et al., 2008) to 30 days (Fillekes et al., 2019). Almost half of the included studies monitored subjects for seven days (n = 18), with seven studies monitoring for 28 days (Gluck et al., 2016; Kaspar et al., 2015; Wahl et al., 2013; Wettstein, Wahl, & Diehl, 2014; Wettstein, Wahl, Shoval, et al., 2014; Wettstein, Wahl, Shoval, Auslander, et al., 2015; Wettstein, Wahl, Shoval, Oswald, et al., 2015) three studies monitored for 14 days (Boissy et al., 2018; Harada et al., 2017; Heatwole Shank & Presgraves, 2018) and two studies monitored for four weeks (Shoval et al., 2008; Werner et al., 2012). Three studies used GPS tracking for three days (Gell et al., 2015; Rosenberg et al., 2013; Tung et al., 2014) and two studies monitored for three to eight days (Zandieh et al., 2017; Zandieh et al., 2016). Single studies tracking subjects for 45 minutes (Le Faucheur et al., 2008), 10 hours (Theou et al., 2012), one day (Webber & Porter, 2009), four days (Hand et al., 2018), six days (Rosenberg et al., 2017), eight days (Barclay et al., 2018), 10 to 14 days (Heatwole Shank & Cutchin, 2016), 21 days (Zhu et al., 2013) and one month (Jayaraman et al., 2014) were included.

4.5.5 Methods of data analysis

There was a wide range of data analysis described across the included studies. Descriptive statistics were used to compare subjects and activity levels. The data analysis compared variables that were dependent on the GPS outcomes used, and due to variability were unable to be aggregated. The most frequent was use of the Pearson correlation, used for continuous variables (n = 10) and the t-test, when comparing means of continuous scores, (n = 6). Five of the studies did not detail data analysis or were protocols. Overall, there were 21 different data analyses reported and they were not all relevant to location.

4.5.6 GPS data processing systems

Over half of the studies included did not report the data processing system used to analyse GPS data (n = 23). Of the studies that did report this information, there were 14 different systems reported, of which the Qtravel software was the most frequent (n = 4).

4.5.7 Facilitators and barriers

Table 4.5 outlines the facilitators and barriers to PA and participation in the community identified in the included studies. The most common facilitators were the weather, safety, access to facilities,

and the social component of activity. The most common barriers were weather, safety, low income, and the use of motor vehicles.

Table 4.5 Facilitators and barriers of physical activity and participation

Facilitators	Barriers
Safety (n = 6)	Weather (n = 6)
Weather (n = 6)	Safety within community (n = 6)
Access to multi-purpose facilities (n = 5)	Low income/high deprivation areas (n = 6)
Social component of activity (n = 5)	Use of motor vehicles (n = 6)
Parking (n = 2)	Heavy traffic conditions (n = 3)
Pavement condition/street connectivity (n = 3)	Kerb ramps (n = 3)
Aesthetics (n = 2)	Lack of local amenities (n = 2)
Age friendly environment (n = 1)	Aesthetics (n = 2)
Air quality (n = 1)	Access to transport (n = 3)
Dense green spaces (n = 1)	Air quality (n = 1)
Familiarity with place (n = 1)	Declining health (n = 1)
Quietness (n = 1)	Fear of falling/ decreased confidence (n = 2)
Racial (n = 1)	Lighting (n = 1)
	Low density environments (n = 1)
	Parking (n = 1)
	Pavement condition (n = 1)
	Quietness (n = 1)
	Racial (n = 1)
	Stairs (n = 1)
	Street crossings (n = 1)

4.6 **Discussion**

The overall aim of this review was to scope the extent that GPS devices have been used to measure community participation and PA in older people. Specifically, the review aimed to identify the devices and monitoring methods used to identify the facilitators and barriers to community participation and PA in older adults. To the best of our knowledge, this is the first review to systematically identify and explore GPS tracking of older people in relation to PA. This review found that there was a variety of methods and devices used for GPS monitoring in older people, and that the most common facilitators and barriers to activity and participation were the weather and safety.

While over 40 studies were identified and included in this review, it is interesting to note that these studies have been published over a 12-year period, and the majority were published between 2013 and 2018. This likely reflects that the use of GPS to monitor location and activity in older adults is a fairly new methodology. This may be why there was such diverse methodology in relation to the devices and monitoring periods. The search targeted studies that measured participation and PA, with combined quantitative locational measures. Studies in hospital settings and nursing homes or that defined walking routes were excluded from the review, as these environmental restrictions on movement meant that results were not deemed to reflect natural participation.

Twelve countries were represented in the included studies. It should be acknowledged that the facilities and environments that older people live vary significantly across the globe. This makes direct comparison between studies difficult, particularly in relation to the barriers and facilitators to activity and participation. It is also worth mentioning that 18 included studies used data from the same group of participants or existing studies, often exploring GPS as a secondary outcome. The SenTra study accounted for eight of the included studies, collecting data in a cognitively impaired population to determine PA and location with relation to mood. A limitation in this collaboration is that the comparison of participants across Germany and Israel is problematic due to the vast differences between the populations and countries. It is evident from this review that the use of GPS across the globe is implemented differently and populations recruited are unique thus limiting generalisability.

There were many different GPS devices used in the included studies, and most often the recommended processing systems for the chosen device was used to extract GPS data. Selection occasionally reflected the preferences of the country the study was completed in. The increasing use of consumer wearable devices and smart phones was apparent, with three studies using a consumable wearable device, and five studies using a smartphone app to monitor location. Despite the increase in studies using wearable trackers such as the Garmin, the Qstarz devices were the most commonly used. These devices have been shown to be a valid measure of location (Schipperijn et al., 2014). It is possible that the use of a device that is carried rather than attached or worn on the body may result in poor compliance and therefore the data obtained may not be accurate of the entire monitoring period. There was minimal justification for device selection in the included studies.

The other complicating factor with the use of consumable wearable devices, is that the technology is frequently updated, this means that future studies are unable to replicate the methods. For example, the Garmin Forerunner 205 GPS watch was used by one study (Webber & Porter, 2009) has since been succeeded by 25 versions of the Forerunner and is now retired from manufacturing. More recently a custom-built 'uTrail' device that featured a GPS and accelerometer to reduce the number of devices participants had to carry is an interesting consideration (Fillekes et al., 2019). However, in the included study the devices were restricted by memory capacity, missing 99 days of data (Fillekes et al., 2019). Therefore, further research into the accuracy and usability of consumable GPS devices is required.

Over a quarter of the included studies used GPS to analyse a specific location, however, a variety of GPS outcomes were evaluated across the included studies. In some cases, GPS was used to log the time spent out of home or to produce maps to guide subjective interviews. The use of maps for interviewing triggered reflective conversations and revealed different aspects of living in community in older age (Heatwole Shank & Cutchin, 2016). Unfortunately, studies that used GPS

data to produce maps did not report or analyse the data obtained, limiting the conclusions. Combined qualitative data was often used to confirm locations, explain gaps in the data and provide reasons for location selection. Over half of the included studies combined qualitative and quantitative data when monitoring location with GPS which proved successful and provided detailed reasoning and discussion.

The studies varied considerably within their designs, mixed methods were used most frequently (n = 17) and six reported case studies. The vast differences in study design meant that data analyses were difficult to group and compare. However, it did identify that researchers used the processing systems to extract GPS data using the recommended systems for their chosen device.

There were numerous facilitators and barriers to PA and participation identified in this review.

4.6.1 Safety

Safety was frequently identified as a facilitator and barrier to participation in activity. Safety was the main deterrent of active transport, with older people avoiding areas for fear of 'rowdy people' and being unable to cross at the pedestrian crossing safely (Zeitler et al., 2012). Participants expressed fear of injury from falling, and decreased confidence which reduced their motivation to walk outdoors (Barclay et al., 2018). Interestingly a study of older women in Washington, USA reported that black women were less active than white women, with lower perceptions of neighbourhood safety possibly accounting for reduced activity levels in black women (Li et al., 2017). White women with mobility disability reported avoiding going out after dark and places they perceived as unsafe (Rosenberg et al., 2013). In interviews, safety also acted as a facilitator, with individuals choosing a community that made them feel safe (Aird & Buys, 2015). Some felt safe enough to walk at night which was explained by the familiarity of the place (Franke et al., 2017). Feeling safe is therefore integral to the willingness of older people to participate in activity within their community.

4.6.2 Weather

Six studies identified the weather as a facilitator and barrier of activity and participation. Two studies attempted to account for possible weather variability by collecting data only in the summer (Franke et al., 2017; Prins et al., 2014). However, acknowledgements were made that seasonal influences could not be completely excluded (Le Faucheur et al., 2008). One study identified unseasonably warm weather as a limitation (Werner et al., 2012), with others specifically investigating the hour-to-hour weather influence on walking and cycling (Prins & van Lenthe, 2015). Their results concluded that higher temperatures, lower wind speeds and absence of rain increase the levels of walking in an older population. Rain is identified as a barrier to walking, explained by bad weather '*causing slippery pavements*' (Rosenberg et al., 2013, pp. 273). Some individuals reported having good rain gear so were happy to walk in the rain, others were restricted

reporting difficulties with carrying umbrellas and using walking aids whilst others were restricted by hot weather, reporting limited shade made them reluctant to go out (Rosenberg et al., 2013). The impact of weather was investigated in detail and needs to be considered when monitoring locations and activity participation.

4.6.3 Multiple purpose

Older people were found to prefer locations that provided the opportunity for physical, social and daily activities in one location (Franke et al., 2017). Activities were often combined according to the purpose of the activity, and took place within tracks outside of participant's neighbourhoods (Cornwell & Cagney, 2017). Hand et al. (2018) provided GPS maps which effectively demonstrated multiple destinations visited in one day. It was noticeable from these maps that individuals visited different parts of town for different activities. Older people were willing to travel to access amenities that they needed especially food resources and shopping precincts (Hirsch et al., 2016), and where they could perform multiple tasks.

4.6.4 Social priority

Social tasks were reported as being prioritised over all others, with individuals going out of their way to access locations where they could maintain familiarity with people, often using errands to achieve social goals (Heatwole Shank & Cutchin, 2016). This is also demonstrated with travel patterns remaining consistent, caused by the desire to maintain physical and social activity (Franke et al., 2017). The environment was considered important for social aspects of participation (Hand et al., 2018). Individuals moved outside of their residential tracks over 40 percent of the time monitored, mainly for shopping, exercising and participating in group activity (Werner et al., 2012). The social components of active ageing are interlinked to the majority of facilitators and occasionally barriers with an individual avoiding social interaction whilst out on her walks (Hand et al., 2018). These findings demonstrate that for older people, social interaction is a priority which should be noted when designing interventions.

4.6.5 Motor vehicle dependency

The use of motor vehicle travel was discussed frequently as a significant barrier to PA. It was reported that vast numbers of healthy older people preferred motor vehicle transport even over short distances (Heatwole Shank & Cutchin, 2016). In one study all participants (n = 12) relied heavily on motor vehicles for the majority of transportation (Heatwole Shank & Cutchin, 2016). With another reporting one older individual who only travelled by car over four days of GPS tracking (Hand et al., 2018). In a sample of 48 in Queensland, Australia, one third did not travel on foot over the seven day tracking period, 81.3 percent were drivers and 12.5 percent passengers (Aird & Buys, 2015). Car travel was the predominant transport choice with five people driving for all trips over a monitored week period, and four others reported car use 90 to 99 percent of the time (Zeitler et al., 2012). It was difficult to determine when reviewing the studies how much of the travel

was active and how much was via motor vehicle, even though speed of GPS can be used to calculate travel type. The dependency on motor vehicles was identified as a significant barrier to PA.

4.6.6 Low income/ high deprivation areas

Income was another barrier to participation, one participant was unable to access the baseball stadium following his stroke, this was attributed to his reduced income as he was unable to work (Evans et al., 2012). In a comparison of walking levels of subjects in high and low deprivation areas in Birmingham UK individuals were found to walk less in high deprivation areas due to inequalities in perception of neighbourhood safety, quietness and aesthetics (Zandieh et al., 2016). Individuals with lower incomes may also have less access to travel and therefore could not participate in eating out and shopping activities regularly (Franke et al., 2017). Similarly, low income older adults possibly have less access to travel outside of their neighbourhoods (Hirsch et al., 2016). Older adults living in the community with a low income were found to spend more time at home and have smaller maximal distances of destination (Boissy et al., 2018).

4.7 Conclusion

This scoping review identified the lack of GPS data for older people participating in activities in the community internationally. The review demonstrates an increase in the popularity of GPS in research, yet problematically, the populations, devices and mythologies varied significantly across the 12 countries. Despite this, the use of the Qstarz devices were the most commonly used by researchers, with 7-day monitoring carried out in 50 percent of the included studies. The inclusion of mixed method study designs provided insight into where and why individuals chose certain activity locations and identified numerous facilitators and barriers to community participation and PA. Highlighting that safety, weather, social interactions, income levels and dependency on motor vehicles should be considered when considering community participation. GPS data has the potential to accurately identify location of activity in older people, however larger studies focussed on older people with varying health status are required. Despite the lack of evidence regarding compliance for the use of GPS protocol with older adults, these findings were useful to inform methodologies implemented in Chapters 5,6 and 8.

CHAPTER 5: **COMMUNITY PARTICIPATION OF COMMUNITY DWELLING OLDER ADULTS: A CROSS SECTIONAL STUDY**

5.1 **About this chapter:**

In the previous chapters, it was identified that GPS data for older adults is lacking, despite increasing popularity for researchers. The purpose of this chapter is to use the combined mixed methodologies of GPS, accelerometry and self-reported measures, informed by the findings of Chapters 3 and 4, with older adults to measure community participation. Whilst also determining whether these methods are feasible and applicable with an older population by comparing self-reported and GPS detected locations. Observations will provide a picture of how older adults participate in their community, by measuring PA, social interactions, HRQOL, sleep quality and loneliness. The results of this observational study have been published as; *Gough, C., Lewis, LK., Barr, C., Maeder, A. & George, S. (2021) Community participation of community dwelling older adults: a cross-sectional study. BMC Public Health 21, 612*, (Appendix 3).

5.2 **Research objectives**

The aims of Chapter 5 were to determine:

- the feasibility (burden, adherence, satisfaction) of using a 7-day GPS and accelerometer protocol with older community dwelling adults.
- the validity of self-reported activity diaries for measuring location and community participation compared with objective GPS measures.

Chapter 5 aims to increase understanding of community participation for older adults by observing:

- the locations older adults choose for community participation
- how often older adults participate in their community over a seven-day period
- the associations between community participation and levels of loneliness, sleep quality and HRQOL, and-
- the associations between PA, HRQOL, loneliness and sleep quality.

5.3 **Background**

As our populations continue to age, considerations for healthy ageing are becoming increasingly important. Older adults who participate in such activities have a lower risk of functional disability, increased HRQOL and report lower usage of formal healthcare (Ashida et al., 2016; Munford, 2017). Despite the known benefits of community participation, the evidence is sparse regarding how and where older people participate in their communities. Previous research reports that older Australian adults are more likely to be active in locations that allow for social interaction such as restaurants, churches, and commercial locations such as pharmacies (Nathan et al, 2012). Yet further understanding of these factors may inform healthcare delivery, support services and interventions specifically targeting the promotion of participation through the latter stages of life.

Therefore, the primary aim of this chapter was to describe community participation (specifically by location type and frequency) in community-dwelling older adults and characterise the types of activities in which they engaged. The secondary aim was to investigate the factors associated with community participation, including PA, social interaction, HRQOL, sleep quality and loneliness. The tertiary aim was to determine feasibility of a 7-day monitoring protocol using GPS, accelerometry and self-reported diaries with older adults, and to determine the validity of associated quantitative and qualitative measures.

5.4 Methods

This body of research used an observational cross-sectional design to observe the community participation of community dwelling older adults for a single 7-day monitoring period. Ethical approval was gained from the Flinders University Social and Behavioural Research Ethics Committee (protocol no. 8176). Written informed consent was obtained from all participants. Data were collected from November 2018 to May 2019. Methods combined quantitative and qualitative measures of community participation and PA, to provide a data rich picture of community participation (Creswell, 2018).

5.5 Participants

For inclusion, participants had to live in metropolitan Adelaide, be able to walk independently (+/- walking aids), speak and understand English, have sufficient cognition to understand the research information and be aged 65 years or over. Individuals living independently in retirement villages were included in the study, with those living in residential care facilities excluded. Participants were recruited using flyers advertising the research through local councils, community centres, social media forums and organisations for older adults. Interested individuals were invited to contact the candidate who screened potential participants for eligibility over the phone. The Standardised Mini Mental State Examination (SMMSE) was completed with potential participants to determine whether they had sufficient cognitive capacity to participate in the research, with a score above 25 required for participation (Molloy, 2014).

5.6 Outcomes

5.6.1 Community participation

Community participation was measured using GPS (Qstarz BT1000XT) to calculate the number of trips away from home, type of location visited and the number of in- and out-of-home activities. The Qstarz BT1000XT device is deemed to be accurate to within 10 metres for 79 percent of ≈68,000 GPS points (Schipperijn et al., 2014) and a popular device with researchers as reported in Chapter 4. GPS data provided co-ordinates of the beginning and end locations of identified 'loops' for individual trips. The co-ordinates were viewed on the street view of Google maps (Google, n.d.) to

identify the location visited. The types of location were then grouped into the following categories: residential, recreational, commercial, health, local walk/ greenspace, central business district (CBD) and place of worship (Hordacre et al., 2014) (Table 5.1). For each type of location visited out of home, activity diaries were cross-referenced to ascertain the purpose of the visit and to identify possible social interactions. For example, in a commercial location, grocery shopping was identified as a domestic task, yet attending a walking group in a shopping centre was deemed an important social component of community participation.

Table 5.1 Community participation category definitions (Hordacre et al., 2014)

Residential	Housing other than own home
Recreational	Sports centre, theatre, restaurant, community hall, swimming pool
Commercial	Shopping centres, local shops
Health	Hospital, GP clinic, physiotherapist, blood clinic
Local walk/Greenspace	Local area, park space (beach), or greenery close to home
Central Business district	Adelaide Central Business District (CBD)
Place of worship	A location designed for congregation of faith

Self-reported participation diaries were completed by participants to provide the context of community participation. Diaries reported the time, activity, duration, location, and social interactions out of the home. Participants recorded sleep and device non-wear. An excerpt is provided in Appendix 6. This information was used to cross-check with the objective data, the accuracy of location where GPS data were missing, and report participation in specific activities.

5.6.2 Community participation - Influencing factors

Physical activity was measured using GeneActiv wrist-worn accelerometers, fitted to the non-dominant wrist. GeneActiv accelerometers have been deemed reliable and valid for classifying the intensity of PA in adults (Esliger et al., 2011). Accelerometer data were used to determine times participants were sedentary, and engaging in light, moderate or vigorous activity. To determine overall daily PA, GeneActiv .bin files were converted to 60-second epoch files and analysed using Cobra software (Francois Frayasse, University of South Australia). Cut points developed by Esliger (Esliger et al., 2011) were used (adjusted for the sampling frequency and epochs) to identify activity intensity (light 283, moderate 605 and vigorous 1697 (g min)). Sleep was identified using a combination of visual analysis of the activity trace, and self-reported sleep diaries, and subsequently excluded from the analysis.

The number of social interactions experienced were self-reported by participants in participation diaries (Appendix 1), with the total number and location of social interactions identified. HRQOL was measured using the Assessment of Quality of Life-8 dimension scale (AQOL-8D), deemed valid and reliable with larger samples (Strath et al., 2005). AQOL-8D utility algorithm was used to calculate scores (Richardson, Sinha, et al., 2014) which were compared with the general

population (Richardson et al., 2012), across the following categories: Independent living (IL), Pain, Senses, Mental health, Happiness, Coping, Self-worth and Relationships, with higher scores indicative of greater quality of life. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), an instrument used to measure the quality and patterns of sleep in older adults (Buysse et al., 1989). PSQI scores were calculated manually, with scores of 6 and above used to identify poor sleep quality (Buysse et al., 1989). Levels of loneliness were measured using the de Jong Gierveld loneliness scale which has been validated to measure general, emotional and social loneliness (Tomás et al., 2017). Scores were calculated, with a score of 6 (on a scale of 0-6) representing '*most lonely*' (Tomás et al., 2017).

5.7 Feasibility of community participation measurement

Loss of GPS hours were calculated to determine the completeness of data collection, according to the expected number of cells recorded [n = 120,960 (5 second epochs)](Hordacre et al., 2014). The self-reported locations and number of trips out-of-home (total) were manually checked against GPS co-ordinates to determine the accuracy of self-reported location (community participation). Data were linked to Google Maps (Google, n.d.) for graphic representation of where participants were in the community. A maximum time-difference of 10 minutes was accepted for self-reported location analysis (Pasquale Fillekes et al., 2019). On completion, a 15-item feasibility questionnaire to determine participant experiences of wearing the devices was completed (Lewis et al., 2016).

5.8 Procedure

Eligible participants attended a face-to-face meeting with the candidate, either in their own home or at the university. At this meeting, participants completed demographic (inclusive of gender, age, marital status, education level, postcode to calculate Index of Relative socio-economic advantage and disadvantage score (IRSAD), employment and volunteer status), AQOL-8D, PSQI and de Jong Gierveld loneliness questionnaires and were measured for height and weight using standardised procedures to calculate their body mass index (BMI).

Participants were fitted with a Qstarz BT1000XT GPS device (Figure 5.1) and GeneActiv triaxial accelerometer (Figure 5.2) with device instructions. The researcher explained how to use the devices and assisted with setup for each participant. The GPS device was worn on a lanyard around the neck, attached to a belt loop, on a waist belt or in the participant's pocket (depending on preference and comfort). The device measured 72.2 mm (L) × 46.5 mm (W) × 20.0 mm (H), weighed 8.5 grams and had a battery life of 42 hours. The GeneActiv accelerometer was fitted comfortably to the participant's non-dominant wrist. The device measured 43mm (L) x 40mm (W) x 13mm (H) and weighed 16 grams.

Participants were asked to wear the GeneActiv device continually for the 7-day monitoring period (inclusive of sleeping, showering, and swimming- as the devices were waterproof). GPS devices were to be worn whenever participants left their home and were removed for water-based activities and overnight for charging. Participants were asked to carry out their normal daily routines whilst wearing the devices. Devices were synchronised to begin recording and obtain 7-days of 24-hour data, recording at 5-second epochs, with GeneActiv devices recording at a frequency of 75Hz. Reminder signs were provided to the participants; the first was to be placed near the bed to prompt charging of the GPS device each night (Appendix 4), the second was meant to be placed near the exit to the home to prompt participants to take the GPS device with them (Appendix 5).

Figure 5.1 Qstarz BT1000XT GPS device

Figure 5.2 GeneActiv triaxial accelerometer

Participants were provided with the option to receive daily reminders to charge the GPS device via text message during the monitoring period. On day three, all participants were contacted via telephone to discuss any issues and to provide a reminder to charge the GPS device. During the monitoring period, participants kept a written diary detailing their activities. On monitoring completion, participants attended an exit meeting where the researcher collected the devices and participation diaries. Participants were then invited to complete the feasibility questionnaire.

5.9 **Data processing**

Signal loss from GPS devices is a common and well-documented issue (Hordacre et al., 2014; Kerr et al., 2011; McCluskey et al., 2012), therefore quality measures were prospectively determined for the inclusion of data sets in the analysis. To be included, GPS data required a minimum of 8 hours (480 minutes) for each day, complete for five of the seven days monitored (Carlson et al., 2015). For the accelerometer data, to be included in the analysis, a minimum of four valid days, defined as the recording of at least 8-hours of waking time, with at least one weekend day required (Innerd et al., 2015; Tinlin et al., 2018).

For the determination of community participation, GPS data were downloaded as .csv files using QSTARZ DataViewer Version 1.37.000 software (Qstarz International Co., 2019). GPS data were cleaned to remove title lines that were recorded when GPS signal had been interrupted. GPS data recorded prior to the start of accelerometry monitoring were also removed. Accelerometry data were downloaded using GeneActiv PC Software version 3.2 as .bin files and converted into 5-second epoch .csv files. GPS and accelerometry files were then combined using time stamps with Python coding software version 2.7.14 (Rossum, 1995). These methods allowed for the detection of when and where participants participated in community activity, following recommendations for proper data handling and maintenance of correct time stamps (Hurvitz, 2015). Self-reported diary entries were recorded in an Excel spreadsheet, where locations reported were grouped into residential, recreational, commercial, health, local walk/greenspace, CBD and place of worship (Hordacre et al., 2014). Activities such as gardening were noted as in-home activities, and reports of social interaction were identified according to location.

5.10 **Data analysis**

Data were entered and analysed using the Statistical Package for Social Sciences (SPSS) (IBM, n.d.) with identifying information removed. Questionnaire responses were entered by a researcher and crosschecked by a research assistant. Descriptive analyses were performed for participant demographic data. The normality of data was determined using Z scores (Warner, 2016) with means and standard deviations (SD) reported for normally distributed data, and median and IQR for non-normally distributed data. Spearman correlations were performed to identify the relationships between the number of social interactions, the number of minutes of MVPA, HRQOL, loneliness, and sleep quality scores with the total number of trips away from home and with the number of trips to different locations (MacFarland & Yates, 2016). Paired t-tests (significance set to alpha of 0.05) were used to determine the accuracy of self-reported location with GPS locations with significance set at <0.01 for Spearman's, due to multiple correlations with differences presented visually in a Bland Altman plot (Cleophas & Zwinderman, 2012; Kalinowski & Fidler, 2010).

5.11 Results

5.11.1 Participant characteristics

A total of 46 participants (n= 33, 72% female), mean age 74 years (SD 5) participated in the study. The majority of participants reported living alone (n = 24) and all participants demonstrated '*normal*' cognition (Molloy, 2014) with a mean SMMSE score of 29.2 out of 30 (SD 1.3). Sixty-one percent of participants were either, single, separated or widowed and 39 percent were married/in de facto relationships. Participants self-reported an average of two chronic conditions each and all participants reported their general health as good or above (Table 5.2).

Table 5.2 Participant characteristics

Characteristic	Participants (n=46)
Gender (M:F) n (%)	13:33 (72:28)
Age mean (SD) years	74 (5)
BMI mean (SD)	28 (5)
Underweight n (%)	0 (0)
Normal n (%)	16 (34)
Overweight n (%)	15 (33)
Obese n (%)	15 (33)
Marital status n (%)	
Single/never married	2 (4)
Separated/divorced	10 (22)
Widowed	16 (35)
Married/defacto	18 (39)
Education level n (%)	
High-school	9 (19)
Post-secondary	16 (35)
Bachelor degree	11 (24)
Post-graduate	10 (22)
Index of Relative socio-economic advantage and disadvantage score (IRSAD) n (%)	
…1	4 (9)
…2	4 (9)
…3	14 (30)
…4	15 (33)
…5	9 (20)
Employment status n (%)	
Employed	2 (4)
Retired	44 (96)
Volunteer n (%)	28 (61)
No. of volunteer hours per week mean (SD)	4 (7)
Pet owner n (%)	13 (28)
No. of co-morbidities mean (SD)	2 (1)
Self-rated general health n (%)	
Excellent	8 (17)
Very good	25 (54)
Good	13 (28)
Fair	0 (0)
Poor	0 (0)
SMMSE mean (SD)	29 (1)

(Standard deviation (SD), Body mass index (BMI), Index of relative socio-economic advantage and disadvantage score (IRSAD) (higher score indicative of lack of disadvantage and greater advantage in general), Standardised Mini Mental State Examination (SMMSE), IRSAD score, low score denotes greater disadvantage and lack of advantage in general).

Valid Data sets were obtained for 44 of the 46 recruited participants. Data were excluded from one participant due to equipment malfunction (GeneActiv device). One further data set was excluded as the participation diary was not completed and therefore could not be included in comparisons of self-reported and GPS locations. Following exclusions, of the 7,392 hours of expected GPS data, 6,983 hours (94.5%) were recorded. Two participants requested reminders to charge the GPS device and received text messages on days 1, 2, 4, 5 and 6.

5.11.2 Community participation

Overall, combined GPS and self-report detected a median (IQR) of 15 (8-18) in-home activities and 18 (14-25) out-of-home activities over the 7-day period, with median (IQR) of 15 (9-19) GPS trips out-of-home. Nine participants reported a single day where they did not leave the house. The median (IQR) number of locations visited outside of the home are presented in Figure 5.3, with commercial locations the most frequently visited location type (median 6, range: 3-7), followed by recreational 4 (2-6), local walk/greenspaces 2 (0-6), residential 2 (0-4), CBD 1 (0-2), health 0 (0-1) and place of worship 0 (0-1).
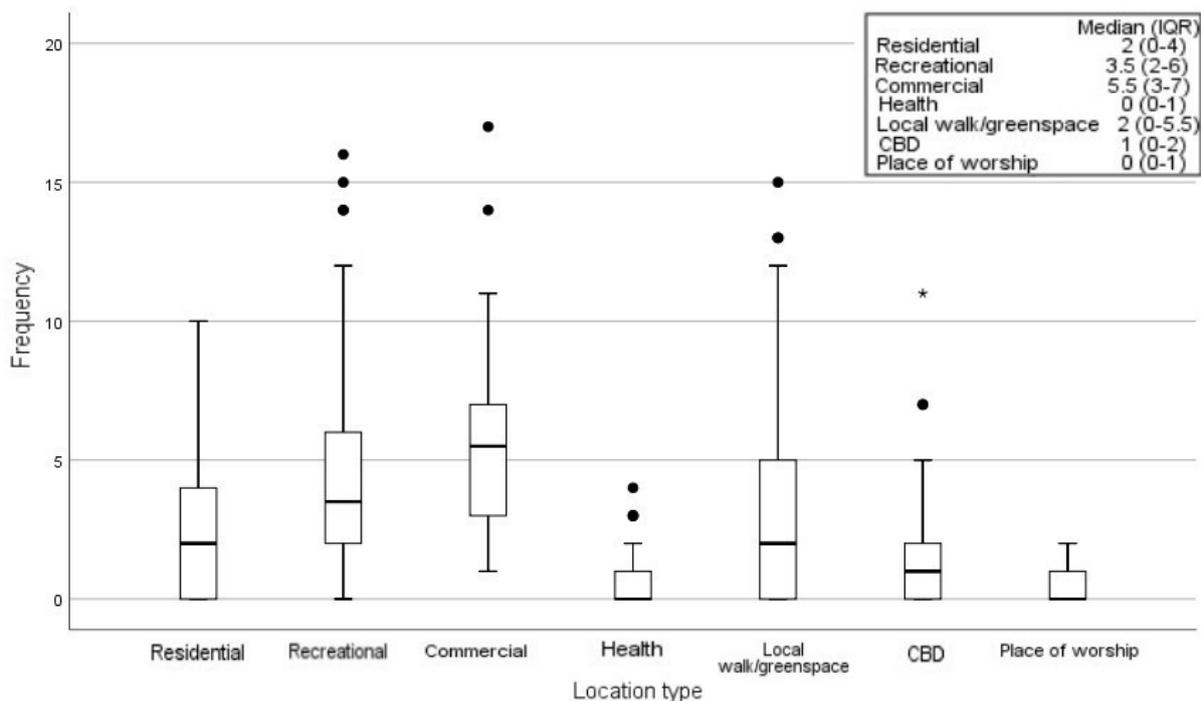
Figure 5.3 GPS out-of-home activity locations visited over the 7-day monitoring period
(• represents outliers, ★ represents extreme outlier)

The type of in-home activities reported are detailed in Appendix 7 and were mainly sedentary in nature, including reading the paper, computer work, watching television and listening to the radio. The type of out-of-home activities varied with the location (Appendix 7).

5.11.3 Community participation - Influencing factors

Physical activity varied between participants, with a daily median of 67 minutes of MVPA (IQR 38-89). A daily median (IQR) of 223 (195-294) minutes were spent performing light activity, 65 (36-89) minutes moderate intensity activity and 20 seconds (0-117) of vigorous activity. Twenty-seven (61%) participants performed no vigorous activity. The mean sleep time was 480 (SD 58) minutes per night and on average, participants spent 659 minutes (SD 91) per day sedentary. Wear time was examined for each participant by manually reviewing the GeneActiv activity trace for each day of data collection. There was 100% compliance for the 24h/d, 7d monitoring protocol for the GeneActiv devices (1440min/d wear time each day for all participants).

Overall, combined GPS and self-report detected a median (IQR) of 2 (0 - 7) in-home social interactions and 11.5 (8 - 17) out-of-home social interactions over the 7 -days. A median (IQR) of 16.5 (10 - 21) social interactions were reported over the 7 -days (positively skewed 0.24). The median (IQR) number of locations of social interactions over the 7 -days is presented in Figure 5.4. The most common location type for social interactions was recreational, median (IQR) 3 (1 - 4) and commercial 3 (1 - 5) followed by residential 2 (0 - 4). No social interactions were reported at health, local walk/greenspaces, CBD, or places of worship.
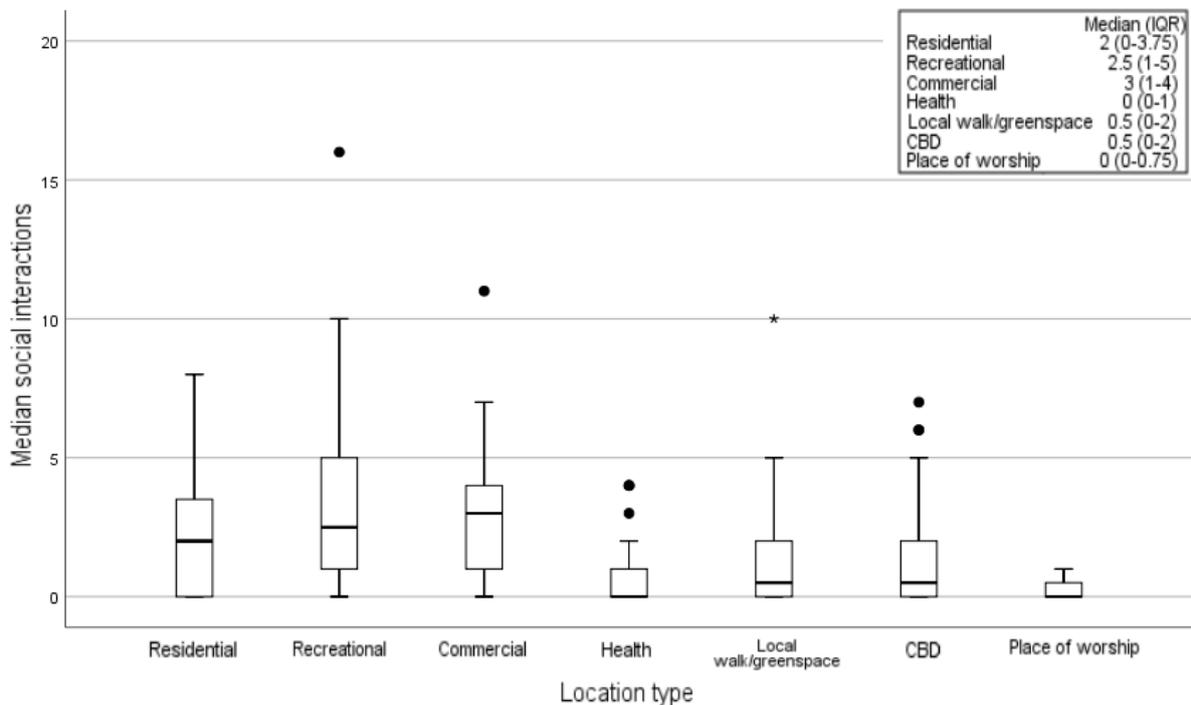
Figure 5.4 Locations of social interactions over the 7-day monitoring period
(● represents outliers, ★ represents extreme outlier)

The mean (SD) AQOL-8D score for the HRQOL for the general population aged between 65 to 74 years old is 0.83 (0.22) (Richardson et al., 2012), which is matched closely by the participant mean (SD) 0.84 (0.75) in this sample. The study sample reported higher Mental Super Dimension (MSD) scores, mean (SD) 0.84 (0.77), when compared with the general population 0.50 (0.01) which combined mental health, coping, self-worth and relationships (Maxwell et al., 2016). Sleep quality ranged from 1 to 14 on the PSQI with a mean of 5.41 (SD 3) with higher scores indicative of poor sleep quality, 19 (43%) participants scored over 6 (Buysse et al., 1989) indicating poor sleep quality. The study sample detected two participants who scored five out of six on the de Jong Gierveld Loneliness Scale, suggesting feelings of loneliness. The overall mean of participants was 1.4 (SD 1.4), representing a non-lonely group.

Significant positive correlations were found between both the trips away from home and social interactions (p = 0.615) and trips away from home and minutes of daily MVPA (p = 0.434) (Table 5.3). There was a significant positive correlation between visits to local walk/greenspaces and minutes of daily MVPA (p = 0.477). Increasing age was correlated with reduced minutes of MVPA (p = 0.42). No significant associations were found between trips away from home and HRQOL, loneliness or sleep quality.

Table 5.3 Correlation between the number of social interactions, the number of minutes MVPA, HRQOL, loneliness and sleep quality scores with the total number of trips away from home and with the number of trips to different location types (n = 44)

Spearman's rho	Social interactions	MVPA	HRQOL	Loneliness	Sleep quality
Trips away from home	0.615**	0.434**	0.006	-0.134	-0.240
Residential	0.322*	0.133	-0.206	-0.210	0.034
Recreational	0.384*	0.267	-0.205	0.016	0.114
Commercial	0.260	0.118	0.146	-0.144	-0.272
Health	0.142	0.033	-0.133	0.106	0.144
Local walk/greenspace	0.196	0.477**	-0.076	0.002	-0.204
CBD	0.151	0.026	-0.239	0.260	0.095
Place of worship	0.144	-0.069	-0.128	-0.061	0.116

(Central business district (CBD), ** Correlation is significant at the 0.01 level (2 tailed))

5.11.4 Feasibility of community participation measurement

Loss of GPS data ranged from 0 to 91 hours (0-54%) per participant, after excluding one data set that did not meet the quality standards for analysis, the overall range was 0 to 50 hours lost with a mean of 9.3 hours (SD 11.8) over the 7-day monitoring period. The responses to the feasibility questionnaire indicated that devices were easy to carry (82%), comfortable to wear (54%), easy to remember to charge (54%) and remember when leaving the house (59%). Participants also reported that the reminder flyers were useful to assist with charging and remembering devices. Participants reported that participating in the study did not impact their normal routine (78%), disrupt sleep (100%) and was not time consuming (89%).
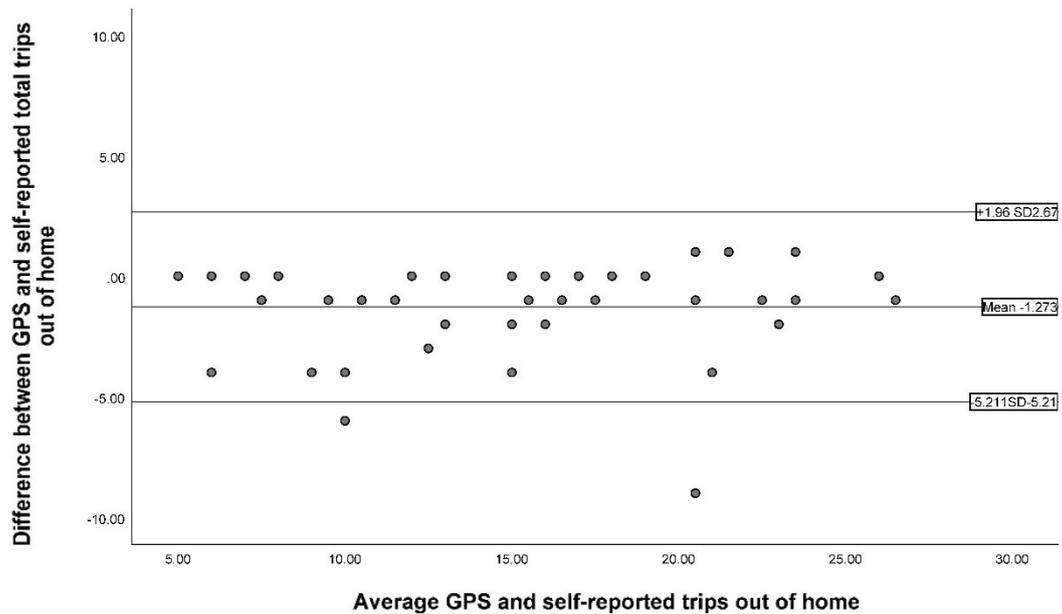
Figure 5.5 Bland- Altman plot of GPS vs self-reported total trips out of home

To determine whether there were differences between out-of-home self-reported locations and GPS co-ordinates, paired t-tests were performed (Table 5.4). Participants self-reported a significantly higher number of trips out of the home compared with GPS data (p<0.001), significant and mean difference is reported in Figure 5.5 Bland- Altman plot of GPS vs self-reported total trips out of home. Participants also self-reported a higher number of out-of-home trips to recreational (p = 0.005) and commercial (p = 0.002) locations than observed in the GPS data (Table 5.4) (t(43) = 3.284, p = 0.002).

Table 5.4 Difference between self-reported location and GPS location accuracy

Location	Self-report n(mean) (SD)	GPS n (mean) (SD)	Mean difference	T-test	Significance
Total trips out-of-home	15.7 (5.6)	14.4 (5.8)	1.3	4.3	**<0.001**
Residential	2.5 (2.7)	2.5 (2.6)	0.0	0.0	1.000
Recreational	5.5 (4.2)	4.9 (4.1)	0.6	3.0	**0.005**
Commercial	6.3 (3.4)	5.6 (3.3)	0.7	3.3	**0.002**
Health	0.8 (1.2)	0.7 (1.1)	0.7	1.0	0.323
Local walk/ greenspace	3.8 (4.5)	3.6 (4.4)	0.2	1.8	0.071
CBD	1.7 (2.2)	1.7 (2.3)	0.0	-1.0	0.323
Place of worship	0.2 (.49)	0.3 (.51)	-0.1	-1.4	0.160

(Central business district (CBD). Bolding denotes significant p<0.05)

5.12 Discussion

This study describes the community participation of older adults living in the community, including the types of activities engaged in, and factors associated with participation. Feasibility of monitoring community participation using both objective (GPS) accelerometer-derived (GeneActiv) and self-reported methods (diary) was also investigated. Participants performed more activities

with social interactions out of home and visited commercial locations most frequently. Additionally, they were very active in terms of daily MVPA, with visits to local walk/greenspaces positively associated with increased activity. The combination of monitoring methods used in this study was feasible with this group of community dwelling older adults.

The self-reported general health of the older adults in this study was good or better, similar to 70 percent of older adults in Australia (AIHW, 2018). The participants in this study were active, engaging in over an hour of at least moderate intensity PA per day. Interestingly this is slightly higher than that demonstrated in community dwelling older adults in Germany who recorded 49 (± 39) minutes per day (mean age of 65-89) (Ortlieb et al., 2014) using triaxial GT3X accelerometers are comparable to the Esliger cut points as per this study analysis (Esliger et al., 2011). Overall, participants HRQOL scores matched Australian population norms for adults aged 65 and over (Richardson et al. , 2012), and demonstrated higher Mental Super Dimension (MSD) scores, which could reflect the health status, independence and social participation demonstrated by the participants in this study (Maxwell et al., 2016).

Participants in this study had a lower sleep quality compared to a Chinese cohort when measured using the PSQI outcome measure (Zhang et al., 2017). These scores could have been affected by the extreme temperatures during data collection, 22 participants carried monitoring devices on days with maximum temperatures over 35 degrees Celsius. As noted by previous research (van den Berg et al, 2015) and by the scoping review discussed in Chapter 4, weather conditions should be considered when using these methodologies. It is possible that the hot weather could have impacted daily minutes of MVPA, the frequency of trips taken out of home as well as minutes of sleep. Meaning that levels of MVPA for this group may be higher than reported during times of cooler weather conditions.

This study sample deemed themselves healthier than the general population and were more active than other samples of older adults, measured with comparable methods (Lohne-Seiler et al., 2014; Ortlieb et al., 2014). Sample bias could have contributed to the high levels of community participation described in this study. It is more likely that a healthy group would self-nominate for a study measuring community participation and PA, than would be experienced by the general population and less healthy groups. Thus, the need for interventions and awareness of the importance of community participation could therefore be more urgent than indicated from this sample.

5.12.1 Community participation

The majority of reported social interactions experienced out of home, at recreational and commercial locations, may reflect the high numbers of people and interactions required to access services in these locations (i.e., gaining access to leisure facilities through a receptionist). These results suggest older adults participate in more activities and social interactions out of home than in

residential settings. Social interaction is important for keeping older adults motivated and engaged (Yarcheski et al., 2004) and maintaining cognitive function (Wilson et al., 2007). Services promoting trips to residential and recreational locations could increase social interactions to promote healthy ageing. Interventions providing social interactions for people who are unable to participate in the community are an important consideration to maximise healthy ageing and should also be considered.

The results indicate that higher numbers of trips out of home are related to increased MVPA, with visits to local walk/greenspaces inclusive of PA which reflects previous findings (Stewart et al., 2016). Services promoting visits to local walk/greenspaces could assist with increasing the PA levels of older adults. In-home activities were mainly sedentary in nature, with sedentary time high in this active group, accounting for over 10 hours per day (Matthews et al., 2008). These findings agree with previous research where older adults were found to spend 80% (534 minutes) of their day sitting (Lewis et al., 2016). Self-reported diaries highlighted activities that participants engaged in between eating an evening meal and going to bed were predominantly sedentary, concurring with previous research that this time of day can be problematic for accruing sedentary time, with television watching commonly occurring during this time of the day (Hu et al., 2003; Reid et al., 2017; Veitch et al., 2016). Despite participants meeting the MVPA recommendations (Nelson et al., 2007), they spent a lot of time sedentary which suggests there is an opportunity to increase activity and reduce sedentary time even in an active community-dwelling population. Presumably less active older adults with varying levels of health participate in the community far less, which demonstrates the need to increase PA both in and outside of the home.

5.12.2 Feasibility of community participation measurement

Valid data sets were obtained from all participants except two, with self-reported and GPS locations similar on analysis, providing a detail rich picture of community participation. GPS data loss for this study was approximately 6 percent, acceptable data loss of 13 percent has previously been reported with a population of stroke survivors (McCluskey et al., 2012). The compliance with the 24h, 7d wear protocol with the GeneActiv accelerometer was excellent, with none of the participants removing the device during data collection. The successful retrieval of full data sets could be due to high levels of cognition and motivation to follow the protocol, or the reminders included in the protocol to ensure participant adherence. Participants reported that the flyers were useful as a reminder to charge the GPS device and take the devices when leaving the house. Self-reported diaries provided a backup, to determine location and often provided detailed descriptions of the location and activity performed that could not be interpreted from GPS or accelerometry alone (Moran et al., 2014).

The number of trips out of home were significantly higher when self-reported than detected by GPS, as were trips to recreational and commercial locations. Differences could be due to short-

duration trips taken which were not detected by the GPS device, or signal drop out. Despite being significantly different, the difference in visits to recreational and commercial locations equates to half a trip more over the 7-days, which accounts for the difference in self-reported total visits out of home. These findings are clinically significant as they take into consideration the nuances of trips out of home, despite the duration, to inform clinical practice. The combination of GPS, accelerometry and self-report was feasible with community dwelling older adults and can provide detailed information.

5.13 Conclusion

These findings suggest that community dwelling older adults are more socially and physically active out of home. The sample recruited were active and highly motivated, despite this, their daily sedentary time remained high, which is a concern as it places these older participants at risk of chronic health conditions. Results suggest that increasing the number of trips taken away from home and trips to local walk/greenspace could increase levels of MVPA, as well as the number of social interactions experienced by older adults. These findings are encouraging but are not conclusive and warrant further investigation to inform future interventions. Research is required observing populations of variable health status, who are at risk of social isolation and loneliness. Determining whether populations with variable cognition and/or health status can follow protocol using these combined measures, would inform the evidence base with regards to measuring community participation for older adults.

Despite self-reported community participation and GPS locations being similar on analysis, the use of the mixed methodological approach provided detailed location and context of community participation for older adults and is recommended for future studies. This active sample demonstrates the opportunity to increase PA and minimise sedentary behaviour at home, with considerations for both in home activity and community participation required in less active groups to increase PA. Furthermore, with the onset of COVID-19 in 2019 it provides a unique opportunity to investigate the impact of enforced social isolation on community participation, PA, social interactions, HRQOL, sleep quality and loneliness for older people.

CHAPTER 6:   **COMMUNITY PARTICIPATION OF
COMMUNITY DWELLING OLDER ADULTS:
PHYSICAL AND SOCIAL ACTIVITIES
DURING AND FOLLOWING COVID-19
SOCIAL ISOLATION**

6.1 About this chapter:

This chapter presents cross sectional mixed methods research, with combined qualitative and quantitative measures that identify changes in community participation from baseline, during and following the COVID-19 lockdown in Australia. Changes in PA and social activities, as well as HRQOL, sleep quality, and loneliness were investigated. Findings of semi-structured interviews which detail participant experiences of social distancing restrictions, social isolation and loneliness are presented in detail.

6.2 Research objectives

The aims of Chapter 6 were to:

- measure and compare the changes in community participation; PA and social interaction for a cohort of older adults living in the community, prior to, during, and following COVID-19 lockdown.
- understand the facilitators and barriers to community participation during lockdown from participants' perspectives and investigate what they would do if social distancing was required in the future, and-
- examine the impact of restrictions on QOL, social isolation and loneliness in community-dwelling older adults.

6.3 Background

In December 2019, the first case of COVID-19, an infection caused by the SARS-CoV-2 virus was detected in Wuhan, China (Koley & Dhole, 2020). The WHO declared a global pandemic on the 11th of March 2020, and millions of global cases and deaths have been reported since. The presence of COVID-19 has subsequently changed the way in which we approach every part of daily life. Major life events such as weddings and funerals have been cancelled, social distancing has occurred, lockdowns have been enforced and international travel put on hold (Koley & Dhole, 2020). Despite the obvious improvements in hand hygiene, and reduction in cases of Influenza, the scale of the pandemic has caused fear across the globe.

From early-on in the pandemic, it was well publicised that older adults and individuals with co-morbidities such as high blood pressure and lung diseases were at a higher risk of mortality should they contract COVID-19 (Shahid et al., 2020). Like many other countries, the Australian government recommended social distancing and isolation for vulnerable groups and older adults. These measures were implemented to reduce the risk of viral transmission and prevent healthcare services from becoming overwhelmed (Armitage & Nellums, 2020; Australian Government Department of Health, 2020).

Measures of social distancing, despite proving beneficial to reduce the transmission of COVID-19, present risks for older adults. As discussed previously, community participation is a vital component for healthy ageing and the QOL of older adults (Johnson and Mutchler, 2014; Robins, Hill, et al., 2018). The impacts of social distancing and enforced isolation in the form of lockdowns are relatively unknown. Understanding how older adults continued to participate in the community during COVID-19 lockdown restrictions would be useful to inform future management. Not only in the long-term management of COVID-19, but also for times where older adults commonly experience isolation, such as hospital admission, severe influenza outbreaks, and even on a smaller scale in the months following retirement.

A vast amount of research has been published detailing the impacts of COVID-19 worldwide. Following the declaration of a global pandemic levels of PA and step count reduced globally (Tison et al., 2020; Yamada et al., 2020) and corresponded with increased sedentary time, declining mental health, poor sleep quality, and loneliness (Cheval et al., 2021; Groarke et al., 2020). These studies provide useful insight into measures of health, however, due to the large sample sizes they use questionnaires often relying on memory to reflect on previous activity which may be subject to bias (Prince et al., 2008). Research that uses objective measures such as GPS and accelerometer derived measures of PA combined with qualitative measures may provide a more accurate and holistic picture of participation changes during the COVID-19 pandemic.

To date, there has been less COVID-19 research published with a focus on older populations. Studies have investigated whether suicide in older adults was influenced by COVID-19 (Wand et al., 2020) and attempted to decipher the opinions on vaccines (Seale et al., 2021). Strutt et al., (2021) (Strutt et al., 2021), examined how COVID-19 lockdowns impacted the lifestyles and health of older adults in Sydney, Australia, finding that older adults adapted to the situation and were resilient and used technology to remain connected with others. However, 1 in 5 older adults reported higher levels of anxiety and psychological distress during periods of lockdown (Strutt et al., 2021). There is little evidence that provides direct comparison of community participation and behaviour change in response to social distancing and isolation for older adults. The subjective perspective of older adults would provide a holistic overview of the impact of social isolation and could assist to inform future management and interventions to prevent reduced community participation

Therefore, the aims of this mixed methods study were to; 1) measure the changes in community participation; PA and social interaction for a cohort of older adults living in the community, prior to, during, and following lockdown, 2) understand the facilitators and barriers to community participation during lockdown from participants' perspective and what they would do if there were future periods of enforced isolation, and- 3) measure health-related factors including, HRQOL, sleep quality, social isolation and loneliness across the three monitoring periods.

6.4 COVID-19 Australian context

Australia's experience of the pandemic, lockdowns, and social distancing restrictions varied from that of other countries, likewise the experience between states across Australia was not homogenous. To provide context, a timeline is provided in Figure 6.1 which details the times of data collection and the corresponding social distancing restrictions in place.

2018   2019   2020

Data collection timeline (COVID-19 Statistics South Australia)

Data collection 1
17th of November 2018 to 10th of May 2019
(No cases or deaths)

Data collection 2
18th of April 2020 to 4th of June 2020
(435 cases at 18th of April to 440 cases 4th of June
Total deaths recorded = 4)

Data collection 3 and interviews
1st of September 2020 to 1st of October 2020
(463 cases 1st of September to 468 cases 1st of October
Total deaths recorded = 4)

South Australia Social distancing guidelines and COVID-19 Statistics

No restrictions
(Collection prior to COVID-19)

Gatherings of 100+ banned
'Do not travel' warning in effect
18th of March 2020

Cafes open, allowed to seat up to 20 people
(10 indoor, 10 outdoor)
22nd of May 2020

Borders to interstate and overseas travellers closed
24th of March 2020

Maximum of 10 people permitted indoors, indoor and outdoor sport cancelled, galleries, museums, libraries and health clubs closed
25th of March 2020

Stay at home unless it is necessary to go out
Vulnerable people should stay home where possible

10 people allowed to gather whilst social distancing
15th of May 2020

No cases of community transmission

Travel restrictions lifted, community sport can resume, 1 person per 4 metres applies for public activities

COVID-19 Timeline (Australia and Worldwide)

January 7th COVID-19 Identified by Chinese authorities

March 1st First Australian fatality from COVID-19

January 25th First case of COVID-19 in Australia

March 11th WHO declares global pandemic

Begin to ease
11th of May 2020

Figure 6.1 Timeline of data collections, social distancing restrictions and COVID-19 statistics in Australia and worldwide

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6.5 **Methods**

This study used an integrated mixed methods design methodology (Creswell, 2018), which included quantitative and qualitative measures collected from semi-structured interviews. The mixed methods approach allowed for investigation of complex processes that contribute to community participation (PA, social interactions, HRQOL, loneliness and sleep quality) in relation to health and health care providing a holistic overview (Fetters et al., 2013). Qualitative data were helpful to determine the validity of the quantitative results against lived experience (Fetters et al., 2013). An integrated parallel approach to data collection was taken, whereby quantitative and qualitative data were collected at similar times, and data analysed after the completion of data collection (Fetters et al., 2013). The two data sets were analysed separately and then merged to determine similarities and differences between the data sets which are provided in the discussion (Creswell, 2018).

Ethical approval was gained from the Flinders University Social and Behavioural Research Ethics committee (protocol no. 8176). An amendment was submitted and approved to return to previous participants who had completed a community participation baseline study, results of which are reported in Chapter 5.

6.5.1 **Participants**

For inclusion, individuals had to be aged 65 years or older, live in metropolitan Adelaide, be able to walk independently with or without walking aids, speak and understand English and have sufficient cognition to be able to understand study instructions. Individuals living in residential care facilities were excluded due to the restrictions on community participation. Participants were recruited using flyers that advertised the study through local councils, community centres and organisations for older adults and on social media platforms. Interested individuals were invited to contact the candidate who screened potential eligibility over the phone. Cognitive capacity was assessed using the SMMSE prior to obtaining consent, with scores over 25 required to participate (Molloy, 2014).

6.5.2 **Outcomes**

Outcomes are reported in detail in Chapter 5, with an overview presented below.

6.5.2.1 *Community participation*

Community participation was measured using GPS (Qstarz BT1000XT) to calculate the number of trips away from home, type of location visited and the number of in- and out-of-home activities over the three separate 7-day monitoring periods. The locations were identified and viewed on the street view of Google maps (Google, n.d.) to identify the location visited. The types of location were grouped into residential, recreational, commercial, health, local walk/greenspace, central business district (CBD) and place of worship (Gough, 2021; Hordacre et al., 2014). Locational data was

cross referenced with self-reported activity diaries to determine the purpose of the visit and to identify possible social interactions.

To provide context of community participation, self-reported participation diaries were completed by participants. These diaries reported the date, time, activity, duration, location, and social interactions that occurred outside of the home, as well as times of sleep and non-wear, an excerpt is provided in Appendix 6. This information was cross-checked against the quantitative data, to ensure accuracy of location where GPS data were missing and report participation in specific activities.

6.5.2.2 Physical activity, sedentary behaviour, and sleep

Physical activity was measured using GeneActiv triaxial accelerometers, these devices have been deemed reliable and valid for classifying the intensity of PA in adults (Esliger et al., 2011). GeneActiv. Bin files were converted into 60-second epoch files to determine overall daily PA and analysed using Cobra software (Francois Frayasse, University of South Australia). Cut points were used (adjusted for sampling frequency epochs) to identify times spent in light, moderate or vigorous PA (light 283, moderate 605, vigorous 1697) (Esliger et al., 2011). Sleep was identified using a combination of self-reported diaries and visual analysis of the activity trace and excluded from analysis.

6.5.2.3 Social interactions

The number of social interactions were self-reported in activity diaries by participants, allowing for the total number and location of social interactions to be identified across the three monitoring periods.

6.5.2.4 Health-related factors

The AQOL-8D questionnaire (Richardson, Sinha, et al., 2014) was used to measure HRQOL, sleep quality was measured using the PSQI (Mariman et al., 2012) and levels of loneliness were measured using the de Jong Gierveld loneliness scale (Tomás et al., 2017).

6.6 **Procedure**

The procedure, data processing and analysis are reported in-depth in Chapter 5. These procedures were repeated over three separate 7-day monitoring periods as detailed in Figure 6.1 and data compared between time-points. Ethical approval was obtained to contact participants via email and telephone and to deliver devices and resources to participant's letterboxes to maintain social distancing.

6.7 Quantitative analysis

Identifying information was removed from data, which were entered into SPSS software for analysis (IBM, n.d.). The normality of data was checked using Z scores, normally distributed data is reported in the results using means and SD, with non-normally distributed data reported using median IQR. Mann Whitney U tests were carried out to compare baseline with follow up samples. Non-parametric Friedman ANOVA tests were performed to detect for differences between paired baseline, lockdown, and post lockdown measures (Martínez-Camblor, 2010). Alpha was set at <0.05.

6.8 Interviews

Participants were invited to take part in a semi-structured interview to provide their experiences of community participation over the course of the research, and during times of social distancing. Interviews were carried out either in person (as social distancing restrictions allowed) or over the phone. Questions included, *'can you describe ways you did things differently to keep active physically and socially during times of social distancing restrictions?'* and *'do you think that your activities have returned to levels prior to the introduction of COVID-19 social distancing restrictions?'* A detailed interview guide can be found in Appendix 8.

6.9 Qualitative analysis

6.9.1 Phase 1

Interviews were recorded and transcribed verbatim. Transcripts were imported into NVIVO 12 Pro for content analysis (Bengtsson, 2016) which was driven by study research aims. Template analysis (Brooks & King, 2014; Brooks et al., 2015) was carried out by the candidate and a co-author who read through a subsample of transcripts and identified an initial list of themes. An interpretive phenomenological approach was used to discover the meaning and experiences of the lived experience (Pietkiewicz & Smith, 2014) (Larkin et al., 2008). This approach is useful in areas where not much is known, and has been used successfully in disability and rehabilitation research (Hutchinson et al., 2020; Ward Khan et al., 2021). For this study, the experience of social distancing and social isolation was investigated using semi-structured interviews, which are appropriate for generating rich descriptions and are consistent with the interpretative phenomenological approach (Pietkiewicz & Smith, 2014).

6.9.2 Phase 2

After identifying themes from the data, a concurrent mixed methodology approach was used. Data was collected at the similar time points and the quantitative and qualitative data was integrated to compare and combine experiences of community participation for older adults. As Creswell and Plano Clark (2017) suggest, mixed methods can be useful where one data source could be

insufficient to explore the complexity of a theme. An advantage of mixed methods is that the combination of methods can offset the inherent weaknesses of both quantitative and qualitative approaches, such as loss of GPS data and memory recall bias for subjective measures (Creswell & Plano Clark, 2017). This approach also allowed for the inclusion of the voices of the participants which was integral to understanding their experiences and reasons for behaviour changes.

6.10 Results

6.10.1 Participant characteristics

A subsample of 27 participants from the original sample of 44 who completed the baseline study (described in Chapter 5) participated in all three quantitative data time points, one data set was excluded from analysis as GPS data did not meet quality standards, having lost 132 hours of data. These results report on the 26 participants who provided full quantitative data sets and 19 participants also completed a semi-structured interview. All participants were community dwelling adults over the age of 65 with a mean age of 75 years (SD 5.2), the sample were predominantly female (n = 21, 81%), with 15 participants living alone (58%). All participants demonstrated normal cognition with an average SMMSE score of 28.9 (SD 1.5). Participants reported two chronic conditions on average with 12% reporting excellent health (n = 3), 61% very good health (n = 16) and 27% good health (n = 7). Full details of participant characteristics can be found in Table 6.1.

Table 6.1 Participant characteristics

Characteristic	All participants (n = 26)	Interview participants (n=19)
Gender (M:F) n (%)	5: 21 (19: 81)	3:16 (16:84)
Age mean (SD) years	75 (5.2)	74 (5)
BMI mean (SD)	28.3 (4.4)	30 (5)
Underweight n (%)	0 (0)	0 (0)
Normal n (%)	8 (30.8)	5 (26.3)
Overweight n (%)	7 (26.9)	3 (15.8)
Obese n (%)	11 (42.3)	11 (57.9)
Marital status n (%)		
Single/never married	1 (3.8)	1 (5.3)
Separated/divorced	9 (34.6)	8 (42.1)
Widowed	8 (30.8)	7 (36.8)
Married/defacto	8 (30.8)	3 (15.8)
Education level n (%)		
High-school	5 (19.2)	4 (21.1)
Post-secondary	10 (38.5)	6 (31.6)
Bachelor degree	7 (26.9)	3 (15.8)
Post-graduate	4 (15.4)	6 (31.6)
Index of Relative socio-economic advantage and disadvantage score (IRSAD) n (%)		
…1	3 (11.5)	2 (10)
…2	3 (11.5)	3 (16)
…3	6 (23)	4 (21)
…4	8 (31)	4 (21)
…5	6 (23)	6 (32)
Employment status n (%)		
Employed	2 (7.6)	1 (5.3)
Retired	24 (92.3)	18 (94.7)
Volunteer n (%)	15 (57.7)	14 (74)

No. of co-morbidities mean (SD)	2 (1.4)	2 (1.6)
Self-rated general health n (%)		
Excellent	3 (11.5)	2 (10.5)
Very good	16 (61.5)	11 (57.9)
Good	7 (26.9)	6 (31.6)
Fair	0 (0)	0 (0)
Poor	0 (0)	0 (0)
SMMSE mean (SD)	28.88 (1.5)	29 (1.6)

(Standard deviation (SD), Body mass index (BMI), Index of relative socio-economic advantage and disadvantage score (IRSAD) (higher score indicative of lack of disadvantage and greater advantage in general), Standardised Mini Mental State Examination (SMMSE), IRSAD score, low score denotes greater disadvantage and lack of advantage in general).

6.10.2 Community participation

During the lockdown period participants took less trips out of home, compared with baseline, and post lockdown with GPS data detecting more days where participants didn't leave the house. Over the seven-day monitoring periods, the number of in-home activities reported increased and out-of-home activities decreased (Table 6.2).

Table 6.2 Community participation trips out of home and activities at baseline, during lockdown and post lockdown

Variable (per 7-day period) (Median (IQR)) unless stated	Baseline	Lockdown	Post lockdown
Trips out of home	15 (9-19)	11.5 (7-16)	13 (9-17)
Participants reporting not leaving the house for a whole day (total)	9	14	10
Number of days without leaving the house (total)	16	26	15
In-home activities (self-reported)	12.5 (4-17)	36.5 (20-51)	31 (15-47)
Out-of-home activities (self-reported)	18.5 (13-25)	13.5 (8-20)	20 (12-21)
Activities reported (total)	33.5 (24-37)	47 (34-67)	49.5 (31-61)

The most frequently visited locations at baseline were commercial (median (IQR)) 5.5 (3-8) followed by recreational 3 (2-7), residential 2 (0-3), local walk greenspace 2 (0-8), CBD 1 (0-3), with no visits to places of worship identified. During COVID-19 lockdown the most commonly visited location type was commercial 6 (2-7), followed by local walk/greenspace 4 (1-10), residential 1 (0-3) with no visits to recreational, health, CBD, or places of worship identified. Post lockdown the most commonly visited location was commercial 7 (3-10), followed by local walk greenspace 3 (0-6), recreational 3 (1-4), residential 1 (0-2) and health 1 (0-2) with no visits to CBD or places of worship detected.

6.10.3 Physical activity, sedentary behaviour, and sleep

Total minutes of MVPA per day were (median (IQR)) 69 (33-110) at baseline, 57 (35-87) during lockdown and 55 (26-84) post lockdown. Minutes spent performing light, moderate and vigorous PA per day as well as times of sleep and sedentary times are reported in Table 6.3. Minutes of MVPA between baseline and during lockdown reduced for 73% (n = 19) of the sample and increased for 27% (n = 7). Levels of MVPA between lockdown and post lockdown increased for 46% (n = 12) and decreased for 54% of the sample (n = 14).

Table 6.3 MVPA, Sedentary time and sleep time of participants at baseline, during lockdown and post lockdown (min/d)

Variable	Baseline	Lockdown	Post lockdown
MVPA	69 (33-110)	57 (35-87)	55 (26-84)
Light PA	252 (181-300)	205 (163-265)	210 (155-272)
Moderate PA	69 (33-108)	57 (34-87)	55 (26-84)
Vigorous PA	0 (0-1.5)	0 (0-1)	0 (0)
Sedentary time (mean (SD))	652 (99)	685 (87)	680 (92)
Time of sleep (mean (SD))	481 (71)	472 (50)	495 (126)

6.10.4 Social interactions

Self-reported social interactions median (IQR) were 15.5 (8-20) at baseline, 9 (5-13) during lockdown and 11 (7-13) post lockdown. At baseline, 12 participants reported 23 days that they did not experience any social interactions, during lockdown 19 participants reported 47 days without social interaction and post lockdown 15 participants reported 37 days without social interaction. The locations of social interactions are provided in Table 6.4.

Table 6.4 Locations of social interaction at baseline, during lockdown and post lockdown (per week)

Social interaction location	Baseline	Lockdown	Post lockdown
Home	1.5 (0-5)	2.5 (1-5)	0 (0-2)
Residential	2 (0-4)	1 (0-2)	1 (0-2)
Recreational	2 (1-5)	0 (0-1)	2 (0-3)
Commercial	3 (1-4)	1 (0-2)	2 (2-4)
Health	0 (0-1)	0 (0)	1 (0-2)
Local walk/greenspace	0 (0-2)	1 (0-3)	0.5 (0-1.5)
CBD	1 (0-2)	0 (0)	0 (0-1)
Place of worship	0 (0-1)	0 (0)	0 (0)

6.10.5 Health-related factors

Participant HRQOL was recorded using the AQOL-8D questionnaire and was analysed across the eleven dimensions (Table 6.5). Sleep quality (mean (SD)) was 5 (3) at baseline, 6 (3) during lockdown and 5 (3) post lockdown. With scores over 6 indicating poor sleep quality (Buysse et al., 1989). Levels of loneliness (mean (SD)) were 1.5 (1.4) at baseline, 1.8 (1.2) during lockdown and 1.8 (1.6) post lockdown, with scores of five and above indicative of loneliness.

Table 6.5 Dimensions of HRQOL at baseline, during social distancing and following the easing of restrictions

Variable	Baseline	Lockdown	Post lockdown
HRQOL (Mean (SD))	85 (7)	83 (8)	82 (9)
Independent living	91 (10)	90 (10)	89 (10)
Happiness	81 (13)	80 (10)	79 (10)
Mental health	81 (9)	81 (7)	81 (7)
Coping	80 (12)	79 (10)	77 (10)
Relationships	89 (7)	85 (10)	86 (10)
Self-worth	87 (11)	89 (10)	78 (52)
Pain	82 (24)	81 (26)	77 (24)
Senses	86 (8)	84 (11)	83 (10)
PSD score	87 (10	86 (11)	84 (10
MSD score	84 (8)	83 (7)	81 (11)

(Super dimensions; Physical super dimension (PSD) inclusive of independent living, pain, and senses variables. Psycho-social super dimension (MSD) inclusive of mental health, happiness, coping, relationships and self-worth variables (Maxwell et al., 2016)).

6.11 **Statistical analysis**

The Mann-Whitney U test was performed to determine whether the follow up sample (n = 26) was reflective of the baseline group (n = 44). There were no significant differences between age, the number of trips taken out-of-home, MVPA, HRQOL, sleep quality or loneliness at baseline. Half of the participants completed the lockdown data collection during strict stay at home restrictions, and the other half following the opening of libraries and cafes where older adults remained advised to stay at home (May 2020). Despite the changes in restrictions, the Mann Whitney U test found no significant differences between participants who completed data collections with strict restrictions and those who were monitored following restriction changes.

Friedman ANOVA detected a significant change in the number of trips taken out-of-home between monitoring periods (p = 0.012). Significant post-hoc pairwise calculations identified a reduction in the number of trips taken out-of-home from baseline to during lockdown (p = 0.021), as well as a significant reduction in the total number of social interactions reported at baseline and during lockdown (p = 0.001).

Friedman ANOVA found difference in minutes of MVPA across the three monitoring periods (p = 0.030), but when adjusted for multiple comparisons the post hoc pairwise comparisons found no significant differences (baseline to post lockdown p = 0.055, and baseline to lockdown p = 0.080). Additionally, no significant difference was seen across the three monitoring periods for HRQOL (p = 0.204) or loneliness (p = 0.650). A significant difference was detected in sleep quality, with pairwise comparisons showing that sleep quality reduced from baseline to lockdown (mean change 1.12) and improved from baseline to the lessening of restrictions post lockdown (mean change 0.34), but no difference between lockdown and post lockdown restrictions were found.

6.12 **Qualitative results**

Qualitative data was collected until saturation was reached (n = 19), with five main themes identified from the transcripts, these described participants' perspectives, as well has highlighted the differences in experiences between participants. The themes were *Reframing of meaning, Redefining to maintain activities, Revision of risk, Reflection and renewal* and *Future planning*. The interaction between these themes, and the importance of reflection and renewal in the ongoing process of redefining community participation and future planning is illustrated in Figure 6.2.
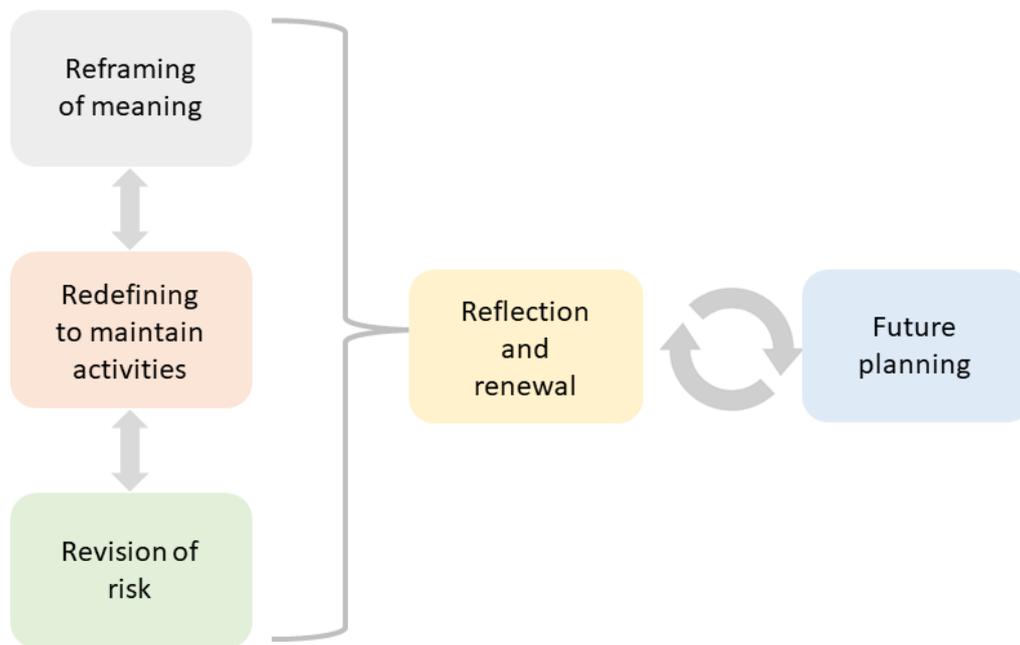
Figure 6.2 Interaction of qualitative themes

6.13 Reframing of meaning

Reframing of meaning refers to changes in the meaning of activities, their setup, environment, and their importance in the lives of participants. Meanings of activities were framed in both positive and negative ways, with some acknowledging how different their social interactions were in the context of social distancing restrictions:

I did see people, but it's not the way I would normally socialise because there were no lunches with mates, and no work/volunteering-related stuff Participant 3, 69-year-old female living alone)

Whilst others reported that the activities they had been participating in prior to restrictions perhaps weren't meaningful and fulfilling to them, restrictions provided the opportunity to complete other activities and attend to things that they had been putting off:

I found the whole thing easy because I got jobs done… yeah, jobs that I had been waiting to do for so long that take a long time to do, so I was grateful for the lockdown (Participant 7, 73-year-old female living alone)

Several participants reported that one of the hardest things was not being able to go out and get a *'good coffee'* whilst sitting down with a friend and having a chat. The process of getting a coffee became an organised, regimented activity, inclusive of incidental interactions with others, and good treatment that made one participant feel special and looked after:

So, every day, I would bop down and get a proper coffee, didn't touch anything, paid in advance so that I got Rolls-Royce treatment because I was the one that had paid– they all knew my name and they made really nice coffee for me and I just had that, and that was a real motivator because I could say g'day to people on the way down (Participant 31, 71-year-old female living alone).

The importance of activities such as getting a coffee, acted as a motivator for individuals and made them realise, and appreciate the incidental social interactions they experienced when leaving the house.

Following the easing of restrictions, some participants reframed the meaning of their activities in terms of what it was they liked about attending. For some, this highlighted that it was making coffee with others and the incidental chats in communal spaces that motivated them to attended:

When I think about it honestly, I really just don't like not being able to make a coffee – have a communal kitchen and do the communal things together. I realise that a large part of that activity was being communal, so we'd go into the kitchen and have a chat while waiting for the kettle to boil or the microwave and that, and they're not allowed (Participant 33, 71-year-old female living alone)

The process of reframing made participants consider the value of their activities, change the way they participated and, in some cases, stop attending activities altogether.

6.14 Redefining to maintain activities

Redefining to maintain physical and social activity describes the conscious adaptations participants made to keep up their physical and social activity during lockdown when organised groups and recreational facilities were closed. Seventeen participants reported ways that they redefined their physical and social activities to '*keep them*' during social distancing restrictions. Redefining activities related closely to feelings of control and for some acted as a coping mechanism.

6.14.1 Redefining physical activity

With gyms closed and organised exercise classes cancelled some participants simply replaced their physical activities:

I found myself, instead of going to work related things, I found myself going for more walks because I just needed to get out of the house (Participant 3, 69-year-old female living alone).

Many participants reported leaving the house with the intent to walk purely for exercise to replace previous commitments*:*

I did go out walking, as the exercises classes I went to stopped, so I was walking about three times a week (Participant 14, 72-year-old female living alone)

Yet some identified that the intensity of exercise was *'not the same,'* (participant 17, 68-year-old female) and that exercising alone was not as enjoyable as attending a group. Many of the participants looked to technology to redefine their PA, using the internet to find resources:

Initially I was doing a lot of exercises from YouTube on the screen, as well as walking and that was really great; so, I got my steps and I got my exercise (Participant 19, 72-year-old female living with son).

In contrast there was a portion of the cohort who made no attempt to redefine PA in their routine during this time:

I was very bad. I sat on my bum and didn't do enough, but I've now got a large knee brace on my right knee because various things that were going wrong with me because of age got worse because I didn't exercise enough, and I don't like exercise, I exercise because I have to, not because I want to and I'm afraid I did less (Participant 33, 71-year-old female living alone)

6.14.2 **Redefining social activity**

Participants were aware of the importance of social interactions and made conscious efforts to retain them. Social interaction was maintained by increasing the effort of reaching out to others, and were often re-defined using technologies that allowed for virtual face-to-face interactions:

Initially I made a point of ringing two or three people every day just so I could get some human interaction and that they could get some human interaction too. I very quickly learned how to use Zoom and talk to my daughter online and do things with my boys (grandchildren) and that kind of thing (Participant 19, 72-year-old female living with son).

The inclusion of social media and technologies were enjoyable for the participants during this time:

We were doing lots of Facetiming. And we were having the loveliest time. Especially doing those little icons where you could stick funny faces on and things. It was good because we sort of kept in touch (Participant 20, 71-year-old female living with friend).

The environment and social activities were redefined regularly in the community:

I would talk to the neighbours and I started doing a lot of cooking and baking. One of the, the girl in that unit is still in the workforce but she was working from home. So, I'd tend to make something and go around and give them all something. Then she'd make something. One day, she came in, she knocked at the door and she said, "Grab a cup of coffee and a chair. We're going to sit out on the driveway." So, the three of us did that, and that was nice (Participant 14, 71-year-old female living alone).

Participants reported participating in activities that they wouldn't have previously such as having a *'glass of wine together on the street in front of our* houses' (Participant 31, 71-year-old female living alone)*.* Despite the venues, length of time, and social activities changing over this period, social interactions were prioritised. Participants planned the modifications of their activities in an attempt to maintain them whilst following social distancing guidelines. However, some participants also felt that restrictions were open to interpretation and therefore activities could be maintained if appropriate social distancing was performed, often in outside spaces:

I missed the being able to go to the coffee shop, and things like this, but we found ways around that a little bit. You know, picking up a coffee, and we went and sat up at the memorial park there apart from one another, and stuff like that. That was – that was something that was quite enjoyable, to do that. Before, it was like, take something with you, if we wanted to go – if we wanted to go and have a catch-up, I'd cut sandwiches or something like that and we'd take a couple of chairs and sit down – down the – along the beachfront. And I found that you're a little bit up in the air to whether that was quite allowable, but I had police go past, and they'd just smile. So – but there was just two of us sitting there on a chair, good distance apart. They left us alone, you know (Participant 34, 77-year-old female living alone).

It was apparent that participants who didn't redefine physical or social activities reported social isolation and feelings of loneliness:

I did feel isolation and lonely at times… I would wake up about 5:00 o'clock in the morning. And suddenly you think about everything that you shouldn't be thinking about. And it always seemed to be magnified, because you think well, I don't know who I can talk to. I can't go out and have a cup of coffee with anyone. So, I did – I did find that a bit – I mean I didn't get the tearies. But I – I did find it was a negative. Yes, it was definitely a negative. And then I found I couldn't be bothered doing the things that I wanted to do (Participant 20, 71-year-old female living with friend).

6.14.3 Combining physical and social activity

Participants described making a conscious effort to combine their physical and social activities to maintain them. These combined activities often occurred outside to follow social distancing guidelines and were enjoyed by participants, even when contact was with passing strangers:

Thank goodness I have a couple of friends who like walking, so I walked a lot in company; so we were arm's length apart, we can still talk, but we could go for long walks and just get out in the fresh air and I'd go on my own sometimes and I'd find other people – just seeing someone else out on the street doing what you're doing and they're waving and saying hello even if you don't know them, made me feel better (Participant 19, 72-year-old female living with son)

I walk every day– the gym was closed so I organised a friend to come and I walked with him three times a week and that's been good value (Participant 16, 85-year-old female living alone).

6.15 Revision of risk

Revision of risk describes the process of participants estimating the likelihood of contracting COVID-19 from the activities and events that they attend and making decisions on their future attendance. This theme raised concerns for the future and feelings of fear and uncertainty for many participants, with some fearful of returning to previous activities:

I did eventually start going to the supermarket and the chemist. But I haven't been to any other places. I haven't been to a shopping centre yet. I hesitate a little to go where there are a lot of people (Participant 14, 72-year-old female living alone)

Others made the conscious decision not to attend over concerns that social distancing was too challenging in some circumstances and the risk was too great:

I go to one night of dancing less a week because of that- too many people there, and I think it's hard to keep social distance with so many crowded in the room, even though they are allowed to have them, I myself think it's too close. As well as being aware of others, *a lot of people don't want to start again. You know they're old and are a bit frightened of getting into the crowd again* (Participant 7, 73-year-old female living alone).

Participants who had chronic illnesses were particularly fearful of returning to their activities and frustrated at others who were healthy and did not understand the importance of following the rules. This was apparent in views around vaccinations:

Gardening club has re-started, but I don't go to it because I'm… If there is someone in there who's got an active COVID infection, and I get it then my chances of coming out of hospital alive are small…They just don't get it. They don't understand it because they are relatively healthy… there are some of us who can't mix with people who don't vaccinate (Participant 13, 67-year-old female living alone)

One participant was very aware of her need for community participation, having self-identified as a social person, on discussing the possibility of an extended lockdown commented that she would take a risk:

I just couldn't do it. I would take the risk. I would rather take the risk of getting COVID than being that isolated. I could do it for two weeks, quarantine you do it for medical reasons, but to do it just in case? No, I would rather take the risk and let it get me rather than just be so lonely (Participant 33, 71-year-old female living alone).

Participants surprised themselves in their reluctance to return to activities that they thought they would be desperate to get back to, due to concerns about the risk and their particular vulnerabilities to COVID-19:

The Prime Minister said we strongly suggest people over 70 or anyone who's got a pre-existing medical condition should stay home. And I thought oh damn, that's me. So, I rang my neighbourhood watch, my Meals on Wheels coordinator and said "I'm sorry. I have to stop", and then I sat down and cried for half an hour. I didn't go back for a while. Eventually, when Meals on Wheels said "we're happy to have people back", I said "no, I think I'll wait a little bit longer" (Participant 14, 72-year-old female living alone).

The direction for older adults to 'stay home', because they were at a higher risk of mortality if they caught COVID-19 was something that participants were aware of, with several stating that these recommendations made them frightened:

Being over 70 and they made us so fearful (Participant 31, 71-year-old female living alone).

On reflection, some participants who thought they had redefined activities and kept busy during social distancing found returning to 'normality' difficult, which made them aware of the effects the whole experience had had on them:

But initially I had thought, I've coped well, and it didn't bother me, but it has, that amount has bothered me, that I'd rather be outside doing things outside, doing exercise outside meeting people outside. Having activities outside, if they're inside then it's only meals or something like that, that don't take too long (Participant 17, 68-year-old female living with son).

6.16 Reflection and renewal

Reflection and renewal on the experience of lockdown and social distancing was described, with participants identifying activities that they missed:

I missed my recitals. I noticed it particularly last week because I went to the theatre for the first time in 6 months (Participant 3, 69-year-old female living alone).

Others noted the things they enjoyed during social distancing, *'I didn't feel the obligation to go and interact with people. It was wonderful'* (Participant 1, 75-year-old male living with wife). This reflection for some allowed them to identify changes they would like to make into the future, *'maybe I don't want to do the pace that we did before'* (Participant 11, 70-year-old female living alone).

Many participants decided to take up new activities that they had always wanted to do *'I have signed up to complete 5 kilometres every day for 10 days'* (Participant 22, 74-year-old female living

alone) and some made the effort to upskill their use of technology, *'Yeah, I think, for example, I've learned the - using remote to sort of teleconferencing skills, that's great'* (Participant 33, 71-year-old female living alone).

On reflection, participants were able to identify positives that had come out of social distancing:

I noticed everybody is cautious about hand sanitising and social distancing. So, I think that is a positive (Participant 20, 71-year-old female living with friend).

They also were aware of the low levels of flu and appreciated not having to wait when they attended a doctor's surgery:

It seems to me that whenever I turn up on time for an appointment I go straight in, and that's good because it used to be a long wait (Participant 18, 78-year-old female living alone).

For most participants, reflections turned into renewed appreciation for the activities they were able to return to:

I felt deprived because of no symphony, no seniors club, no entertainment, no library because I love my volunteering and thank God I am back to that! (Participant 4, 80-year-old female living alone).

Several participants when reflecting mentioned other people that they were concerned for, *'children's education'* (participant 1, 75-year-old male living with wife) and how that had been affected, as well as those less healthy and more vulnerable than themselves:

I'm quite concerned about some of the clients that I've been serving... So, I've met people, we would do a library delivery, they knew we were coming. They knew approximately what time and we roll up about 11:30 and there are people still in the dressing gown and pyjamas. No reason to get up and to get moving. It's a bit sad isn't it? So, I am concerned about some of the older folk who I work with that nobody is, reaching to them in any way. I mean we were just doing a drop off and we were under very strict protocols you know; you put it on the doorstep, you take back anything, but you don't go inside (Participant 3, 69-year-old female living alone).

6.17 Future planning

Participants were asked, *'What would you like to see in place to help you keep in touch with people and maintain your physical activity should we experience a second lockdown?'* Which overall they found difficult to articulate. Those who successfully redefined their activities during social distancing restrictions reported that they would do the same again:

We're like this for the next 12 months, so I've adjusted to that, I'm quite happy to be doing things and being very careful, very, very careful (Participant 22, 74-year-old female living alone).

Others suggested that having means of connection with others was vital, and that technology addressed this need:

Good technology, good internet, cheaper technology because I spent a lot of money upgrading technology (Participant 33, 71-year-old female living alone).

One participant liked to think that the exercise areas that they had set up at home would get more use:

It's hard to know, but I am a bit more confident that I would absolutely do a little bit more (exercise) in the garage in the gym area than I have been (Participant 11, 70-year-old female living alone).

6.18 Discussion

This mixed methods research combined quantitative and qualitative methodologies to investigate community participation in community dwelling older adults, identifying the number of trips taken out-of-home, in and out-of-home activities, locations visited, minutes of MVPA, social interactions, HRQOL, sleep quality and loneliness. During lockdown participants took less trips out-of-home, performed more in-home activities, reported fewer social interactions and reduced sleep quality. An overall reduction in minutes of MVPA was found during social distancing restrictions, with the majority of the sample demonstrating reduced activity during this time. The four themes that emerged from individual's perspectives; '*Reframing of meaning, Redefining to maintain activities, Revision of risk, Reflection and renewal* and *Future planning*,' highlighted the importance of maintaining community participation and the differences between the older adults recruited.

In comparison to studies evaluating Japanese older adults, participants of this study demonstrated higher cognition (Taniguchi et al., 2017) and self-reported good to excellent general health, similar to seventy percent of the Australian population (AIHW, 2018). Two chronic conditions were reported on average, with one third of the population reporting at least one chronic condition (AIHW, 2014). The majority of the sample were overweight following the general population trend for older Australian adults (AIHW, 2004). However, they were active, participating in an average of 87 minutes of MVPA a week (at baseline) and spent a vast amount of time sedentary. The overall HRQOL of the sample matched the general Australian population at baseline, and scores for dimensions of independent living and senses were higher than average (Richardson et al., 2012). Dimension scores for happiness, coping, self-worth, and pain were slightly lower than the general Australian population. The sample demonstrated much higher scores of mental health, relationships, PSD and MSD (Richardson et al., 2012).

The reduction in the number of trips out-of-home taken during lockdown was apparent in both quantitative and qualitative data. Conscious attempts to follow the rules were evident for older adults to protect themselves and others who they deemed more vulnerable than themselves. In conjunction, the number of people who didn't leave the house for a whole day increased during lockdown, when compared with baseline, highlighting that the governments social distancing recommendations to 'stay home' were followed. These findings reflect Finnish older adults who reduced the number of destinations they visited during times of social distancing (Portegijs et al., 2021). Personal accounts of this time acknowledge the loss of out-of-home activities, which was highlighted by the reduction of out-of-home activities and increased in-home activities reported. The overall number of activities reported during lockdown increased, however, this could be due to participants having less to do and reporting more monotonous 'every day' activities that were not reported at baseline.

Commercial locations were visited most frequently across all three time points, and perhaps highlights the dependence on these locations for older adults. Literature suggests that individuals in France experienced consumer attachment, whereby commercial settings offered familiarity, authenticity and security (Alain et al., 2014). Feelings of security during the uncertainty of COVID-19 lockdowns whilst taking trips out-of-home may explain the high number of commercial visits. In contrast, Portegijs et al. (2021) found that Finnish older adults only reported locations for exercise (Portegijs et al., 2021). These variations may be due to the differing number of confirmed cases of COVID-19 and variation in social distancing restrictions worldwide.

Globally, visits to urban parks during the pandemic increased (Geng et al., 2021). Which was evident in the increased number of trips to local walk/greenspaces during the lockdown period and linked with themes of redefining activities and reframing meaning. Whereby participants frequently adapted their activities, due to closure of recreational facilities and moved them outside. In conjunction, the trips to local walk/greenspace became inclusive of social interactions during the times of social distancing. This was not the case at baseline, or post lockdown, possibly because participants started returning to their previous activities and routines. However, Geng et al. (2021) found these visits and social interactions were effective for management of mental health and stress reduction for older adults (Geng et al., 2021). With evidence suggesting that visits to parks and greenspaces reduced the psychological burden from COVID-19 (Freeman & Eykelbosh, 2020).

Results provided a mixed picture for how participants redefined their activities to maintain PA. A non-significant reduction in minutes of MVPA was found across the time points, which corresponds with 79 percent of the sample who were less physically active during restrictions. These individuals did not redefine to maintain PA. However, 21 percent of the sample adapted their activity to maintain their PA, and on occasion increased it, with some describing the adaptation of indoor

activities to include PA, such as the YouTube exercises. The vast difference between participants is highlighted by the large IQR reported (29-101) for MVPA minutes during restrictions and may explain the insignificant overall results. As well as the response following lockdown, whereby the majority of the sample increased their MVPA (58%) however levels continued to reduce for the rest of the sample (42%). The reduction of activity in this study is higher than found in Japanese older adults where about half (47.3%) reduced their activity levels during restrictions (Suzuki et al., 2020). This difference may be due to the use of self-reported methods with older Japanese adults, or that at baseline the participants recruited were highly active. It should also be considered that due to COVID-19 and participant drop-out between baseline and follow-up monitoring periods, the reduced sample size means this research is underpowered to find differences in the levels of physical activity for this population.

During times of social distancing older adults relied on their technology to maintain social connections (Adams et al., 2021). Regardless of the increase in recorded telephone calls and use of social media in participant diaries, social interactions reduced significantly during times of social distancing which aligns with the decreased social interaction experienced by older adults in the USA (Adams et al., 2021). Despite attempts by participants to redefine their social activities to maintain them, the incidental and informal interactions that came with attending locations, such as recreational facilities, were lost. As previously discussed, some participants went out of their way to add social interactions to their local walks, however, the majority were not successful in replacing these interactions. Often feeling that substitute activities, phone calls and non-face-to-face interactions were not as meaningful or rewarding. Days without social interactions were reported by a higher number of participants during lockdown which did not return to baseline. Prior to social distancing restrictions another study reported 10 percent of 213 respondents did not experience any face to face social interactions for two days (van Den Berg et al., 2015). During restrictions 76 percent of the participants reported days with no social interactions face to face, or otherwise. Which highlights the social isolation experienced by older adults during and following lockdown.

Overall, HRQOL scores did not change significantly during the monitoring periods. Similar findings were reported with US older adults, however, increases in feelings of anxiety and less satisfaction with participation were found (Adams et al., 2021). In this study, HRQOL of participants reduced to match the general population average in dimensions of independent living and coping scores continued to decline below the normal population levels during and following lockdown (Richardson et al., 2012). When considered with qualitative data, HRQOL appeared to reduce for individuals who were not successful in redefining or reframing their activities.

Sleep quality significantly reduced from baseline to lockdown, yet quantitative results demonstrated increased sleep during these monitoring periods (mean of +8 minutes) and following the easing of restrictions (mean of +28 minutes). At baseline (Chapter 5), numerous participants wore GeneActiv

devices during extreme summer temperatures during baseline data collection which could have affected these results. The increase in sleep quality between baseline and post lockdown may be due to 'less worry' as the situation improved. However, this was not evident in the qualitative data or with other research that instead found significant reduction in fatigue during times of lockdown (Adams et al., 2021). This could be due to the high levels of activity demonstrated by participants in this research, who perhaps did not sleep as well when they were less active during the period of lockdown.

Loneliness levels did not change significantly, however, the sample were not classified as lonely at baseline and the de Jong Gierveld loneliness scale was likely not sensitive enough to detect changes. Despite the validity and reliability of the de Jong Gierveld loneliness scale, it has been acknowledged that the inclusion of positive or negative wording can change the response style (Penning et al., 2014), which is perhaps why levels of loneliness did not change for this sample. However, from the qualitative data it was apparent that some participants struggled with social isolation and feelings of loneliness during the restrictions, yet others were not affected, and some even enjoyed it. Highlighting that older adults are not a homogenous group (Stones & Gullifer, 2014), perhaps those that enjoyed social distancing were more introverted and enjoyed the excuse not to be sociable. It is also worth considering that a prolonged lockdown, with strict restrictions was only enforced for five weeks in South Australia. The experiences of loneliness would perhaps be different in states such as Melbourne where lockdowns have been prolonged.

When analysing the results, there seemed to be two different approaches to social distancing restrictions. One group accepted that they could not participate in their usual activities and stayed home performing sedentary activities such as using the computer, craft and online gaming. The other group adapted their activities to keep them, i.e. walking with a friend. Those who adapted generally reported a more positive experience and were able to consider others who were perhaps worse off than themselves, which Verhage et al. (2021) suggested allowed older Dutch adults to maintain both self-esteem and self-confidence during COVID-19. It is possible that if supportive services were available to assist individuals modify, reframe, and adapt their activities, the outcomes and experiences of social isolation and loneliness for older adults could be reduced.

6.19 Conclusion

This chapter suggests that during a period of enforced social isolation, due to COVID-19, the physical and social activities of community dwelling older adults changed. Older adults reduced their trips out of home during lockdown yet maintained their trips to commercial locations. Some participants acted to redefine and reframe their activities to maintain them following the closure of recreational facilities. Yet others accepted the loss of organised activities and experienced feelings of social isolation and loneliness which they were unable to overcome. These results report on a sample of older adults who were active physically and socially and were not lonely at baseline,

which raises concerns for older adults who were socially isolated and/or lonely prior to enforced social distancing and lockdown. How COVID-19 lockdown and subsequent social distancing affected older adults, in lesser health who were frail and vulnerable remains unknown. Yet is of high importance to be able to identify older adults at increased risk of social isolation. Further research is required to determine whether the experiences of more vulnerable older adults, such as those transitioning from hospital to home, reflect those discussed in this chapter, and whether services that assist older adults to actively reframe and redefine their activities may help to maintain community participation for these people.

CHAPTER 7:   **INTEGRATING COMMUNITY PARTICIPATION IN THE TRANSITION OF OLDER ADULTS FROM HOSPITAL TO HOME: A SCOPING REVIEW**

7.1 About this chapter

This chapter scopes the literature to determine whether community participation has been considered for older adults in their transition from hospital into their own homes. As previously discussed, older adults are at increased risk of social isolation and loneliness which in turn can result in poorer health outcomes. An event that has previously been deemed to increase the risk of social isolation and loneliness is discharge from hospital. This chapter reviews the available evidence and provides specific recommendations for transition care services to improve the reintegration of older adults back into their communities. Findings from this chapter have been published as; *Gough, C., Baker, N., Weber, H., Lewis, LK., Barr, C., Maeder, A., & George, S. (2021) Integrating community participation in the transition of older adults from hospital to home: a scoping review, Disability and Rehabilitation, 1-13 (*Appendix 9).

7.2 Research objectives

The aims of Chapter 7 were to:

- determine the extent to which community participation has been considered in the transition of older adults from hospital to home
- investigate how health-related factors of community participation have been measured in this population (PA, HRQOL, sleep quality and loneliness)
- identify interventions used to promote community participation for older adults returning home from hospital, and-
- identify perceived barriers and facilitators to community participation and consider recommendations for future transition care programs to inform guidelines

7.3 Background

In 2004, the Australian Government and State Territory Governments introduced the TCP in response to the ageing population and increasing costs of healthcare for older adults (AIHW, 2018). TCPs provide an individualised package of services to older people returning home from hospital to support their transition and prevent hospital readmission (AIHW, 2012). In Australia between 2010-11, 18,084 people received TCPs with two-thirds of service user's female (AIHW, 2012). Eligibility for TCPs is determined by the Aged Care Assessment Team (ACAT), with individuals required to be older adults who have completed acute care, be medically stable and have the capacity to benefit from supportive services to optimise their functional ability (AIHW, 2012). In the 2019 review of transition care, it was highlighted that the program was disconnected from the aged care policies already in place (Department of Health, 2019). Despite updates to aged care procedures and policies, transition care has remained unchanged and outcome measures that can capture holistic aspects of care were not used (Department of Health, 2019).

The aim of the TCP program is to enhance function, prevent extended hospital stay and delay premature admission into residential aged care facilities (Couzner et al., 2013; AIHW, 2011). The service is targeted at older people who require further care and support to return home (Couzner et al., 2013). The TCPs work towards optimising function for hospital discharged patients, providing them and their families additional time to make long term care plans where required (Couzner et al., 2013). Services provided in the TCP may include nursing support, personal care and low intensity therapy with the aim of restoring the recipient to optimal function (Giles & Australian Department of Health, 2008). Allied health professionals including Occupational Therapists and Physiotherapists have an important role in providing interventions that enable individuals to function in their home and community. TCPs are offered for up to 12 weeks, with a maximum extension of six weeks, to ensure the individual's needs are met (Australian Government Department of Health, 2021). Benefits of TCPs are widely reported (Kim & Thyer, 2015), including reducing unnecessary hospital stay, yet, little is known about whether these approaches promote community participation or conversely contribute to social isolation, loneliness and ongoing health issues (Coyle & Dugan, 2012).

When compared to the cohort of community-dwelling older adults reported on in Chapters 5 and 6, TCP users are often more frail than the general community, making them vulnerable to social isolation and loneliness from the loss of meaningful leisure activities (Provencher et al., 2018). Levels of frailty are predicted to continue to increase and could leave transition care services unable to meet the needs of future ageing populations (Department of Health, 2019). Service users are presenting with greater clinical, physical, and psychological needs with an increase in the number of patients with dementia, mental health issues and individuals in the early stages of palliative care (Department of Health, 2019). TCP services in South Australia accept clients with non-weight bearing fractures and therefore levels of mobility may be low and require a significant amount of support to live successfully in the community (AIHW, 2012). As discussed in Chapter 6, understanding community participation for older adults who are more vulnerable is important to guide future care and interventions.

Therefore, this scoping review aims to answer the question; '*How is community participation considered for older adults' transition from hospital to home?*'; with secondary enquiries '*how have the health-related factors of community participation been measured?*', '*what interventions have been used to promote community participation for older adults returning home from hospital?*', '*what barriers or facilitators to community participation have been identified?*', '*how prepared are older adults to return home into the community?*' and '*what recommendations have been made for future transition care services?*'

7.3.1 Materials and methods

This review was carried out using the guidelines of Arksey and O'Malley (Arksey & O'Malley, 2005) to determine the availability of current evidence following the updated PRISMA extension for scoping reviews (Tricco et al., 2018). The purpose of this scoping review was to summarise the existing literature and identify the gaps for future research. This review was prospectively registered with JBI Database of Systematic Reviews and Implementation Reports (Joanna Briggs Institute, 2018) as '*Community participation in the transition of older adults from hospital to home: A scoping review'.*

7.3.2 Search methods

A rigorous search strategy was developed, and peer reviewed by an experienced academic librarian. The electronic search was completed in December 2020 using five electronic databases (MEDLINE, EMBASE, CINAHL, Cochrane Library CENTRAL and Ageline) without date parameters. The search was inclusive of case studies, RCTs, qualitative, observational, and retrospective studies. Citations were exported into Covidence software (*Covidence*, 2018).

Wherever possible, both subject heading and keyword searches were completed. The search strategy from one database is included in Table 7.1**.** All searches were limited to the English language.

Table 7.1 Search Parameters for the Medline database

Older people		Community participation		Physical activity		Transition care	
Subject headings	**Keywords**	**Subject headings**	**Keywords**	**Subject headings**	**Keywords**	**Subject headings**	**Keywords**
Aging/ OR Aged/ OR aged 80 and over/ OR frail elderly/	Geriatric* OR gerontology* OR retire* OR elder* OR eldest OR frail* OR geriatric* OR old age* OR oldest old* OR senior* OR senium OR very old* OR septuagenarium* OR octogenarian* OR nonagenatian* OR centarian* OR centenarian* OR supercentenarian* OR older people or older subject* OR older patient* OR older age* OR older adult* OR older man OR older men OR older male* OR older woman OR older women OR older female* OR older population* OR older person*	Community participation/ OR community integration/ OR leisure activities/ OR social participation/	Participation OR leisure	Walking/ OR running/ OR exercise	Activity OR exercise OR walking OR running	Transition care/	Transition OR transitional OR transfer/ hospital OR care OR service OR program OR support Or hospital/home OR posthospital OR aftercare

(Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R)) *truncation symbol

7.3.3 Screening

Following the removal of duplicates, two independent reviewers completed the screening process in two rounds. The first involved screening of titles and abstracts against the pre-defined eligibility criteria, and the second involved screening the full texts. A third independent reviewer was available to resolve conflicts. Where the abstract was unavailable, or ambiguity existed, the full text was obtained for further review. Reference lists of all selected articles were screened to identify any other relevant articles.

7.3.4 Eligibility criteria

The population of interest was adults aged 60 years and older transitioning from hospital to home care. Studies reporting a subgroup of age 60 years and older were included. Studies reporting on community participation of individuals returning home from hospital, community leisure activities, social activities and PA were included. As the intention of this scoping review was to scope the literature for consideration of community participation, articles describing study protocols were excluded.

Studies with a mean population age under 60 years and/or transitioning from hospital to supportive facilities or aged care facilities were excluded due to the restriction on community participation. Studies that focused on in-home PA were excluded, as were studies with populations that were palliative, had dementia or psychosis.

7.3.5 Data extraction

A spreadsheet was developed using Microsoft Excel for data entry and management. Data were extracted from the included full text articles by the candidate, with a random sample (25%) extracted by a second independent reviewer to ensure agreement. The country of study, study type, condition/diagnoses of participants, study aims, measures of community participation and PA, interventions, results, and key findings were extracted.

7.4 Results

The initial search identified 2,206 studies, with 19 meeting the inclusion criteria. Twelve studies included measures of community participation, yet community participation was not the focus of the studies, nor was it discussed; therefore, these twelve articles were excluded (acknowledged as a subgroup in Figure 7.1). Exclusions are detailed in Figure 7.1, with a summary of the included studies provided in Table 7.2. The additional record (Zidén et al., 2009) was found in the reference list of on an included study.
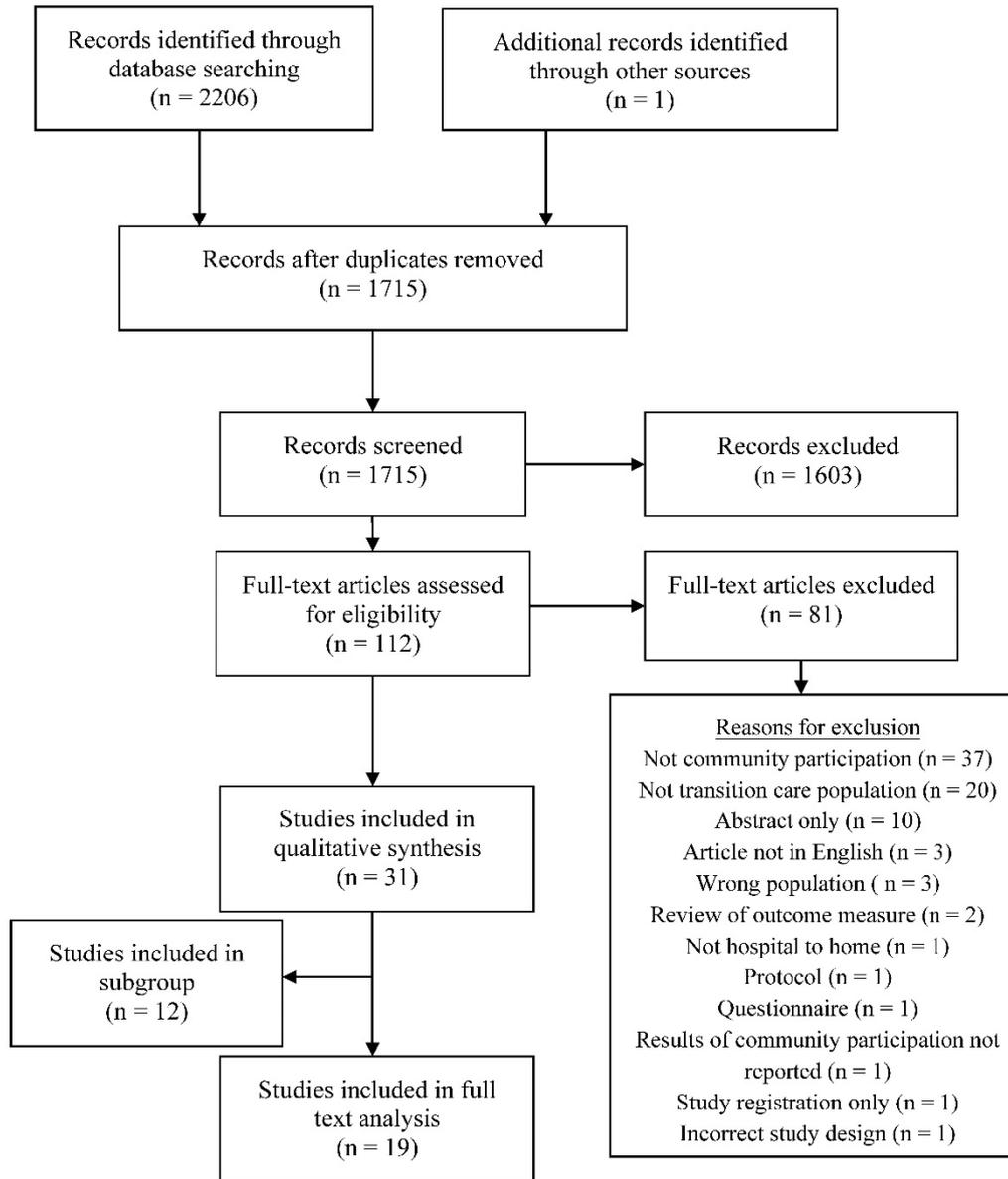
Figure 7.1 Screening process flow chart

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Table 7.2 Summary of included studies

Article (year)	Country	Title	Study type	Participant condition or diagnoses	Sample size and mean age (SD)(years)	Study aims	Measure of Community Participation	Measurement of PA used	Key findings
Anderson et al., (2002)	Denmark	Follow-up services for stroke survivors after hospital discharge - a randomized control study	RCT	Stroke patients, with persisting impairment and disability who were discharged into their own homes	N = 155 Age INT1-HVP group 69.8 (9.9), INT2-P1 74.1 (11.4) and Control 68.3 (12.3)	To evaluate whether follow-up services for stroke survivors could improve functional outcome and reduce readmission rates	FAI and Index of Extended Activities of Daily Living.	_	Low levels of community participation, function and social interaction were identified in this sample of stroke patients. Further research is required to determine how to support stroke survivors resume social and leisure activities.
Bouffioulx et al., (2011)	Belgium	Satisfaction with activity and participation and its relationships with body functions, activities, or environmental factors in stroke patients	Descriptive	Stroke or CVA patients	N = 45 Age 69 (10.7)	To report the body functions, activities and environmental factors in stroke patients during the acute, post-acute, and chronic phases and to investigate their relationships over time with the patients' perceived satisfaction of activity and participation.	SATIS stroke questionnaire was used to measure satisfaction with activities and participation.	Walking ability ABILOCO questionnaire	Satisfaction with activity and participation tended to increase over time. Similar to the improvement in manual and locomotion abilities, there was a significant improvement in satisfaction with activity and participation between the acute and post-acute phases, but not between the post-acute and chronic phase.
Brown et al., (2016)	USA	Comparison of post hospitalization function and community mobility in hospital mobility program and usual care patients. A randomized clinical trial	RCT	Older adults, hospitalized for medical illness	N = 100 Age 73.9 (9.6)	To examine the effect of an in-hospital mobility program on posthospitalization function and community mobility one month after discharge.	LSA	Accelerometry (experienced technical failure- no data obtained)	In-hospital mobility interventions prevented loss of community participation at one-month post hospitalization when compared to usual care.
de Weerd et al., (2011)	Netherlands	Perceived wellbeing of patients one year post stroke in general	Observational	Ischaemic stroke patients, L side 61%	N = 244 Age 77 (range 65-91)	The purpose of this study was to examine the wellbeing of patients who returned home immediately after	Interviewed with specific questionnaires about way of life. Multiple	Self-reported measures	A high percentage of participants (63%) had trouble maintaining their hobbies following

		practice-*recommendations for quality aftercare*				discharge from hospital, at one year post stroke, in comparison with the general Dutch population of the same age and to determine factors that could influence wellbeing	choice questions to determine activity, habit and occupational changes.		discharge home. 2% quit their hobbies and 34% could not do them as often as before the stroke. 57% of patients engaged in fewer physical activities due to restrictions caused by stroke. 7% had to cease all PA. Patients who could not perform housekeeping, exercise, participate in hobbies or visit family and friends showed significantly lower HRQoL.
Dijkerman et al., (1996)	UK	Long-term outcome after discharge from a stroke rehabilitation unit	Observational	Stroke survivors	N = 57, (SAH n=7) Age 66 (11.2)	To examine social activities, cognitive, emotional and environmental consequences following stroke.	FAI	_	There was a mean reduction in outdoor activities of 45%. All but 4 of 57 subjects were less active after stroke
Fathi et al., (2017)	USA	Life-space assessment predicts hospital readmission in home-limited adults	Observational (from an existing RCT sample)	CHF or COPD hospitalized from home	N = 478 Age 59 (11), RLS 64 (12)	To describe the association between restricted life-space and characteristics of community- dwelling adults, to estimate the effect of hospitalization on post discharge mobility, and to determine whether baseline restricted life-space predicts hospital readmission.	LSA	_	A high proportion of the sample were home limited (77.8%). Baseline restricted life-space was associated with greater risk of hospital readmission within 90 days.

Hill et al., (2019)	Australia	Falls After Hospital Discharge: A Randomized Clinical Trial of Individualized Multimodal Falls Prevention Education	RCT	New onset stroke or other neurological conditions. Orthopaedic diagnoses such as hip fracture, functional decline, general medical conditions or reconditioning after acute surgery.	N = 382 (Intervention n = 194, control n = 188) Age intervention 77.4 (8.8), control 78.1 (8.5)	To evaluate the effect of providing a tailored multimedia falls prevention education program plus usual care on falls rates in the 6 months after hospital discharge.	Katz index and IADLs	_	IADL scores at baseline (prior to admission) Intervention group 7 (5-8), 6 months post discharge 5 (5-6). Levels of functional ability and community participation declined following hospital stay.
LeClerc et al., (2002)	Canada	Falling short of the mark. *Tales of life after hospital discharge*	Qualitative descriptive and exploratory approach	_	N=14 qualitative interviews, n=4 (photonovellas) Age 84.3 (range 72-83)	The purpose of this study was to describe and explore the everyday issues, challenges, struggles, and needs of elderly, community-dwelling women in the first 6 to 8 weeks posthospital discharge. To identify insights from everyday experiences in order to inform discharge planners, service providers, and policy makers; and add to the scarcity of knowledge concerning this segment of the population.	Qualitative	_	All 14 women described their posthospitalization experience as one composed of physical and emotional struggles. The daily course of recovery was characterized by excessive fatigue and decreased mobility, which altered the women's ability to engage in even basic activities of daily living such as attending to hygiene and toileting, affected their capacity to socialize, and influenced their emotional ability to cope.
Lin & Chang, (2004)	Taipei	Functional recovery among elderly people one year after hip fracture surgery	Qualitative interview study	Individuals who had experienced femoral neck fracture (FNF) and intertrochanteric fracture (ITF) due to falling	N = 103 Age 78.31 (5.84) range 65-93	To follow up on physical functional recovery one year after hip fracture. To understand the factors that affect physical functional recovery after hip fracture.	IADL Outdoor walking	_	Prior to hip fracture 73.8% of the sample could walk outdoors independently. Only 58.2% of patients could do so one year following fracture.

Martinsen et al., (2015)	Denmark	Being back home after intermediate care: the experience of older people	Qualitative Interview study	_	N = 12, range 65-87 years	The aim of this study was to explore older people's experiences of being back home after a stay in the intensive care unit.	Interviews	_	The older people referred to what they used to be able to do and they expressed a strong wish to get back to their previous functional level. To be able to move about inside the home was important; however, getting outside had a special value and was a sign of recaptured freedom. Limitations imposed by loss of mobility combined with an increased responsibility for their own physical training generated experiences of isolation and loneliness.
Melin & Bygren, (1992)	Sweden	Efficacy of the rehabilitation of elderly primary health care patients after short-stay hospital treatment	RCT	Most common diagnoses were of the circulatory system, predominantly cardiovascular diseases. Other frequent diagnoses were disorders of the musculoskeletal system, neurologic and psychiatric disorders and unspecified problems and symptoms.	N = 249, team group (n = 150) and a control group (n = 99). Age 80.5	The purpose of this study was to investigate the impact of a primary home care intervention program on the functional outcome of and utilization of long-stay hospital services by elderly dependent patients after their discharge from a short-stay hospital	Outdoor walking	_	Social activities were found to have doubled in both groups from baseline to follow up. Team group recorded higher scores for ADL-functions and walking outdoors from entry to follow up compared with controls.
Melin & Bygren, (1993) (Uses the same data set as Melin & Bygren, (1992))	Sweden	Perceived functional health of frail elderly in a primary care programme and correlation of self-perception with objective measurements	RCT	Cardiovascular diseases 24%, other circulatory diseases 20%, Fractures and other traumatic injuries 10%, musculoskeletal diseases 11%, unspecified or symptoms 5%,	N = 249, team group (n = 150) and a control group (n = 99). Age 80.5	The specific aims were to assess the impact of a primary home care intervention programme on self-rated functional health, and to examine how self-rated functions in frail elderly people are related to	Outdoor walking	_	In general patients seemed to overrate their physical health. They tended to overestimate social contacts compared with objective scoring, measured as the number of contacts.

				Psychiatric disorders 7%, diseases of nervous system and sensory organs 6%, Other diseases 17%			objectively rated functions.			
Melin et al., (1995) (Uses the same data set as Melin & Bygren (1992))	Sweden	Health outcomes of post-hospital in-home team care: Secondary analysis of a Swedish trial	RCT	Cardiovascular diseases 24%, other circulatory diseases 20%, Fractures and other traumatic injuries 10%, musculoskeletal diseases 11%, unspecified or symptoms 5%, Psychiatric disorders 7%, diseases of nervous system and sensory organs 6%, Other diseases 17%	N = 249, team group (n = 150) and a control group (n = 99). Age 80.5	Aims were to identify patient risk/protective factors for selected health outcomes in this frail older population, whether modifiable or not; and using multivariate analysis, to explore whether specific patient subgroups may be at risk given either in-home team or usual care.	Outdoor walking	_		Patients who had more than 2 social contacts in the week before randomization were twice as likely to have higher IADL scores. Participants in social activities in the week before randomization were over four times as likely as nonparticipants to be ambulant without personal assistance; Patients receiving in-home team care were almost three times as likely to achieve ambulatory independence as usual-care patients: this was a statistically significant result in multivariate analysis.
Reay et al., (2015)	Australia	The patient's experience of early discharge following total hip replacement	Qualitative	Total hip replacement (THR)	N = 10 Over 65 (range 65-85)	The aim was to describe the post-discharge experience of elderly patients following primary THR	Discussed in qualitative interviews	_		Mobility restrictions experienced following discharge prevented participants from engaging in their normal activities, which resulted in limited social contact with others. Consequently, social isolation was a common experience amongst the participants.

Redeker et al., (1995)	USA	Women's patterns of activity over 6 months after coronary artery bypass surgery	Time series, descriptive-correlational	Females post Coronary artery bypass surgery (CABS)	N = 13 Age 62 (10.76) Range 43-78	To examine the relationships between objectively measured activity patterns over 6 months after CABS and their relationship to self-reported functional recovery at 6 weeks and 6 months after CABS.	SIP	Accelerometry	Activity levels increased up to 6-months. Although all but one of the subjects had returned to their normal activities of daily living at 6 months, the timing of daily routines and duration of activities (e.g., work, household activities, leisure) was not obtained.
Smith & Fields, (2020)	Australia	Changes in older adults' impairment, activity, participation and wellbeing as measured by the AusTOMs following participation in a Transition Care Program	Retrospective clinical audit	Orthopaedics 42.7%, neurological 21.8%), medical 20.1%, surgical 13.6% and mental health 1.8%.	N = 110 Age 80.4 (8.54) Range 63-97.9	To understand the impact the TCP is having on older adult occupational performance in their ADLs. To (a) describe the changes in impairments, activity limitations, participation restrictions and distress/wellbeing of clients participating in the TCP, between admission and discharge, using a retrospective clinical audit; and (b) describe which AusTOMs-OT scale the TCP clients experience the most significant changes in.	Australian Therapy Outcome Measures for Occupational Therapy (AusTOMs-OT)	AusTOMs-OT	Clients using Transition Care Programs experienced significant improvements in activity limitation and participation restriction. Benefits of using outcome measures such as AusTOMs-OT to quantify and validate client change were highlighted for clinical use.
Taylor et al., (2010)	_	Community ambulation before and after hip fracture: a qualitative analysis	Qualitative	Hip fracture	N = 24, 12 receiving inpatient rehabilitation and 12 discharged home to continue therapy. Age 76.6 (7.5) inpatient, 80.6 (7.5) outpatients.	The main aim of this qualitative study was to explore the perceptions of people undergoing rehabilitation after hip fracture about mobility levels around the home and in the community before and after hip fracture.	London Handicap Scale	_	The majority of people with a hip fracture were functioning at a lower level in their community before they had fractured their hip. With reduced walking and mobility both in the home and the community. All participants were either not walking outside or walking much less than they used to. Positive feelings present prior to

									discharge seem to diminish when the reality of returning home became apparent.
vanSeben et al., (2019)	Netherlands	"I Feel Worn Out, as if I Neglected Myself": Older Patients' Perspectives on Post-hospital Symptoms After Acute Hospitalization	Qualitative interview study	Pneumonia, dyspnoea, sepsis, heart failure, urinary infection, bacterial infection and dysregulated diabetes.	N= 20 Age 82.7 (7.82)	The objective was to characterize patient experiences regarding recovery at home during the first month after an acute hospitalization.	Semi-structured interviews	_	Patients indicated that they had not taken up their usual leisure activities following discharge. With reduced motivation and a fear of falling apparent. Patients appeared to be passively waiting to recover.
Zidén et al., (2009)	Sweden	Long-term effects of home rehabilitation after hip fracture - 1-year follow-up of functioning, balance confidence, and health-related quality of life in elderly people	A randomized, controlled longitudinal study	Hip fracture	N = 102 (Home rehab n = 48, CC n = 54 Age 81.2 (5.9) Rehab, CC 82.5 (7.6)	To investigate the long-term effects of home rehabilitation (HR) after hip fracture in elderly people. The aim of the intervention was to help every person who had been able to walk outdoors pre-fracture to resume walking outdoors within the rehabilitation period.	IAM, FAI	_	The focus of the physiotherapy intervention was to encourage self-efficacy and physical activity with special attention to outdoor ambulation. Forty persons (85%) in the HR and 36 persons (75%, NS) in the control group were back to pre-fracture outdoor walking ability 1 year after hospital discharge. The HR group regained outdoor walking ability significantly faster than the control group.

(FAI- Frenchay Activity Index, CVA- Cerebrovascular accident, LSA- Life Space Assessment, CHF- Chronic heart failure, COPD- Chronic obstructive pulmonary disease, IADLs Instrumental activities of daily living, THR- Total hip replacement, CABS-Coronary artery bypass surgery, SIP- Sickness Impact Profile, IAM- Instrumental activity measure, SPPB- Short Physical Performance Battery).

Overall, 19 studies published from 1992 to 2020 measured community participation for a transition care population Table 7.2. Articles were inclusive of a range of diagnoses; numerous conditions included in one study sample (n =7)(Fathi et al., 2016; Hill et al., 2019; Melin & Bygren, 1992, 1993; Melin et al., 1995; Smith & Fields, 2020; van Seben et al., 2019), stroke (n = 4)(Andersen et al., 2002; Bouffioulx et al., 2011; de Weerd et al., 2011; Dijkerman et al., 1996) and hip replacement or fracture (n = 4) (Lin & Chang, 2004; Reay et al., 2015; Taylor et al., 2010; Zidén et al., 2009) were the most frequently represented, followed by unknown diagnoses (n = 2) (LeClerc et al., 2002; Martinsen et al., 2015), cardiac conditions (n = 1)(Redeker et al., 1995), and medical illness/acute medical admission (n = 1) (Brown et al., 2016). There were seven randomised controlled trials (RCTs)(Andersen et al., 2002; Brown et al., 2016; Hill et al., 2019; Melin & Bygren, 1992, 1993; Melin et al., 1995; Zidén et al., 2009) and qualitative studies (n = 6) (LeClerc et al., 2002; Lin & Chang, 2004; Martinsen et al., 2015; Reay et al., 2015; Taylor et al., 2010; van Seben et al., 2019) included, with three observational (de Weerd et al., 2011; Dijkerman et al., 1996; Fathi et al., 2016), two descriptive (Bouffioulx et al., 2011; Redeker et al., 1995) and one retrospective clinical audit (Smith & Fields, 2020).

7.4.1 **Measures of community participation**

Numerous measures of community participation were reported across the included studies. Semi-structured interviews and qualitative measures of community participation were reported in six studies (de Weerd et al., 2011; LeClerc et al., 2002; Lin & Chang, 2004; Martinsen et al., 2015; Melin & Bygren, 1992; Reay et al., 2015), three studies used the Frenchay Activity Index (FAI) (Andersen et al., 2002; Dijkerman et al., 1996; Zidén et al., 2009), which includes a category of outdoor activities such as walks, social occasions and outings (Holbrook & Skilbeck, 1983). Three studies measured outdoor walking (Melin & Bygren, 1992, 1993; Melin et al., 1995). Two studies used self-reported Life-Space Assessments (LSA) (Brown et al., 2016; Fathi et al., 2016) which measure community mobility, using the distance which an individual has moved through (Peel et al., 2005). Two used Instrumental Activities of Daily Living (IADL) (Hill et al., 2019; Lin & Chang, 2004), with single studies using Extended Activities of Daily Living (Andersen et al., 2002), SATIS stroke questionnaire (Bouffioulx et al., 2011), Sickness Impact Profile (SIP) (Redeker et al., 1995), London Handicap Scale (LHS) (Taylor et al., 2010), Katz index (Hill et al., 2019), the Instrumental Activity measure (Zidén et al., 2009) and the Australian Therapy Outcome Measures for Occupational Therapy (AusTOMs-OT)(Smith & Fields, 2020) (Three studies reported two measures of community participation (Andersen et al., 2002; Hill et al., 2019; Zidén et al., 2009)). The reported level of community participation was interpreted by the authors depending on the outcomes used compared to normative data. Community participation was reported as low in three studies (Andersen et al., 2002; Brown et al., 2016; Fathi et al., 2016) and reduced (following medical episode) in eight studies (de Weerd et al., 2011; Dijkerman et al., 1996; Hill et al., 2019; Lin & Chang, 2004; Reay et al., 2015; Taylor et al., 2010; van Seben et al., 2019; Zidén et al.,

2009). Eight studies did not report levels of community participation demonstrated by older adults. No studies reported high levels of community participation in an older population receiving transition care.

7.4.2 Physical activity

Physical activity was measured in five of the included studies (Bouffioulx et al., 2011; Brown et al., 2016; de Weerd et al., 2011; Redeker et al., 1995; Smith & Fields, 2020), two studies used accelerometers (Brown et al., 2016; Redeker et al., 1995), however, one study did not obtain any data due to technical failure (Brown et al., 2016). Single studies used the Walking ABILICO questionnaire (Bouffioulx et al., 2011), AusTOMs-OT (Smith & Fields, 2020) and self-reported measures (de Weerd et al., 2011). The other 14 studies did not measure PA.

7.4.3 Health Related Quality of Life

Five studies measured HRQOL. The SF-36 was used in two studies (de Weerd et al., 2011; Zidén et al., 2009) and the AQOL-6D (Hill et al., 2019), Sickness Impact Profile (Redeker et al., 1995), and London Handicap scale (Taylor et al., 2010) were both used once.

7.4.4 Sleep quality

Sleep quality was reported in semi-structured interviews following hospital discharge (van Seben et al., 2019). Other measures included asking whether problems were experienced with sleep (yes/no) (Dijkerman et al., 1996) and the Sickness Impact Profile (Redeker et al., 1995).

7.4.5 Loneliness

Six included studies reported mood/depression measures which included loneliness. No specific loneliness outcome measures were used. The depression subscale of the Hospital Anxiety and Depression Scale (HADS) was used to measure mood level (n = 3) (Brown et al., 2016; de Weerd et al., 2011; Dijkerman et al., 1996), with the Geriatrics Depression Scale (GDS) full version (n = 1)(Hill et al., 2019) and Short Form (n = 1) (Brown et al., 2016), and the CES-D (Center of Epidemiologic Studies - Depression Scale) used once (Zidén et al., 2009).

7.4.6 Community participation interventions

Five included studies reported interventions to change the behaviour of older adults receiving transition care (Table 7.3), three studies reported on the same data and have therefore been counted as one intervention (Melin & Bygren, 1992, Melin & Bygren, 1993; Melin et al., 1995), another study used TCP services as the intervention and has therefore been omitted from Table 7.3 (Smith & Fields, 2020). Four of the five studies reported improving components of community participation such as LSA scores, IADLs, outdoor walking, participation (FAI), independence in locomotion, number of outdoor activities and HRQOL. However, effect sizes were small, interventions were sparse and methodologies variable. One study reported no differences in post

discharge falls following intervention and a decrease in IADL function scores following discharge (Hill et al., 2019). Only one intervention study reported re-admission rates, with 46% of the intervention group and 44% of the control group being readmitted to hospital (Melin & Bygren, 1992). All interventions included increased support from physicians and/or practitioners in the transition process.

Table 7.3 Community participation interventions

Reference	Study type	Intervention	Outcome
Anderson et al., (2002)	RCT	Three types of aftercare allocated to groups 1) Follow up care by physician 2) Physiotherapist's instruction in patient's home, and 3) Standard aftercare	No statistically significant differences between groups (at 6 months). However, groups 1) and 2) demonstrated higher scores indicating better function.
Brown et al., (2016)	RCT	In hospital mobility program (MP) assisted with ambulation up to twice daily and a behavioural strategy was used to encourage mobility. Patients in usual care (UC) group received twice-daily visits.	One month following discharge LSA score was higher in MP group. LSA score was similar to admission scores for MP group. UC group LSA declined.
Hill et al., (2019)	RCT	A workbook and digital video was used to present information about falls and falls prevention specific to the post-discharge period. Therapists had face to face structured discussions with each participant to tailor the information to be personally relevant for their medical and social circumstances. Therapists helped each participant to develop a documented goal-oriented action plan to be used once they arrived home. Therapists made phone calls for 3 months after discharge to reinforce education and to modify the plan as appropriate.	There were no significant differences in falls rates between intervention and control groups.
Melin & Bygren, (1992), Melin & Bygren, (1993) & Melin et al., (1995) (3 articles reporting on the same dataset).	RCT	Primary home care intervention program. Intervention group were provided with physician led primary home care and home assistance services on 24-hour basis vs control group who received standard care.	Significant improvement in IADLs and outdoor walking was found.
Zidén et al., (2009)	Longitudinal RCT	Home rehabilitation program: 1st phase included in hospital goal setting and support to reduce 'uneasiness' about discharge. 2nd phase included home visits by OT and PT for 3 weeks, with the aim to try and get every patient who was walking outdoors prior to hip fracture walking outdoors in the rehabilitation phase.	One-year post discharge the intervention group reported significantly higher independence in self-care and locomotion, balance confidence with stairs, perceived physical function. Participated in a greater number of outdoor activities, more outdoor walking and had higher HRQOL when compared with the control group.

(Mobility program (MP), usual care (UC), occupational therapist (OT), physiotherapist (PT), life space assessment (LSA), independent activities of daily living (IADL), health related quality of life (HRQOL)).

7.5 Barriers and facilitators to community participation

7.5.1 Barriers

Of the included studies, six reported barriers to community participation (Dijkerman et al., 1996; LeClerc et al., 2002; Martinsen et al., 2015; Reay et al., 2015; Taylor et al., 2010; van Seben et al., 2019). Barriers to community participation, were mostly discussed in observational and qualitative studies. The main barriers reported were: a decline in physical function, including reduced mobility, pain, weakness, stiffness and balance (Dijkerman et al., 1996; LeClerc et al., 2002; Martinsen et al., 2015; Reay et al., 2015; Taylor et al., 2010; van Seben et al., 2019). These barriers resulted in limitations with the ability to carry out ADLs, specifically hygiene needs (i.e. continence and showering) which then related to a reduction in social interactions, reluctance to venture out of home and fatigue (LeClerc et al., 2002). Presence of co-morbidities were associated with less walking in the community (Taylor et al., 2010) as were access issues in and out of the home (LeClerc et al., 2002). Walking in poor weather, for example wet conditions (LeClerc et al., 2002), being unable to drive (Martinsen et al., 2015) or access transport were factors that prevented participants from attending follow-up medical appointments (Reay et al., 2015).

7.5.1.1 Access restrictions

Despite participants communicating that getting outside was important to recapture their freedom (Martinsen et al., 2015), restrictions in accessing the outdoors were commonly mentioned. In one study, 30% of participants (n = 57) reported difficulties with getting in and out of the home, with 21% having difficulty accessing their own garden (Dijkerman et al., 1996). There was also a mean reduction of almost 45% of outdoor activities following stroke, with only four participants returning to their pre-stroke levels of activity (Dijkerman et al., 1996).

7.5.1.2 Transport

Six studies acknowledged that access to transport and often inability to drive acted as a barrier to community participation (de Weerd et al., 2011; Dijkerman et al., 1996; LeClerc et al., 2002; Martinsen et al., 2015; Reay et al., 2015; Redeker et al., 1995). The loss of driving license and inability to return to driving was particularly limiting for stroke survivors (de Weerd et al., 2011; Dijkerman et al., 1996) and prevented participants from attending important appointments e.g. '*I should have gone yesterday but I couldn't get transport, my wife can't drive all the way over there*' (Reay et al., 2015, pp. 135). Inability to drive or access transport was a cause of frustration, and the lack of access to public transport led individuals to rely on family members or friends (Martinsen et al., 2015; Redeker et al., 1995).

7.5.1.3 Social isolation and loneliness

Two studies quoted participants describing themselves '*like prisoner's in your home*' (Taylor et al., 2010, pp. 1287; LeClerc et al., 2002, pp. 251) with other participants reporting '*hospitalization was pleasant due to the company they had there*' (van Seben et al., 2019, pp. 319). A lack of social

interaction was commonly discussed by participants, with mobility issues often causing the reduction in socialisation after returning home. Limitations caused by a decline in mobility, combined with the responsibility for their own physical training, generated social isolation and loneliness (Martinsen et al., 2015). Ability and motivation to socialise was affected by the strength and effort required to attend to personal hygiene, including incontinence issues (LeClerc et al., 2002; Martinsen et al., 2015). A lack of individualised assessment caused feelings of frustration and abandonment, which highlighted low levels of social interaction (Reay et al., 2015). This left individuals feeling isolated and unable to attend to their usual activities (Reay et al., 2015), increasing their feelings of social isolation. A high number of stroke patients reported making fewer visits to family and friends following hospitalisation, which resulted in loss of social contacts (de Weerd et al., 2011).

7.5.1.4 *Fear*

Feelings of fear were reported as a barrier to community participation with many participants fearful of falling e.g. *'I would like to walk outside again but I feel so uncertain. I'm not standing on my feet properly'* (van Seben et al., 2019, pp. 322). Fear of falling and poor balance contributed to individuals not returning to their previous activities (Taylor et al., 2010). The fear also extended to the prospect of being alone when returning home (LeClerc et al., 2002), becoming homebound or being forced to move into residential care facilities (Martinsen et al., 2015). Fear was an underlying factor which reduced motivation to venture out of home and participate in the community.

7.5.1.5 *Depression, fatigue, and apathy*

Participants reported depressive thoughts, and identified feelings of being '*unable to cope*' (LeClerc et al., 2002, pp. 249) on returning home from hospital. The physical limitations they experienced resulted in constant challenges and strained their emotional ability to cope (LeClerc et al., 2002). In conjunction, the thought of being dependent on carers and family members, resulted in participants' feeling a burden to others (Martinsen et al., 2015). Loss of independence was viewed as demeaning, a reluctance to ask for assistance due to pride was expressed and conceding to services, such as having food delivered, was '*considered a defeat and a sign life was going downhill*' (Martinsen et al., 2015, pp.426).

7.5.2 **Facilitators**

Facilitators were not specifically identified in any of the included articles, however, being able to drive, or returning to driving was deemed as important for returning to community participation (Taylor et al., 2010).

7.6 **Preparedness to return home**

To examine the recommendations for future transition care services with the intention to promote community participation, it was important to consider how prepared older adults were to return

home. Hospital discharge plans were described as falling *'short of the mark'* because they did not reflect the complexity of experiences encountered on discharge (LeClerc et al., 2002, pp. 249). Participants noted that assessments were limited to basic needs such as bathing, which left them feeling unprepared for life at home following discharge (LeClerc et al., 2002). Inadequate assessment for adaptive equipment resulted in unsuitable aids being provided, resulting in individuals making unsafe mobility choices e.g., ascending stairs with a rollator frame (Reay et al., 2015).

All qualitative studies noted the confronting and overwhelming nature of returning home. Individuals often experienced shock, as they felt unprepared for the difficulties they would face, and were unsure whether their experience was normal (LeClerc et al., 2002; Martinsen et al., 2015). The question was raised as to whether inpatient rehabilitation promoted unrealistically optimistic expectations about the ability to cope at home (Taylor et al., 2010). As an inpatient, individuals received regular visits from loved ones, full support with cleaning and catering was provided, yet on returning to the community they received much less support and attention (Taylor et al., 2010). In conjunction, information was limited regarding community services available on discharge (Dijkerman et al., 1996), and led to participants passively *'waiting to recover'* (van Seben et al., 2019, pp.322).

7.7 Recommendations for future transition care services

There were common themes in the included studies' recommendations for transition care. These included, considering community participation and social interaction, meeting mobility requirements, using a patient-centred approach, receiving thorough assessment, providing appropriate patient education/information and the inclusion of psychological services. These are further described below:

7.7.1 Community participation

Recommendations were made for transition care services to focus on maintaining patients' previous activities (de Weerd et al., 2011), and take the time to determine how to support stroke survivors return to social and leisure activities (Andersen et al., 2002). To improve the wellbeing of stroke patients beyond discharge. Recommendations were made to incorporate outdoor walking as part of transition care programs to return participants to previous levels of mobility and improve HRQOL (Martinsen et al., 2015; Zidén et al., 2009).

7.7.2 Mobility requirements

Transition care services were identified as an important service to support functional outcomes, that could prevent hospital readmission (Andersen et al., 2002). Meeting mobility requirements to

enable individuals to participate both inside and out of the home and to prevent falls was considered vital (LeClerc et al., 2002).

7.7.3 Social interaction

The importance of social interaction and the risk of social isolation and loneliness were discussed in two studies (Bouffioulx et al., 2011; de Weerd et al., 2011) with recommendations that therapists identify contextual factors. For example, the physical environment could be modified to facilitate performance of activities of daily living, leaving individuals less fatigued, and able to participate socially. Further investigation was recommended to determine whether ADL independence would improve the number and/or quality of social interactions (de Weerd et al., 2011). Health care professionals were not always aware of the impact of social isolation on recovery (Reay et al., 2015).

7.7.4 Patient centred approach

Despite patient centred discharge plans being recommended, this did not occur due to the focus on early discharge (Reay et al., 2015). One included study customised the individual management of transition out of hospitals with Chronic Heart Failure (CHF) and Chronic Obstructive Pulmonary Disease (COPD) patients. Baseline LSA scores were used to determine that those with a lower score were at an increased risk of re-admission (Fathi et al., 2016).

7.7.5 Thorough assessment

A thorough assessment of an individual's living environment, including access to their home, and bathroom, was recommended prior to discharge. Detailed assessments were deemed integral to reduce access issues and feelings of isolation (Dijkerman et al., 1996). Modifications were vital to reduce the number of falls (Lin & Chang, 2004) as part of the discharge planning process (LeClerc et al., 2002). It was recommended that symptoms be assessed in the post discharge period to identify the patients who were at risk, and help to prevent further functional decline (van Seben et al., 2019).

7.7.6 Patient education and information

Patient education was recommended to empower individuals in their independence and to manage their expectations when returning home (van Seben et al., 2019). Improvements to education and information provided were proposed (LeClerc et al., 2002) and included: information about the transition process, to give a better idea of what to expect; broadening of the scope of discharge planning and teaching to assist patient's to anticipate their needs in the recovery process; to alleviate fears of what to expect when returning home (LeClerc et al., 2002).

7.7.7 Psychological services

Recommendations were made to include psychological evaluation using standardised outcome measures as part of transition care (Reay et al., 2015). Improved access to psychology services was recommended for stroke patients (Dijkerman et al., 1996) to assist individuals who feel unable to cope on returning home.

7.8 Discussion

Studies that considered community participation of older adults who transition from hospital to home were sparse, with a mix of qualitative and quantitative methods. The populations and measurements of community participation in the included studies were variable, with no standardised methodologies evident. Concerningly, none of the included studies reported high levels of community participation, which is perhaps reflective of older adults returning home following a hospital stay, or the interpretation of community participation relying on the participants feelings and perceptions. Despite Australia providing TCPs for 16 years, only two of the included studies collected data from participants in Australia, highlighting that research in this area remains scant.

Levels of PA were measured infrequently using both self-report and accelerometry. Self-reported measures often include bias and therefore may not provide accurate representation of PA (Brusilovskiy et al., 2016; George & Gough, 2018). Additionally, the use of accelerometry in these articles was limited by technical failure, with levels of adherence and cut points unknown. Measures of PA are currently not a component of assessment for TCPs. Further understanding of PA in this population could inform interventions that support older adults to meet activity guidelines, maintain healthier lifestyles, and promote community participation.

Measures of HRQOL can be useful to determine a person's ability to cope and may allow for earlier detection of complications that arise on returning home. The measure provides an individual's perception of how their health is affecting their participation (Karimi & Brazier, 2016). However, the included studies measured HRQOL infrequently, with a variety of methods and often focussed on carer burden which makes generalization of HRQOL difficult across a broader population. Sleep quality was not a focus of the included research, yet it was acknowledged that sleep issues influenced the fatigue experienced by participants following discharge (van Seben et al., 2019). Similarly, loneliness was a common theme throughout the qualitative literature, yet not the specific focus of outcome measures used.

Interventions to increase community participation were limited and despite the majority reporting improvements, sample and effect sizes were small and methodologies variable. Interventions provided increased support through the process of transition from hospital to home. Yet none

provided social support or education sessions which was identified as a shortcoming of TCP services.

There were numerous barriers to community participation and PA identified in the included literature. These barriers prevented participants from functioning and participating in their home and community environments as they would have liked to. TCPs aim to improve the capacity for independent living (Australian Government Department of Health, 2021). Despite this, limitations in access to both homes and gardens were reported throughout lived experiences. The inability to leave the house, or get back in, contributed to the reduction in community participation and outdoor activities. In conjunction, accessing suitable transport has previously been identified as a barrier to attending outpatient appointments, causing stress and suboptimal arrangements (Cain et al., 2012). The included articles reinforce the struggles that participants experience with organising and accessing transport on returning home.

Social isolation and loneliness were underlying themes throughout the literature, with participants feeling like prisoners in their own homes. Individuals who experience significant life transitions, such as a health crisis are at high risk of social isolation (Kaye & Singer, 2019). Social isolation can reduce life expectancy and increase rates of dementia, falls and self-reported health (Kaye & Singer, 2019). In the included articles, feelings of isolation and loneliness were often linked back to mobility issues which caused reduction in trips out of home and opportunities to socialise.

In conjunction, the fear of falling prevented people from leaving their homes and participating in their communities. Many experienced a loss of balance which reduced their confidence in their own ability (Taylor et al., 2010; van Seben et al., 2019). Fear of falling was a significant barrier to leaving the house and participating in the community.

Feelings of depression and apathy were underlined by the fatigue individuals experienced on returning home. Independently bathing, dressing, and cooking were exhausting. Performing activities of daily living (ADLs) highlighted physical restrictions and moods declined resulting in apathy and lack of motivation to participate in both physical and social activities.

Facilitators were not reported in the included studies, which is perhaps a limitation on informing recommendations and future interventions. However, regaining the ability to drive for some was a facilitator to get back out in the community and return to pre-morbid activities. Therefore, considerations should be made for when the return to driving is not achievable due to functional limitations and options for community mobility facilitated.

7.9 Implications for transition care services

The importance of transition care services for older adults should not be underestimated. Whilst providing assistance with shopping and low-level therapy to improve mobility, these services also

act to facilitate community participation by motivating older adults. Services act to increase confidence and allow individuals to regain control and increase their independence. However, despite the best intentions of transition care delivery, the scope of previous research suggests that service users were not prepared to return home following hospital stay. Returning home was often described as a shock, with many participants feeling confused as to whether their experience was reflective of others. On leaving hospital, individuals were often provided with unrealistic expectations of the transition home. This coincided with preparation and education on discharge from hospital being rushed, and exposed people to making unnecessary risks when returning home (Pollack et al., 2016). This highlights that discharge procedures should be prioritised, with increased education and resources provided to enable individuals to return home feeling confident and supported.

Throughout the literature, older adults deemed returning to their previous leisure activities and being able to walk outside as important goals. However, it was evident that transition care services were not successful in incorporating previous activities and outdoor mobility into their support services, which often left users feeling frustrated. Interventions that incorporate outdoor walking, leisure, and social activities into the transition from hospital to home are required. Reviewing the scope of practitioners and the appropriateness of clinical working hours is suggested to support activities that occur in the evenings. Health practitioners should not be confined to the scope of their clinical practice. Enabling individuals to return to previous activities that were meaningful should be promoted and services should focus on providing support to build stamina. To date it appears that education and support are provided during working hours which may be something that service providers need to review to support older adults return to their evening social activities.

The consideration of mobility requirements for transition care users is integral to the success of transition from hospital to home. Qualitative research identified that some individuals were unable to access their own home, or the outdoors which subsequently prevented them from leaving the house. As Chapter 5 suggests an increased number of trips out of home is linked to increased PA, the inclusion of low-level therapy services may not be enough for some service users and may act to increase the risk of social isolation if not addressed. Therefore, meeting the mobility requirements of individuals prior to discharge can reduce the 'fear of falling' and increase the capacity of this population to venture out of home and participate in outdoor community activities required to age in good health (LeClerc et al., 2002).

Previous research has identified that individuals with social support attained better health outcomes than those who lacked social support (Shen et al., 2004). The importance of social interaction for recovery is crucial to the success of transition from hospital to home, despite this, our knowledge of social interaction in this population is limited. Health practitioners possibly lack awareness of the importance of social interaction to recovery, and due to time restraints, do not

consider social integration a priority (Turcotte et al., 2018). Therefore, services are recommended to maintain, and where possible increase the ability of services users to participate in social interaction.

The included literature encouraged service agencies to rethink their admission criteria to reflect the needs identified as important to the person, thus, meeting individual needs, focussing on independence in valued activities and supporting individualised recovery (LeClerc et al., 2002; Zidén et al., 2009). A patient-centred approach inclusive of biopsychosocial factors, such as physical health and the surrounding environment, has previously led to successful integration back into the community (Taylor et al., 2010). Independence in self-care tasks may not be the priority for everyone receiving transition care, thus, individualised assessment and intervention is important to increase strength, prevent fatigue, and provide the skills to enable participation in valued social and physical activities.

Results of this review included recommendations that the education of patients prior to returning home would give them a better idea of what to expect, reducing the shock of the transition and assist with problem solving. These findings agree with previous research that determined patients lacked sufficient detail of what to expect, as patient education on day of discharge was often ineffective with patients rushing to get home and staff members under time pressures (Cain et al., 2012). This resulted in patients being unable to translate their knowledge into safe practice on returning home. In general, teaching appeared to be a low priority, yet to reduce readmissions, better education preparation is required prior to discharge day.

A lack of information provided to patients regarding community services they could access meant that they were passive in their recovery and waiting to recover. As per previous literature, patients need to be involved in decision making, taking ownership of their treatment goals to take active responsibility for their recovery (Baker et al., 2020), regain self-efficacy and manage their illness (Pollack et al., 2016). Emotional support through this process is required for both patients and caregivers (Pollack et al., 2016), yet these services are currently not integrated into TCPs and would assist individuals cope with the often-daunting transition from hospital to home.

Transition care services should not only look to reintegrate people back into their communities. But should assist to educate the individual with the coping skills and resilience to allow them to thrive at home. The unrealistic expectations that some people leave hospital with need to be reviewed and addressed to ensure that returning home is a positive experience.

7.10 Conclusion

Despite TCPs being provided in Australia for over 16 years, research considering community participation for service users remains scant. This chapter highlights the often-unrealistic

expectations of returning home from hospital and lack of awareness for community resources which may add to the challenges of returning home from hospital. The included literature acknowledged the health benefits of community participation and the success of interventions, however activities that service users deemed important are often out of the scope of the clinical practitioner's expertise and/or normal working hours. Services appear to focus more on functional mobility and less on returning clients to their meaningful activities with future services required to provide adequate information to prepare individuals for what to expect on returning home from hospital. Whilst targeting an individualised approach to maintaining valued leisure and social activities which in turn can improve mobility, reduce falls, and increase community participation and HRQOL in this population. Future research should focus on the community participation for more vulnerable groups and their changes in behaviour due to periods of social isolation to inform future management.

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CHAPTER 8:   **TRANSITION FROM HOSPITAL TO HOME DURING COVID-19: A CASE REPORT FROM AN AUSTRALIAN TRANSITION CARE PROGRAM**

8.1 About this chapter

This chapter presents the case study of a TCP client who completed GPS, accelerometry and self-reported diary monitoring on returning home from hospital, and at the end of her TCP. These measures were taken prior to the introduction of COVID-19 social distancing restrictions, with all follow up monitoring ceased due to changes in social distancing restrictions. This case study provided the opportunity for in-depth insight into the experience of returning home from hospital during the COVID-19 global pandemic. With the aim to determine whether a TCP user could maintain community participation whilst social distancing measures were in place. Results of this chapter are published as; *Gough, C., Hutchinson, C., Barr, C., Maeder, A., & George, S. (2021). Transition from hospital to home during COVID-19: A case report from an Australian transitional care program. The Allied Health Scholar, 2(1), 1-19* (Appendix 10).

8.2 Research objectives

The aims of Chapter 8 were to:

- investigate community participation, PA, barriers, and facilitators for participation of an older adult receiving a TCP prior-to and during social distancing restrictions (COVID-19).

8.3 Background

The scope of the literature presented in Chapter 7 identified numerous barriers to community participation that older adults had to overcome on their return home from hospital. Despite the intentions of transition care services to assist older adults in this vulnerable transition period, service users were underprepared and often shocked by the difficulties they faced. Older adults were restricted by access, transport, social isolation, loneliness, fear and often presented signs of depression, fatigue, and apathy. These factors prevented them from reintegrating into the community and participating in their usual, meaningful activities.

These barriers were heightened at this time as Australians were advised to stay at home unless performing essential activities and to maintain a social distance of at least 1.5 meters from others to manage the COVID-19 pandemic. A maximum of 10 people were permitted indoors and pubs, hotels, gyms, entertainment venues, galleries, museums, and libraries were closed. These restrictions were perhaps felt most by the older members of society, as they were singled out as being the most vulnerable to COVID-19. Concerningly, socially isolated older adults who were previously identified as more likely to seek medical assistance to satisfy the need for social interaction (Gerst-Emerson & Jayawardhana, 2015) did not seek medical assistance during the COVID pandemic, in fear of contracting the virus. This has resulted in a trend towards delayed care for acute issues such as coronary symptoms and stroke (Holt et al., 2020). In accordance,

during this time, the Australian Government acknowledged that transition care services could be restricted for service users and TCP clients may not be able to receive the services they needed, due to isolation, health advice or other factors (Government, 2020). Despite the best intentions of supportive services following hospital discharge, some older adults prior to COVID-19 restrictions described themselves *'like prisoners in your own home'* (Taylor et al., 2010) (p. 1287). When older adults are presented with such challenges returning home from hospital, it is unclear how the addition of social distancing guidelines and periods of lockdown due to COVID-19 may impact upon the transition home from hospital, and the subsequent health of older adults. Therefore, the effects of disruption to supportive transition care services and the impact of the COVID-19 pandemic on the utilisation of multidisciplinary health services, targeting restorative care of people over 65 years of age warrants investigation.

8.4 Aims

The original aim of this study was to explore community participation, PA, barriers, and facilitators for participation in older adults during and after community transition care programs (CTCPs), answering the question *'do transition care programs promote active community participation?'* Due to the global pandemic this research was not plausible with a vulnerable older population. Therefore, ethics were amended to report on the data of one participant, collected prior to lockdown, and the study aim adjusted to explore community participation, PA, barriers, and facilitators for participation of an older adult receiving a TCP prior-to and during lockdown and social distancing restrictions (COVID-19). The specific research question was, *'Can an older adult returning home from hospital prior to and during social distancing restrictions maintain community participation?'*

8.5 Ethical approval

Ethical approval was gained from Southern Adelaide Clinical Human Research Ethics Committee (SAC HREC). An amendment to carry out a telephone interview and publish the account of a single participant was sought and approved. Research was carried out following the rules of the Declaration of Helsinki of 1975 and informed written consent was obtained

8.6 Case Presentation

The participant, '*Kathy*,' was an 83-year-old female, who was living alone in her own home. She reported no chronic health conditions and 'good' overall health. She was admitted to hospital with a head injury following a fall and received a residential transition care program (RTCP) in a rehabilitation facility prior to returning to her own home with a CTCP. Her services were approved for 45 days, including assistance with cleaning tasks, shopping, and physiotherapy. Following hospital admission, Kathy demonstrated reduced mobility, and was reliant on a rollator frame at

home, and four wheeled walker outside of home. She was no longer able to drive due to the nature of her injury, although referrals had been made for reassessment.

8.7 Timeline

Kathy's CTCP began prior to social distancing restrictions on the 24th of January 2020 and concluded on the 9th of March 2020. A timeline of data collection and COVID-19 social distancing restrictions for South Australia is provided in Figure 8.1.
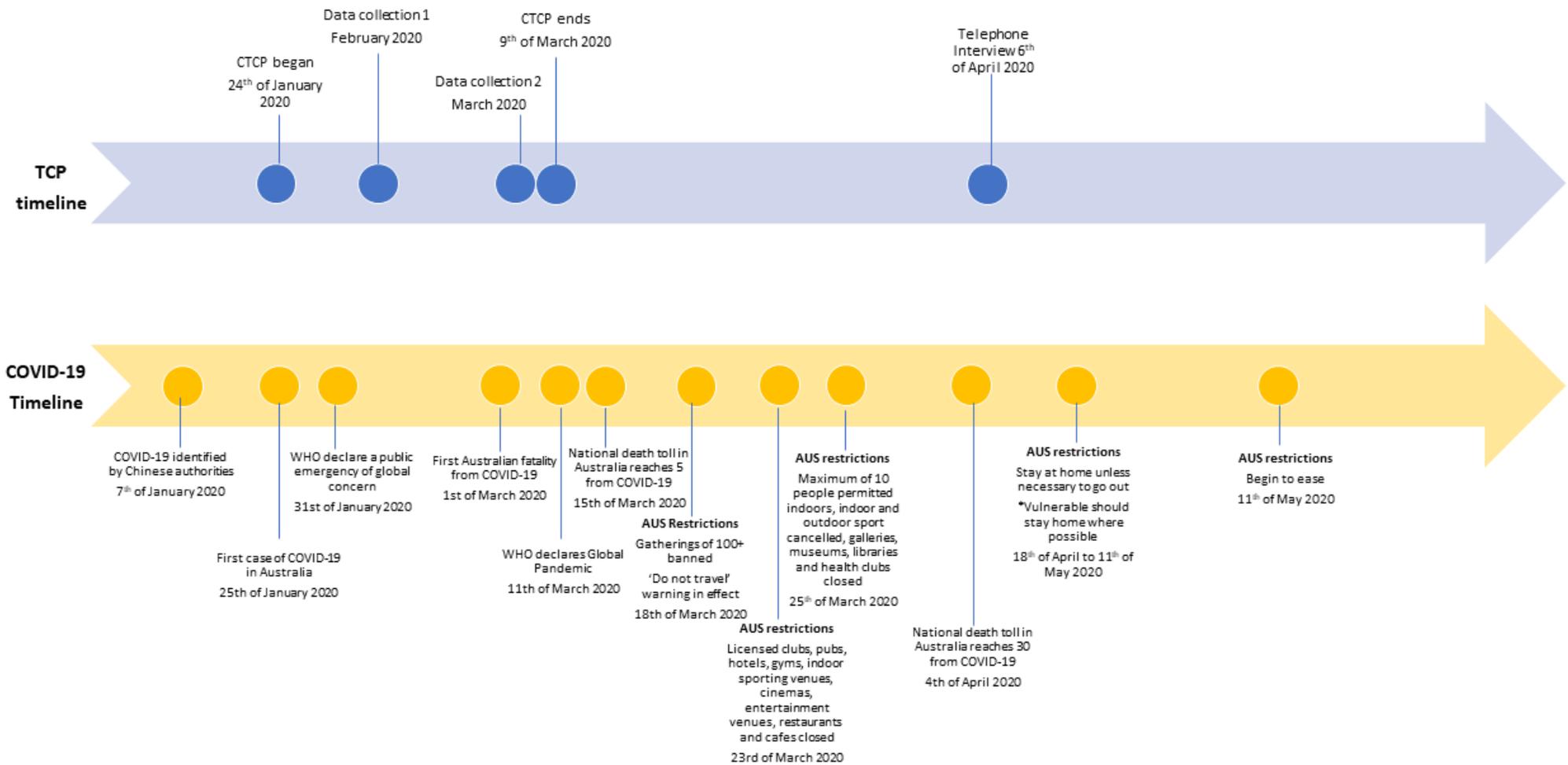
Figure 8.1 Timeline of TCP and COVID-19 in South Australia

TCP timeline

- CTCP began 24th of January 2020
- Data collection 1 February 2020
- Data collection 2 March 2020
- CTCP ends 9th of March 2020
- Telephone Interview 6th of April 2020

COVID-19 Timeline

- COVID-19 identified by Chinese authorities 7th of January 2020
- First case of COVID-19 in Australia 25th of January 2020
- WHO declare a public emergency of global concern 31st of January 2020
- First Australian fatality from COVID-19 1st of March 2020
- WHO declares Global Pandemic 11th of March 2020
- National death toll in Australia reaches 5 from COVID-19 15th of March 2020
- AUS Restrictions Gatherings of 100+ banned 'Do not travel' warning in effect 18th of March 2020
- AUS restrictions Licensed clubs, pubs, hotels, gyms, indoor sporting venues, cinemas, entertainment venues, restaurants and cafes closed 23rd of March 2020
- AUS restrictions Maximum of 10 people permitted indoors, indoor and outdoor sport cancelled, galleries, museums, libraries and health clubs closed 25th of March 2020
- National death toll in Australia reaches 30 from COVID-19 4th of April 2020
- AUS restrictions Stay at home unless necessary to go out *Vulnerable should stay home where possible 18th of April to 11th of May 2020
- AUS restrictions Begin to ease 11th of May 2020

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8.8 Methods

8.8.1 Recruitment

Individuals referred to Southern Adelaide Local Health Network (SALHN) transition care services were assessed by an external clinician to determine their eligibility and service requirements. To be eligible, participants needed to be aged 65 years or over, receiving CTCP, live in metropolitan Adelaide, mobilise independently (+/- walking aids) and be able to communicate in English. If the individual was interested in participating, consent was obtained to pass on their contact details to the candidate (CG), who then made contact, confirmed eligibility, provided further study information and obtained informed written consent where appropriate. An initial sample of 40 participants was sought, due to the COVID-19 disruption only one participant was recruited.

8.8.2 Data collection

Prior to discharge home with a CTCP, and on completion of the CTCP external assessors carried out the modified Barthel Index to measure functional independence(Shah et al., 1989). All other data were collected on returning home with a CTCP and repeated on completion of the CTCP, prior to COVID-19 social distancing restrictions. The participant was asked to complete a demographic questionnaire, the AQOL-8D questionnaire (Richardson et al., 2012) to measure HRQOL and the de Jong Gierveld loneliness scale (Tomás et al., 2017). The participant was asked to carry a GeneActiv triaxial accelerometer to measure minutes of MVPA, and a Qstarz BT1000XT GPS device to measure community participation, whilst keeping a self-reported diary of community activities for two separate seven-day monitoring periods as recommended in previous studies (Hirsch et al., 2016; Hordacre et al., 2014; Schipperijn & Etroelsen, 2014). The GENEActiv device was worn 24 hours a day (inclusive of sleeping, showering, and swimming- as the devices are waterproof) and the GPS device was removed for water-based activities as well as overnight so the device could be charged.

A semi-structured interview lasting approximately 37 minutes was carried out via telephone on the 6th of April 2020 during social restrictions, to gain the participant's perspective of community participation following hospital discharge, prior to and during social distancing restrictions (COVID-19). Questions included *'what are the greatest difficulties or barriers you face when attempting to be actively involved in the community?'* and- *'what things helped you to be actively involved in the community in the way that you want to?'* The interview was recorded and transcribed verbatim. Content analysis (Bengtsson, 2016) was driven by the research aims. For reporting purposes, the participant was given a pseudonym to maintain anonymity.

8.8.3 Data analysis

Physical activity*:* was measured using wrist worn GeneActiv accelerometers. Accelerometer data were used to detect times spent sedentary, engaging in light, moderate or vigorous activity using

cut points developed by Esliger once adjusted for the sampling frequency and epochs (light 283, moderate 605 and vigorous 1697) (Esliger et al., 2011). To determine overall daily PA, GeneActiv .bin files were converted to 60-second epoch files and analysed using Cobra software (Francois Frayasse, University of South Australia). Sleep was excluded from the analysis and detected using visual analysis of the activity trace combined with self-reported sleep diaries.

Community participation: GPS (Qstarz BT1000XT) data were used to calculate the number of trips away from home. GPS data provided co-ordinates of the beginning and end locations and total number of trips were recorded. Activity diaries were used to cross-check with the objective data, where GPS data were missing.

Interview data: Transcript data were imported into NVIVO 12 Pro and analysed for examples of facilitators and barriers to community participation.

8.9 **Results**

8.9.1 **Quantitative data**

Outcome measures completed on entry to and exit from the CTCP program are summarised in Table 8.1 Outcome measures. Kathy's levels of functional independence and HRQOL increased, and levels of loneliness decreased over the course of the CTCP. An overview of community participation is provided in Table 8.2, Kathy's total trips out of home, minutes of MVPA and sleep time had increased on exit from the CTCP, social interactions decreased, as did minutes spent sedentary.

Table 8.1 Outcome measures

	Outcome measure	Total score (interpretation)	Data collected by	Score on entry to CTCP	Score on exit from CTCP
Functional Independence	Modified Barthel Index	100 (fully dependent)	SALHN	88	95
HRQOL	AQOL-8D Independent living Happiness Mental health Coping Relationships Self-worth Pain Senses PSD score MSD score	100 (high quality of life)	CG	58 28 37 67 50 59 67 80 85 59 58	63 50 44 64 58 67 58 90 85 71 60
Loneliness	de Jong Gierveld Loneliness Scale	6 (most lonely)	CG	4	3

(Southern Adelaide Local Health Network (SALHN), candidate (CG), Assessment of Quality of Life-8 dimension scale (AQOL-8D), Super dimensions; Physical super dimension (PSD) inclusive of independent living, pain, and senses variables. Psycho-social super dimension (MSD) inclusive of mental health, happiness, coping, relationships and self-worth variables (Maxwell et al., 2016)).

Table 8.2 Measures of community participation

Community participation	Entry to CTCP (% of day)	Exit from CTCP (% of day)
Trips out of home (per week)	1	7
Social interactions (per week)	11	10
MVPA (mean per day)	8 minutes (0.5)	12 minutes (0.8)
Sedentary time (mean per day)	822 minutes (57)	793 minutes (55)
Sleep time (mean per day)	494 minutes (34)	517 minutes (36)

8.9.2 Qualitative data

Kathy discussed her experience of the transition home from hospital in depth, identifying barriers and facilitators to resuming previous activities. The perceived barriers and facilitators are outlined below, followed by a discussion of how COVID-19 restrictions further contributed to these barriers.

8.10 Barriers of community participation

Kathy reported that going out of home to carry out ADLs such as shopping were difficult because of the need for a walker, '*the walker limits me to how far I can go because I haven't much stamina.*' Stamina and fatigue following hospital admission prevented visiting the shops as, '*it was too far for me to walk.*' Shopping was also limited by the amount of shopping she could fit into her walker, combined with environmental challenges, such as a, '*funny little ramp at the end of my road. It's been badly done*'. Windy weather conditions meant that she was unable to go out altogether, '*so that means that I'm virtually housebound on a windy day*' unless she asked for her sister to take her out in her car, which she considered being a burden.

When asked what prevented her from participating in her community as she used to, the answer was direct, '*A lack of transport really.*' With specific reference to a choir group Kathy was involved in: '*You see I wouldn't have been able to get there if I had to walk. Probably one of the others would have picked me up. But trouble is, I haven't really been strong enough. Well, I got too tired too quickly. I can't actually be away more than a couple of hours. That makes it a bit awkward if you're sort of socialising and you know, you really need to be a (group of) three or more.*'

8.11 Facilitators of community participation

Kathy described the benefits of her CTCP services in facilitating community participation on returning home from hospital. Her experience of receiving assistance to the local shopping centre was positive and facilitated community participation. She also found physiotherapy useful to reduce her dependency on mobility aids and increase her independence:

'*Well, I think they instigated I had a physio coming. And she particularly the last one was a very active person. And it was very encouraging in what she was wanting me to do. She asked me what my goals were and I said, ultimately I wanted to get rid of the walker. Just walk with a stick. And so she was trying to get me to be active with a walker and get more confidence that way. And then*

giving me exercise up my passage, you know, without the walker and using my stick and things like that. Yeah. So that person was very motivated. So that was good.'

8.12 COVID-19

The changes in daily life due to COVID-19 ran throughout the interview with isolation and restrictions at the forefront of answers related to community participation, *'At the moment you can't go out anyway. As we are supposed to be isolated.'* Normal behaviours and places that were visited previously were no-longer an option, *'the library is closed anyway, but what isn't closed?'* Deciding to follow the recommendations was quite definite with comments such as *'I won't be going out'* and *'I won't be visiting anybody'* repeated. However, the awareness that remaining home might not be feasible for long periods caused Kathy to state that she, *'might just walk around the block'* to maintain normality. The GPS data recorded one visit out of home during the first week of CTCP and seven in the last week of CTCP (see Table 8.2). Indicating that Kathy was becoming more active in the community prior to COVID-19 restrictions being enforced.

Kathy expressed the feeling she was starting to get some control of her life back following hospital admission, *'I was getting stronger each day.'* This comment was supported by an average increase of 4 minutes MVPA (50%) per day and decrease in sedentary time by 29 minutes. She also felt able to go shopping with a support person, only for this activity to be terminated *'you can't ride in the car anymore, the next time you have to give us a list.'* Not knowing whether she would be able to access supportive services was a real concern that resulted in fear that support services would be ceased, *'I am expecting them to ring up and say, no, you can't have anybody!'* The possibility of contracting the virus was described as *'frightening'.* Despite an overall improvement in HRQOL, components of mental health and self-worth declined (see Table 8.1).

A more positive aspect of COVID-19 restrictions was an increase in neighbourly support. Neighbours who were previously strangers made a concerted effort to provide contact details and knock when visiting the shops to ask, *'is there anything you need?'* Neighbours rallied during the times that *'the shelves were being stripped of toilet paper.'* Very aware that the shops were quite *'bereft',* Kathy was almost surprised when her neighbour returned with the jam that she had asked for.

Deciding to preserve health but also be involved in social interactions became a priority which was extensively planned, *'I can observe the rules and we can sit on the front veranda.' 'We had coffee, she brought her own - and I turned the kettle on!' 'We had a lovely visit.'* In the first week of CTCP Kathy reported 11 social interactions, which decreased to 10 in the final week of the CTCP (See Table 8.2). However, the majority of the visits in the first week involved service set up and home adaptations, rather than the social visits which were more apparent following CTCP.

8.13 Discussion

Reintegration into the community following hospital discharge has previously presented barriers for older adults. Kathy was no exception, she identified barriers including mobility restrictions, the environment, weather, reliance on others, lack of transport and fatigue that prevented her from resuming previous activities. Yet services provided as part of her CTCP such as physiotherapy and assistance shopping, acted to facilitate community participation. During this transition, COVID-19 was declared a global pandemic and social distancing guidelines were gradually escalated, further increasing the barriers to active community participation and reducing supportive services.

Experiences of social isolation and loneliness were present throughout the interview, with community participation limited by access to transport, feeling a burden, and levels of fatigue, preventing Kathy from attending activities of longer duration where potentially transport with friends could have been arranged. Her experiences are supported by previous research that suggest a lack of individualised treatment left older adults returning home from acute care unable to attend activities they would have previously (Reay et al., 2015), and frustrated by reduced mobility, and lack of transport which limited the opportunities to socialise on returning home (Martinsen et al., 2015). For Kathy, these restrictions exacerbated isolation and loneliness from her family and community connections.

Behaviour change for this participant and those around her were evident prior to and following the introduction of social distancing restrictions. There was a sense of trying to preserve 'normality' despite the fear of the unknown, contracting COVID-19 and feelings of loneliness. The intent of taking a walk, just to get out of the house was an attempt to feel a sense of purpose and change the environment. Receiving a guest on the front veranda, with visitors bringing their own tea, was an important coping mechanism for Kathy to meet the need for social interaction. Neighbours also changed their behaviours by taking the time to offer their help and reach out to support others, which has previously been deemed important in providing a sense of belonging for older adults (Stanley et al., 2010). Neighbourly support was possibly a benefit of the high number of individuals furloughed at home with additional time on their hands to consider the more vulnerable individuals living nearby.

The Australian government acknowledged in June 2020, that during COVID-19 TCP clients may not be able to receive the services they need (Australian Government, 2020). Service disruptions may be due to isolation or quarantine restrictions, directions by a GP, client's personal preference or staff shortages of TCP providers. The case presented, describes the experience of Kathy, whose CTCP program was not vastly disrupted, yet she still demonstrated low levels of PA and community participation. Consideration for individuals who are unable to commence or continue with TCP services, in the context of restrictions, whilst transitioning from hospital to home requires urgent consideration to negate the potential negative health consequences.

8.14 Conclusion

The findings of this chapter highlight the challenges of returning home from hospital experienced by an older adult. This transition was made more difficult by the social distancing restrictions introduced to prevent the spread of COVID-19. COVID-19 has thrust social isolation into the spotlight and increased awareness for the negative effects on health at a global level. As society returns to a new 'normal' following the easing of restrictions, social isolation of older adults will remain, and requires ongoing intervention. This chapter has highlighted how an older adult receiving a CTCP, and those around her, adapted their behaviours to meet their social needs, mirroring some of the adaptive behaviours found in the study exploring community participation of community dwelling older adults, discussed in Chapter 6. Neighbourhood support will hopefully continue long after the acute phase of COVID-19 has passed. But more importantly, methods to assist with positive behaviour changes to prevent social isolation during transition care and times of social distancing need to be considered by allied health professionals. Despite supportive services, levels of PA were low for this individual, therefore older adults may require individualised assistance to maintain their physical and social activity, particularly at vulnerable times when they return home from hospital or follow social distancing restrictions requiring lockdown.

This case study provided in-depth insight into the experiences of an older adult returning home from hospital prior to and during COVID-19 restrictions, yet the findings are not conclusive. Future research should measure community participation in a larger cohort of transition care clients to determine how they reintegrate into the community following hospital discharge. Using mixed methods with older populations who have varying health status would also be useful to inform future interventions and transition care services. The regular inclusion of social isolation outcome measures could assist in the identification of individuals at risk of poor health and reduced QOL and necessary to understand the effects of COVID-19 social distancing.

CHAPTER 9: **DISCUSSION**

9.1 About this chapter

This chapter provides an overview of the main findings of this research, identifies the strengths and limitations, and highlights areas where further research is required to inform clinical services and practice to promote community participation and healthy ageing.

9.2 Research summary

Community participation, inclusive of physical and social activities is integral to the ability of society to age in good health, and has the potential to reduce chronic disease and social isolation of older adults, both in Australia and worldwide (Jeste et al., 2020; Kung et al., 2021). The research presented in this thesis synthesises the evidence related to the measurement of community participation, the influencing factors of PA, social isolation, loneliness, the association between; and explores how community participation is considered by supportive services. This research focussed on events when older adults were unable to participate in their communities, being increasingly vulnerable to social isolation. With specific consideration for the transition home from hospital and COVID-19 lockdown and social distancing. This research explores: what community participation looks like for a sample of community-dwelling older adults using combined mixed methods innovative technologies; considers differences in the context of social distancing, periods of lockdown and transitioning from hospital to home; the barriers and facilitators to community participation experienced by older adults; and coping mechanisms used to maintain and redefine physical and social activities. The discussion below summarises the major findings and themes that arose from this research including social isolation and loneliness, community participation, PA, HRQOL, sleep, the positives from social distancing, and adaptive strategies.

9.3 Social isolation and loneliness

As older adults remained at home during the COVID-19 lockdown, their awareness of the risks of social isolation increased. People of all ages experienced the loss of activities and social interactions that often diminish naturally with increasing age, and for many, this experience highlighted that older populations require more support to prevent social isolation becoming normal. Younger individuals who were furloughed from work, considered the needs of their older neighbours, in the sample of community dwelling older people, and went out of their way to provide support (Chapter 8). In the case report described in Chapter 8, Kathy the TCP client, received increased assistance from neighbours, yet reported feelings of social isolation and loneliness, which was mirrored by experiences reported in existing transition care research (Chapter 7). Kathy's reliance on services and neighbours for support was evident throughout her interview. These experiences were perhaps heightened by the fact that she had already experienced social isolation during her hospital stay, whereby she was forced out of her community into hospital and

her ability to choose activities was restricted. Kathy provided examples of how she adapted her social activities to maintain them i.e., taking tea on the front veranda, which reflects the group of community dwelling older adults who were able to redefine their activities to preserve them whilst maintaining social distancing. For all participants, restrictions on community participation meant that incidental social interactions were lost, this supports the findings that taking a higher number of trips out of home allows older adults to participate in more social activities and should be considered for future interventions.

Despite neighbourly assistance and increased awareness, the scoping review presented in Chapter 3 demonstrates the severity of social isolation and loneliness experienced by many older adults prior to COVID-19. With high levels of social isolation and/or loneliness inversely associated with PA. Thus, demonstrating that older adults who are isolated and lonely participate in less PA and are at increased risk of chronic health conditions and poorer QOL. However, fully understanding the relationships between social isolation, loneliness and PA for older adults requires homogenous methods and suitable outcome measures for both researchers and clinicians. As per the review findings, this body of research used the de Jong Gierveld loneliness scale (Tomás et al., 2017), a recommended multidimensional measure of loneliness. Despite being a standardised measure, this scale was not sensitive enough to detect changes in levels of loneliness between the monitoring periods. This may explain why despite qualitative reports of isolation and feelings of loneliness and higher loneliness scores during lockdown, the changes were not statistically significant. Therefore, review findings remain inconclusive, highlighting the need for a sensitive measure of loneliness for community-dwelling older adults using both qualitative and quantitative methods, as the perceptions of social isolation of older people, needs to be considered to inform practice.

Overall, the recruited sample of community dwelling older adults did not demonstrate loneliness, with only two participants classified as lonely at baseline and lost to follow up. Despite the lack of people who reported being lonely included in this research, measures of social interactions demonstrated that at baseline less participants experienced days without any social interaction when compared to times of lockdown. During lockdown, more participants experienced days without social interaction over a greater number of days. This lack of social interaction could have acted to increase feelings of loneliness, as identified in interview transcripts, and to socially isolate participants from their communities. The frequency of social interactions reported did not return to baseline at post-lockdown follow up and is a concern for future times of social distancing and isolation. Consideration for research using standardised measures of social isolation and with longer follow up periods might also have been useful, as the self-reported social interactions reported in this research were open to interpretation and varied between baseline and follow-up. In accordance, the definition of social interaction may need to be redefined for future research, as enforced physical and social isolation led to older adults increasing their communication using

technology such as Zoom and Facetime. They also redefined their social activities and participated in social events such as having a glass of wine at the end of the driveway, which they would not have done prior to COVID-19.

Social isolation and feelings of loneliness varied throughout the sample of community dwelling older adults during lockdown reported in Chapter 6. Approximately half of the sample expressed feelings of social isolation and loneliness, with some participants enjoying the reduced social pressures that came with social distancing. Participants who were able to redefine their social activities generally did not report being isolated or feeling lonely, whereas participants who ceased their previous activities were more likely to report being isolated and/or lonely. The variation and individuality in coping mechanisms can perhaps explain the differences in experiences and will be discussed further in *Adaptive strategies* (9.9). Unfortunately, the sample size recruited did not allow for the comparison of participants who reported being lonely to those that did not and highlights that older community dwelling adults are not homogenous in their experiences of social isolation. Therefore, finding appropriate outcome measures and interventions suitable to assist older adults to maintain social interactions will continue to be a complicated process. Furthermore, outcome measures will need to use mixed methods, including quantitative methods to measure objective factors and qualitative methods to measure experiences and inform individualised interventions.

9.4 Community participation

9.4.1 Trips out of home

Observation of community dwelling older adults showed that the number of trips taken out of home was associated with levels of MVPA and the number of social interactions experienced. Therefore, suggesting that ***if older people were to take more trips out of home, they would have the opportunity to be more physically and socially active.*** As expected, during the lockdown period the number of trips older adults took out of home significantly reduced, as did the social interactions they experienced, this demonstrates that during lockdown older adults were more susceptible to becoming socially isolated. Therefore, this period is identified as a time of increased vulnerability for older adults which requires further investigation.

In contrast to lockdown, in the case report of Kathy (Chapter 8) who demonstrated an increase in the number of trips she took out of home. This could be due to her improved mobility, reduced levels of fatigue or increased confidence making her able to leave the house more often as per the intention of the TCP she received. Her increase in trips taken out of home may also have been impacted by the reduction in her supportive services. Previous research suggests that during the early stages of supportive services clients felt that they were unable to leave the house due to the number of visitors and appointments they had to keep. These appointments could be with clinicians providing therapy, or handy men who were carrying out home modifications which in the final stages of TCP were no-longer required (Walker et al., 2014). Thus, leaving the client with

more autonomy to leave the house, visiting the locations and people that she wanted to and returning to more normal community participation. Future TCP services should focus on the demands of early stages of therapy to promote confidence in community activities as demonstrated by Kathy's experience.

9.4.2 **Locations visited**

Understanding the locations chosen by older adults for physical and social community participation were the main aims of this program of research, not merely to understand the barriers that older people experienced to participating in their community but to inform recommendations and to guide interventions. Previous research lacks detail of where older adults participate in their communities and why they choose the locations they access (Li et al., 2005). Details of the locations accessed were often overlooked and occasionally the research focus was on the use of a particular location (i.e., park) rather than the daily movement patterns of an individual moving through it (Chow et al., 2016), or locational data and maps were collated to guide qualitative interviews but not reported (Rosenberg et al., 2013; Zeitler et al., 2012). However, as Chapter 4 discussed, some evidence about the locations older adults accessed was more conclusive, for example, visiting locations where multiple activities could be performed (both physical and social) were preferred by older adults (Franke et al., 2017). Further understanding of the locations visited in the community could inform future interventions to increase PA and social interactions for older adults.

This body of research presents unique comparisons of community participation locations older adults accessed prior to and during periods of lockdown and social distancing in South Australia. Prior to restrictions, commercial and recreational activities were the most popular locations visited by community-dwelling older adults, followed by local walk/greenspaces. In accordance with guidelines and closure of recreational facilities, these locations were not accessed during lockdown. Despite the increase in people visiting local walk/ greenspaces, Stanton et al., (2020) suggested that these individuals might predominantly be those who were already active. Thus, moving their activities from recreational facilities such as gyms, and thereby adapting and redefining their activities to maintain them (Stanton et al., 2020). As per previous research, at baseline, visits to local/walk greenspaces were significantly associated with MVPA (Stewart et al., 2016). Many older adults appear to have replaced other recreational activities and increased the number of visits to local/walk greenspaces during the COVID-19 lockdown period, perhaps to cope with the uncertainty of the global pandemic (Geng et al., 2021). Increased access to urban parks was found to be effective in the management of mental health and in reducing levels of stress (Geng et al., 2021) and needs to be considered for future periods of social distancing and for older adults at risk of reduced community participation, such as when transitioning from hospital to home.

Somewhat surprisingly, ***commercial locations were the most commonly visited location across all three monitoring periods*** for community dwelling older adults. It would have perhaps been plausible to hypothesise that older adults would reduce their trips to commercial locations during periods of lockdown, as they did with other locations, due to the number of people and risk of contracting the virus. The opposite appears to have happened, with older adults increasing their trips to commercial facilities. This could highlight their dependency on these locations for food and staples to survive. However, other suggestions have been made that commercial locations can evoke feelings of comfort and security due to consumer attachment (Alain et al., 2014), although older adults may have simply visited the shops as it was allowed, and therefore an excuse to get out of home. In contrast to these findings, older Finnish adults only reported accessing locations where they could exercise during periods of lockdown (Portegijs et al., 2021), this variation in reporting could be explained by the variation in social distancing guidelines and lockdowns between the two countries.

It must also be acknowledged that this program of research defined community participation as '*engagement in activities occurring outside the home that are complex in nature, social and nondomestic'* (Chang et al., 2013, pp. 772). Further clarification is perhaps needed for the inclusion of commercial locations that older adults visited. The use of commercial locations using GPS data was ambiguous and one would probably assume that grocery shopping and domestic chores were taking place. However, when commercial locations were detected on GPS, participation diaries were cross-referenced to determine the purpose of the visit. As discussed in Chapter 5, some older adults participated in walking groups in a shopping centre or met friends for coffee. This was a benefit of having self-reported diaries to refer to for clarification and context of trips to certain locations. Therefore, these activities in commercial locations met the definition for community participation and were included in analysis. This supports the combining of mixed methods when exploring community participation in older adults. Older adults appeared to use commercial locations for their community participation and therefore this was deemed important for data analyses and should be a consideration for the promotion of community participation for older adults.

In conjunction with changes in visits to commercial, recreational, and local walk/greenspaces, community dwelling older adults reported no visits to healthcare facilities during lockdown. Despite the sample reporting generally good health and no visits at baseline, there are global concerns for those who may have avoided or delayed medical appointments during this period. Despite an increase in the use of Telehealth during this time, healthcare avoidance may have occurred for those who were less technology savvy due to concerns of catching COVID-19 and could subsequently effect health for those who are more vulnerable (Czeisler et al., 2020). The long-term effects of delaying or avoiding medical appointments is unknown and warrants further investigation for the long-term health of older adults.

9.4.3 **Barriers and Facilitators**

Barriers and facilitators to community participation and PA were identified following a scope of existing literature (Chapter 4), with community dwelling older adults (Chapter 5 and 6) and for transition care recipients (Chapters 7 and 8). Interestingly some factors were identified as both barriers and facilitators, such as the weather and feelings of safety. Older adults identified that feeling safe was important for community participation, both in terms of a lack of threat from others but also in the ability to cross the road safely. When feeling unsafe, older adults were more likely to stay at home increasing the risk of social isolation, this reflects the reduced number of trips taken during COVID-19 lockdown when participants were fearful of contracting the virus.

Weather conditions were recognised as both barriers and facilitators to community participation, in the case report of Kathy, who was receiving a TCP (Chapter 8), she reported being unable to go out when it was windy, unable to mobilise safely with her walker, thus is an important factor in confidence for community participation. In contrast, warmer weather was identified as a limitation to community participation for older adults during data collection reported in Chapter 4 (Werner et al., 2012). Prins and van Lenthe (2015) measured the influence of hourly weather on older adults' participation in walking and cycling and found that older adults were more likely to walk in higher temperatures when there was no rain. Thus, highlighting the importance of considering weather conditions for community participation, which would vary across the globe. The influence of weather was experienced firsthand during data collection in this research with community dwelling older adults and will be discussed in the limitations section of this discussion (9.10).

The scope of the literature (Chapter 7) reported specific barriers to community participation for individuals returning home from hospital. A decline in physical function inclusive of mobility and balance was reported, which meant that individuals could not carry out their ADLs without increased support. Some older adults transitioning from hospital to home found they could not take care of their own hygiene, which subsequently meant they were less likely to participate in social activities or leave home. Other health issues combined with restricted access in and out of home, as well as weather conditions, being unable to drive or access transport to attend follow-up medical appointments meant that they didn't attend. Following hospital stay, individuals were limited by their reduced mobility and stamina, meaning they could not be away from home for long. During lockdowns, limitations were more general in that all recreational facilities were closed and organised activities cancelled. With Kathy (Chapter 8) discussing her fear that her assistive services would stop and she would not be able to get her shopping.

Throughout the literature, the dependency on motor vehicles and difficulty accessing transport to attend and participate in the community was reported. With previous research finding that older adults mainly drove for shopping and to visit family and friends (George et al., 2006). The ability to drive for many gave a sense of freedom and independence, and conversely the inability to drive

has been linked to reduced QOL and depression for older adults (Buys et al., 2012; Marottoli et al., 2000). The cessation of driving often results in reduced out of home activity levels (Marottoli et al., 2000). This could explain why Kathy was so keen to regain her license, which would enable her to take control of and resume her community activities. Previous research suggests that inadequate public transport results in lower social participation and can result in social isolation (Lamanna et al., 2019), this is an important consideration for future research and service planning.

Identifying facilitators to community participation was more difficult, as often the barriers were easier for participants to describe. Evidence suggests that assistive services were useful to facilitate independence (i.e., assistance with shopping) and physiotherapy was useful to improve confidence and provide aids required to be able to walk safely in the community. Regaining a driving license was the only facilitator that was identified in numerous sources, as the ability to return to driving was deemed important to restore independence and allow individuals to resume previous activities and manage their health (Ruggiano et al., 2016).

9.4.4 Measures of community participation

Following a scope of the existing literature (Chapter 4) it became apparent that research using GPS to measure the locations of community participation for older adults was limited. Despite the lack of evidence this review was useful to inform observational methodologies, such as the use of the Qstarz BT1000XT, which was most frequently used by researchers and deemed an accurate measure of location in real-world settings (Schipperijn et al., 2014). In contrast, the use of accelerometers, duration of monitoring periods, and outcome measures reported using GPS with older adults were highly variable. The variability of methods, as well as the contrasts between climate and infrastructure across the different countries included in this review meant that direct comparisons were not possible. However, the variation can perhaps be explained by the limited use of GPS with older adults. This method remains in its infancy when compared to the evidence available for younger more active populations. Despite the lack of standardised methodologies, the scoping review provided insight into devices used and monitoring times required to record sufficient data to determine locations and levels of PA in this population. Thus, providing options to increase the understanding of community participation and appropriate outcome measures.

Informed by the results of the scoping review, the aims of Chapter 5 were to determine whether combined GPS, accelerometry and self-reported activity diaries were feasible with community dwelling older adults. A mixed methods approach was utilised to obtain a detail rich picture of community participation for older adults. Overall data collection was successful, with a total loss of 6% of GPS data at baseline, which compares well to a previous study with older stroke patients where acceptable data loss was defined as 13% (McCluskey et al., 2012). Previous research has suggested that data loss increases with the length of monitoring period (Krenn et al., 2011), resulting from signal loss, device battery power running low, and poor adherence to protocols

provided (Krenn et al., 2011). The success of this data collection was in part due to the levels of cognition and enthusiasm demonstrated by the participants. All were motivated to charge the devices and remember them when they left the house. However, the integration of visual reminder flyers (Appendix 4 and Appendix 5) in the study protocol was reported as being appreciated by participants and acted to ensure that participants remembered to charge devices and carry them when leaving the house. This inclusion in the study protocol appears to have been successful in promoting participant compliance and should be considered for future GPS research with older adults.

The inclusion of self-reported diaries in this research acted to support the quantitative measures. Where signal or GPS data was lost, these diaries acted to provide details of locations and activities. Perhaps more importantly, these diaries provided context of activities where the use of locations was ambiguous. In Chapter 6 it was identified that understanding community participation and PA of older adults requires details of the specific activity participated in, which is often not reported, nor detected using accelerometers (Taraldsen et al., 2012). Despite thorough instructions, completing activity diaries was open to interpretation, and some participants sought clarification during data collection of what was required. As a result, the detail reported varied, although, reporting remained largely constant for participants across the separate monitoring periods. The use of self-reported participation diaries allowed for social interaction and corresponding location to be identified, which despite being a simple measure, provided a more holistic overview of community participation and highlighted social interactions that older adults deemed important.

Previous research measuring location has not relied on self-reported measures, as they are often subject to reporting bias and rely on memory recall. Fillekes et al., (2019) found that self-reported measures of life-space were underestimated by older adults which could impact the observation of community participation. Despite this, the results reported in this body of research suggest that self-reported and GPS detected locations were similar. There was a significant difference detected between GPS and self-reported recreational and commercial locations (Chapter 5). However, the difference accounted for half a trip over the seven days monitored. This difference presents less of an issue for the generalisability of results and suggests that self-reported measures of location in participation diaries could be accurate. However, ***the use of combined mixed methods provides a more conclusive overview of community participation.***

In this body of research, the similarities in reporting could be due to the high levels of compliance and cognition of participants. The feasibility of these methods with older adults presenting with reduced cognition and mobility remains unknown. Data collection for Kathy, a TCP client was successful, however her entry to TCP services did not measure her cognition, instead subjective assessment was carried out to determine whether she would be able to participate in low level

therapy services. However, it was evident that Kathy's mobility and general health were lower that the community dwelling sample and she demonstrated higher levels of frailty. Therefore, research to determine the feasibility of these combined methods with larger samples of older adults presenting with varying levels of cognition, mobility and frailty is required to guide future research.

9.5 Physical activity

Results of this research show that ***participants demonstrated higher levels of MVPA outside of the home***, with all baseline trips reported to local walk/greenspaces inclusive of MVPA**.** These findings could inform interventions that increase the trips taken out of home by older adults and increased use of local walk/greenspaces to promote PA in this age group. Or could be considered for interventions that engage older adults in opportunities to increase their MVPA in the home using innovative technology, especially during times they are unable to leave their homes potentially incorporating green space or local environments. In conjunction, there was a reduction in the levels of MVPA of participants, coinciding with a reduction in the number of trips taken out of home during the COVID-19 lockdown. These results agree with another Australian study where almost half of participants (n = 729, 48.9%) reported a reduction in PA since the onset of the COVID-19 pandemic (Stanton et al., 2020). However, due to sample size recruited by Stanton et al., (2020), self-reported measures were used to determine this change. The body of research reported in this thesis identified that some people were able to find alternative activities such as online classes, but others demonstrated lower levels of PA perhaps due to reduced social support, health status or the fear of contracting COVID-19. The sample variation appears to relate to resilience, and adaptive behaviours and has had a direct influence on levels of PA levels during times of lockdown and social distancing. These coping mechanisms will be discussed further in 9.9.

Despite community dwelling older adults demonstrating high levels of MVPA, their sedentary times were also high. ***In-home activities reported were mainly sedentary in nature***, with diaries and previous research identifying the time between eating an evening meal and going to bed included several hours of watching television. During social distancing restrictions, sedentary time increased coinciding with participants spending more time at home performing sedentary activities. It is unclear whether time spent sedentary or participating in PA returned to baseline following lockdown and social distancing, and this requires consideration for the long-term health of older adults. These findings support the use of diaries for individuals who are unable to leave their homes to record levels of PA and potentially assist older adults to increase their activity levels.

9.5.1 Measures of PA

As suggested in the findings of Chapter 4, the popularity and accessibility of consumer wearables, phones, and accelerometers to measure PA has continued to increase. This program of research found that the GeneActiv accelerometer was feasible for use with older adults and data collection

overall was successful, with only one dataset lost due to device malfunction. Fifty-four percent of participants reported that the devices were comfortable to wear, however some of the smaller female participants found the device large on their wrists and uncomfortable especially in the warmer weather. However, this discomfort did not disrupt sleep for any of the participants. The GeneActiv accelerometers enabled accurate calculation of MVPA for older adults. However, as seen throughout the literature, measures of PA can be variable with older adults between devices (Kowalski et al., 2012), and to date there are no validated cut-points available for GeneActiv data specific to older adults, this is a limitation of PA measurement and also an opportunity for future research. In addition, details of the specific activity participated in could be particularly useful for understanding community participation and informing future interventions to increase levels of PA for older adults. Regular measurement of PA with TCP service users could assist individuals return to their previous activities when returning home from hospital and provide meaningful and individualised feedback.

9.6 Health related quality of life

Health related quality of life provides an overview of how individuals perceive their own health and the quality of the life they live. At baseline, recruited community-dwelling older adults presented higher HRQOL than the general population (Richardson et al., 2012), which may be related to the high levels of physical and social participation demonstrated. Previous research suggests that community activity groups can act to increase PA and HRQOL (Lindsay-Smith et al., 2019) which may have been demonstrated by baseline participants. In contrast, during lockdown, coping scores for many of these individuals declined, with levels of resilience and coping mechanisms variable throughout participants. *Kathy, the TCP recipient (Chapter 8) reported an increase in her HRQOL and her coping scores*, possibly related to her enjoyment of regaining control of her life and the activities she was able to participate in. These findings highlight the opportunity to develop adaptive skills to be able to maximise community participation on transition from hospital to home and to maintain community participation following periods of social isolation and individualised responses to such events.

9.7 Sleep

Sleep is important for the health and wellbeing of older adults, at baseline, participants reported lower sleep quality than a Chinese population of older adults using the same outcome measure (Zhang et al., 2017). Reports of lower sleep quality could be due to the extreme weather conditions experienced by participants at baseline, yet it is interesting that *sleep quality reduced significantly during lockdown* and improved above baseline following the easing of restrictions. Stanton et al., (2020) found that half of their sample reported no change in their sleep quality from the onset of COVID-19 (Stanton et al., 2020), this could be due to the adaptive strategies older adults recruited to maintain physical activities, allowing them to maintain quality sleep. In contrast,

Grossman et al., (2021) found that sleep problems were associated with loneliness, worries related to COVID-19 and resilience (Grossman et al., 2021), this could be demonstrated by Kathy in Chapter 8 who reported increased sleep quality towards the end of her TCP. This improvement may be a result of increased activity levels and comfort on returning to her home surroundings or the resilience and coping strategies that she demonstrated.

9.8 The positives from social distancing

Many of the older adults involved in this research were positive when reflecting on their experience of lockdown and social distancing. They were able to '*look on the bright side*,' and often described someone who was worse off than themselves. Many discussed the positive experiences they had during these times such as meeting their neighbours and receiving increased support from them. Whilst others enjoyed the extended periods at home, being able to complete jobs they had been putting off and the reduction in pressure to be in a certain place at a certain time. Others found that they were able to increase their interaction with relatives and friends overseas using social media and technologies allowing for video communication. This reflects findings that social network sites were effective in making older adults feel more connected (Yu et al., 2015) and may provide further support to a review of the definition of social interactions and the importance of advancing technology for older adults. These learnings could inform clinical practice in programs such as TCP, enabling social interaction when older adults transition from hospital to home.

Participants enjoyed some of the effects of social distancing, such as increased hand washing and hygiene practices, no waiting time when attending a doctor's surgery for an appointment and a guaranteed view in the theatre due to spaced seating. There was also a feeling that the community came together and united with a common aim of getting through social distancing together, which for some participants was very reassuring and added to their positive outlook. However, the ability to find positives in the situation and cope with social distancing restrictions appears to be dependent on how individuals managed to adapt.

9.9 Adaptive strategies

The experiences of older adults observed in self-reported diaries and qualitative interviews demonstrated a stark contrast between the older adults involved in this research. Participants did not present as a homogenous sample, some experienced social isolation and loneliness, whilst others were able to adapt and find the positives of social distancing. Many older adults were able to adapt and redefine their activities to maintain them, such as Kathy who adapted her behaviour and coped after her return home from hospital (Chapter 8). Yet in contrast others returning home took a passive approach and '*waited to recover.*' These results agree with findings from other Australian samples that demonstrated differences in responses to social distancing and the COVID-19 pandemic (Stanton et al., 2020). Further understanding of these adaptive skills is

required prior to providing interventions or recommendations for management of future periods of social distancing and to inform clinical practice and transition care services.

The use of adaptive coping strategies for successful ageing, is not a new concept. As older adults prefer to age in place, in their own homes, modifications of their environments are required to maintain access, allow participation in daily activities, and interact with the environment in the way that they want to (Lien et al., 2015). Coping is described as a process that is dependent on the situation occurring, the time duration of the event, and perhaps most importantly the individual experiencing the event (Lazarus, 1993). Needing to adapt and cope with situations can lead to both successful adaptiveness and maladaptiveness (Lazarus, 1993), with examples of these concepts discussed in Chapters 6 and 8. Participants in this research identified their behaviour changes and adaptive strategies when returning home from hospital, and in response to periods of lockdown and social distancing restrictions. These coping mechanisms suggest that ***adapting successfully to a situation allows older adults to overcome barriers to community participation***.

To understand coping measures and adaptive behaviours, understanding what a person is thinking and doing to cope with stressors is vital to successful observation (Lazarus, 1993). Previous research highlights that at times when older adults return home from hospital, their coping residual is low because of illness and or fatigue experienced after their hospital stay (Fitzgerald Miller et al., 2008). By observing coping during the first three weeks of hospital discharge in adults (mean (SD) age of 54.6 (4.8) years), many suggested that experiencing pain, getting back to work, caring for their family, mobility issues and striving to resume normal activities were of high importance (Fitzgerald Miller et al., 2008). Resuming activities was restricted by fatigue and feeling weak, and returning home was inclusive of a loss of self. Reconstruction of a sense of self could be facilitated over time with supportive services (Fitzgerald Miller et al., 2008), however, these barriers to coping on returning home may be different for older populations and requires further investigation.

Despite experiencing similar events in the management of the COVID-19 pandemic, the individual perception of how stressful a situation is can be highly variable (Vannini et al., 2021). How people experience stress and their ability to cope in stressful situations is dependent on individual resilience. Resilience is defined as '*the process of adapting well in the face of adversity'* (American Psychological Association, 2015, pp.1), which can be inclusive of trauma, tragedy, and sources of stress, such as the uncertainty of the COVID-19 global pandemic. Factors important for resilience include skills in communication and problem solving (American Psychological Association, 2015). However, as this research suggests, not all participants demonstrated resilience, giving up their previous activities and were therefore more susceptible to social isolation and loneliness.

Community-dwelling older people living in the USA demonstrated three main coping strategies during the COVID-19 pandemic, they included acceptance, positive reframing, and active coping

(Vannini et al., 2021). Resilience was related to acceptance of the situation, use of humour and active coping techniques, with those who reported engaging in healthy behaviours, such as healthy eating and participation in regular PA, being more resilient (Vannini et al., 2021). These findings suggest that resilience and active coping skills such as problem solving were facilitators to adjust to the stress of COVID-19, with future research needed to examine how active coping and resilience can be used in interventions to navigate stressful events, such as on transition from hospital to home. This may also assist in the identification of those who are less resilient and allow for effective interventions to help develop these skills.

Recommendations for the incorporation of behavioural coping strategies to prevent disability and promote social participation for older adults in the community have previously been recommended (Provencher et al., 2015). Yet the success of these strategies is dependent on individualised tailoring to specific needs and for use in relevant contexts (Provencher et al., 2015). This is an important consideration in the transition of older adults from hospital into their own homes, following more personal times of social isolation such as bereavement and on a global scale for management of the COVID-19 pandemic. Research with older Australian's suggests that strategies that promote health by adopting or maintaining health behaviours should be useful to manage psychological distress during the COVID-19 pandemic (Stanton et al., 2020). These findings should be considered for older adults to assist coping and promote good health especially at vulnerable times of reduced community participation.

9.10 Mixed methodological approaches

The use of mixed methodological approaches in this research allowed for the nuances and context of community participation for older adults to be considered. By combining GPS measures of location, with accelerometry that detected PA and self-reported diaries detailing the activities participated in, the context and complexity of community participation for older adults was observed. The findings reported in Chapter 5 acknowledge that objective GPS measures identifying trips out of home may not have detected short duration trips, and locations were possibly missed due to signal drop out. Thus, the use of GPS alone may have underreported trips out of home and the inclusion of self-reported activity diaries used to cross-check subjective reports with GPS data strengthened methods and provided the context of activities such as participating in a walking group in a commercial location. Therefore, the use of mixed methods provided detailed perspective of community participation for older adults useful to inform future research.

The use of combined mixed methods is further supported by the findings presented in Chapter 3, where measures of social isolation and loneliness varied throughout the available literature. This body of research recorded the number and location of social interactions and perceptions of social

isolation and loneliness on interview. However, the inclusion of standardised measures sensitive to change could have provided further insight into older adults' experiences of COVID-19 social distancing, as reported in Chapter 6. The use of mixed methods could be useful to inform practice based on individual factors, such as the measurement and development of adaptive strategies, targeted at overcoming barriers to community participation, and enabling confidence, which programs such as TCP could use to maximise community participation for older adults. This body of research recommends that future community participation research should include mixed methodological approaches to observe the complexity of community participation necessary to inform individualised assessment and clinical practice.

9.11 Limitations

Despite obtaining a detail rich picture of community participation, there are some limitations to this research that should be acknowledged. The samples recruited for this research were affected by sampling bias, those who volunteered to participate were often active physically and socially, not lonely, and highly motivated to participate. This was useful for re-recruitment for follow-up data collections but may have affected the overall feasibility of the use of these methodologies with older adults. The small sample size also meant that correlations between older adults who reported social isolation and/or loneliness and those who did not, was not possible. Therefore, combined methods of community participation should be tested with larger samples of older adults with varying levels of health, cognition, and frailty.

Despite the strict protocol, we are unable to guarantee that participants carried the GPS devices for the duration of the monitoring period. However, cross checking GPS data against diary entries were performed to reduce this limitation. Despite loss of GPS data being commonly reported (Hordacre et al., 2014), data loss in this research remained relatively low. However, data loss may have affected the overall analysis.

As discussed in Chapter 5,6 and 8, the weather during data collection of baseline community participation for community dwelling older adults was extreme. Temperatures were consistently high, with some participants carrying devices on multiple days over 35 degrees Celsius. Baseline levels of MVPA, sedentary minutes and sleep could have been affected as older adults changed their activities to stay home and avoid being out in the heat. This could have affected the comparison of community participation during and following COVID-19 lockdown. In conjunction, we are unable to determine whether the community participation of the sample returned to baseline levels following the easing of restrictions, this would have been useful to understand the extent of behaviour change in this population. However, due to the rapidly changing restrictions and time-constraints of completing this thesis it was not plausible.

Standardised outcome measures of social isolation were not identified, or used in this research, instead social interactions were self-reported in activity diaries, and identified using semi-structured interviews. Participants self-reported their social interactions which limits the study, as we are unable to be certain that all participants recorded social interaction in the same way. However, as a measure of social interaction, diaries provided details of social experiences and were analysed as best possible. Despite allowing for the number of social interactions and locations to be identified, this method was open to interpretation. Future research should review the gold standard measures for community-dwelling older adults and integrate measures into community participation research.

Although COVID-19 social isolation and social distancing allowed for interesting comparisons of community participation for older adults, the pandemic disrupted the intended trajectory of this research. The original aims of Chapter 8 acknowledge that the intention of this research was to determine how TCP users reintegrated into their communities following hospital discharge. COVID-19 disrupted TCP services and led to older adults changing how they participated in their communities on returning home from hospital. The inability to complete this area of research limits the picture of community participation in this population. However, ethics for this study has been paused with the intention to return to collect data for a larger sample when transition care services return to normal and social distancing restrictions for older adults cease.

CHAPTER 10: **CONCLUSION**

10.1 About this chapter

This chapter highlights the contribution to knowledge presented in this body of research, recommendations for future research and summarises the implications for clinical services with particular focus on identifying social isolation and incorporating community participation into existing services for positive health outcomes.

10.2 Future research

Additional research is required to develop our understanding of community participation and its clinical importance for older adults. Future research should standardise guidelines for the use of GPS and combined methodologies to identify community participation for older adults. Streamlined methods will be useful to allow for comparison between studies, with feasibility of these methods for large samples of less healthy, more vulnerable adults important to guide interventions and future clinical practice. Larger studies should look to establish causal relationships between community participation, location, PA, and social interactions. Findings from this thesis suggest that interventions to increase levels of PA and reduce sedentary time would be useful in this population. As would further exploration into whether teaching adaptive strategies to enable older adults to maintain their physical and social activities could be effective during times of social isolation. As previously mentioned, completion of the TCP research detailed in Chapter 8 is important to determine what happens after cessation of TCP services. Research in this area will prove helpful to inform services, clinical practice, and interventions to promote community participation in the lives of older adults.

10.3 Implications for practice

Measuring community participation using combined mixed methods appears to be effective to improve our understanding of the specific activities and social interactions older adults choose to participate in. Increased awareness of these constructs could inform the design of interventions which can promote and enable older adults to participate actively in their communities and experience the associated health benefits. A review of the literature and Kathy's personal experiences identified many barriers to community participation for older adults returning home from hospital. These findings should be considered to inform supportive services, not only to support mobility, but to effectively reintegrate older adults back into their communities. Thus, reducing the risk of social isolation and loneliness. In the future, periods of social isolation may become more frequent in the ongoing management of the COVID-19 pandemic. Providing older adults with the skills required to be resilient and adapt their activities to maintain PA and social interactions should be a consideration for clinical practice. Especially given that healthcare workers and allied health professionals are in the position to identify those who are at increased risk.

In summary, this research highlights that community participation is currently not a priority for healthcare services yet benefits for QOL and healthy ageing suggest that it should be routinely measured. Services and interventions should routinely consider:

- the use of standardised outcome measures of PA, social isolation and loneliness using both qualitative and quantitative measures
- maximising opportunity, confidence, and the underlying factors e.g., PA, to promote community participation out of home, and-
- meaningful individualised activities that maximise PA and social interactions are required during times when older adults are unable to get out of home.

10.4 Contribution to knowledge

This research implemented innovative mixed methods to measure community participation with a group of community dwelling older adults and identified that community participation is an important consideration for healthy ageing, yet is often overlooked by supportive services and healthcare clinicians. Findings suggest that services should consider maximising coping mechanisms for older adults to adapt their physical and social activities and maintain community participation into the latter years.

The main findings arising from this body of research are:

- awareness of social isolation for older adults increased during the COVID-19 lockdown
- older adults who take more trips out of home have the potential to be more physically and socially active
- commercial facilities were the most commonly visited locations at baseline, during lockdown, and post lockdown by older adults
- the use of combined mixed methods can provide a detailed picture of community participation for older adults
- participants demonstrated higher levels of MVPA outside of home
- in-home activities were mainly sedentary in nature
- supportive TCP services increased HRQOL and coping scores for a single older adult
- sleep quality reduced significantly for community dwelling older adults during lockdown
- participants enjoyed some of the effects of social distancing such as increased hand washing and hygiene practices, and-
- demonstrating resilience and adapting successfully to a situation allows older adults to overcome barriers to community participation.

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APPENDICES

Appendix 1: Included studies (Chapter 3)

Authors	Country	Study design	Aims	Population	Age (mean (SD))	Main findings
Boekhout et al., (2019)	Netherlands	Longitudinal single-group pre-test–post-test	Aims were to 1) determine whether there is an association between changes in PA and loneliness and 2) to determine whether a potential association between changes in PA is different for single older adults with a physical impairment than for a single older adult without such an impairment	N=575, single, community dwelling older adults. Physically impaired (n = 414) Non-impaired group (n = 161).	>65 years, Impaired group 76.71 (7.76), non-impaired group 72.81 (6.74).	Improvements in moderate to vigorous PA were associated with decreases in loneliness (B = −0.09, SE = 0.04, p = .020); this association became nonsignificant when including the presence of physical impairments in the analyses (p = .824), which in itself was positively associated with loneliness (B = 0.51, SE = 0.10, p < .001).
Buchman et al., (2010)	USA	Cross sectional. Observational	To examine whether feeling alone is associated with the rate of motor decline in community-dwelling older persons	N = 245, community dwelling older adults, 24.87% male	79.67 (7.36)	The level of loneliness at baseline was associated with the rate of motor decline (Estimate, -0.016; S.E. 0.006, p = 0.005). Participants, who reported higher levels of loneliness at baseline were older, less educated, reported less frequent participation in social, physical, and cognitive activities, reported more disability, had lower cognitive function, and were more likely to have vascular diseases.
Chen et al., (2015)	China	A Cross-sectional questionnaire survey	To investigate physical activity among older people living alone in Shanghai, People's Republic of China, and key factors contributing to their physical activity.	N = 521, community-dwelling older people living alone (aged 60 years and above)	Participants ranged from 60 to 99 years (mean, 76.5), with 24.2% (n = 126) aged 60 – 69 years old, 38.4% (n = 200) aged 70 – 79 years, and 37.4% (n = 195) aged 80 years and above.	The relationships between physical activity levels and both loneliness and social support were also examined: there was a significant difference in the social support level between the adequate and inadequate physical activity groups, with a mean score on the SSRS of 32.8 and 30.0, respectively (p < 0.001); however, there was no significant difference in reported loneliness between the groups with different physical activity levels (p > 0.05).
de Koning et al., (2020)	England	Cross-sectional: Observational	a) To explore the association between objectively measured PA and loneliness or SI from friends, family, or neighbours. b) To explore associations between specific activities out of the house and loneliness or SI from friends, family, or neighbours.	N=112, older adults, living across 23 rural villages or isolated dwellings in Wiltshire, South West England, 51.8% female	72.8 (6.6)	Daily mean light, moderate to vigorous, and total PA were not associated with loneliness or SI. Volunteering, accompanying others, and sports/exercise were associated with lower SI from neighbours (odds ratio = 0.23, 95% CI [0.06, 0.91]), family (odds ratio = 0.39, 95% CI [0.22, 0.68]), and friends (odds ratio = 0.56, 95% CI [0.33, 0.97]), respectively. There were no associations between loneliness, SI, and objectively measured PA.
Herbolsheimer et al., (2017)	Germany	Cross-sectional analyses	To understand the relationship between physical activity and social isolation in old age. Specifically, whether older adults' (objectively assessed) physical activity levels are differently associated with the two sources of social isolation (i.e.,	N = 1162, Community dwelling older adults from the greater area of Ulm, Germany. Activity and Function in the Elderly in Ulm (ActiFE) study.	75.6 (6.6), range 65-90	Socially isolated older adults were physically inactive (-7.8 minutes; p = .007) compared to non-isolated persons. Persons who were socially isolated from family were more likely to be sedentary indoors (-4.5min, p = .014).

			friend/neighbours and family) and whether indoor and outdoor physical activity is differently related to social isolation			
Herbolsheimer et al., (2018)	Germany	Longitudinal	To identify the role of (out-of-home) physical activity in mediating between social isolation and depressive symptoms and to analyse the varying impact of different sources of social isolation.	N = 293, community dwelling older adults from the greater area of Ulm, Germany. Activity and Function in the Elderly in Ulm (ActiFE) study.	Mean age at T0 was 72.6 (5.0) and at T1 75.4 (5.0)	Being socially isolated was associated with lower levels of out-of-home physical activity, and this predicted more depressive symptoms after 3 years.
Kobayashi et al., (2018)	England	Longitudinal cohort study	To investigate the longitudinal and independent relationships between baseline social isolation, baseline loneliness, and consistent weekly moderate-to-vigorous physical activity (MVPA), consistent five daily fruit and vegetable servings, daily alcohol drinking at any time point, smoking at any time point, and a consistently overweight/obese BMI over the follow-up over a 10 year period	N = 3392, Adults from the English Longitudinal Study of Ageing from 2004/05 to 2014/15 (ELSA)	52-59 (n = 1,330, 39%), 60-69 (n = 1,299, 38%), 70-79 (N=661, 19%), >80 (n = 102, 3%)	Socially isolated participants were less likely than non-isolated participants to consistently report weekly moderate-to-vigorous physical activity. Loneliness was not associated with health behaviours or body mass index in adjusted models.
Kowitt et al., (2020)	USA	Cross-sectional observation	To examine if neighbourhood characteristics are associated with depressive symptoms, and if so, what factors mediated these relationships.	N=3,392 adults from the English Longitudinal Study of Ageing from 2004/2005 to 2014/2015 (ELSA)	68.1 (9.1)	Mediation analysis indicated that associations among neighbourhood characteristics and depressive symptoms were mediated by loneliness, physical activity, and perceived individual control.
Luo et al., (2014)	China	Longitudinal survey	To examine the relationships between loneliness, social and health behaviours, physical, emotional and functional health outcomes, and mortality among older Chinese adults.	N = 14,072, Chinese older adults from the Chinese Longitudinal Healthy Longevity Survey	Mean 72.34 (5.94)	Loneliness both affects and is affected by social activities, solitary leisure activities, physical exercise, emotional health, self-rated health, and functional limitations over a 3-year period.
McKee et al., (2015)	Ireland	Cross-sectional design	To identify the socio-demographic, social connectedness, physical environment and physical and mental health related factors associated with self-reported PA in community living older adults.	N = 3499, adults aged 65 years and over, living in the community	72.6 (5.2)	31.8% of older people did not meet recommended activity guidelines. The regression model was significant, explaining 31.3% of the variance in PA (F= 34.32, P< 0.001).
Nagarajan et al., (2020)	Australia	Prospective cohort study	This study aims to identify risk factors amongst older adults at hospital discharge that are associated with social isolation at three months post-hospitalization.	N = 311, 0lder adults discharged home after an extended hospital stay. Participants were hospitalized for a	78.42 (7.69)	Higher depressive and anxiety symptoms at hospital discharge, comorbidity of cancer, history of cigarette smoking, prior access to community and respite service, and arrangement for shopping assistance post discharge were factors independently associated

				variety of diagnoses, including but not limited to stroke, falls, and heart and lung conditions.		with an increased risk of social isolation at three months posthospitalization
Netz et al., (2012)	Israel	Cross sectional observation survey	The aim of this study was to examine whether the feeling of loneliness is a moderator of this relationship. Specifically, living alone versus living with another person was compared with feeling lonely versus not feeling lonely, with regard to the level of physical activity. In addition, we assessed the degree to which loneliness is a risk factor for insufficient physical activity independent of its association with the demographic and health variables known to be associated with a lower likelihood of physical activity.	N = 1663, (799 male) Israeli citizens from both Jewish and Arab sectors, aged 65 years and over living in the community, residing in the country for at least one year	Feeling lonely group mean age 74.77 (6.21), Not lonely 74.06 (5.92)	Chi-square analyses indicated that loneliness, but not living alone, were inversely related to level of physical activity in both genders. Based on multinomial stepwise logistic regressions body mass index, being religious versus secular, self-rated health, and education were associated with engaging in physical activity in men. Loneliness contributed significantly to explaining the level of participation in physical activity beyond these variables in women, but not in men. The rate of feeling lonely was significantly higher in women than in men across all activity groups.
Newall et al., (2013)	Canada	Longitudinal correlational study	To examine the longitudinal relationships between loneliness, physical activity, and mortality in older adults. This study also tested the implication of Fredrickson's Broaden and Build Theory (1998, 2001) that positive emotions (happiness) might serve to "undo" the detrimental effects of negative emotions (loneliness)	N = 228, Community dwelling older adults, 62.3% female from two linked datasets Aging in Manitoba (AIM) study and Successful Aging study (SAS).	83 (4.22) range 77-96	Regression analyses showed that loneliness longitudinally predicted perceived physical activity and mortality. Moreover, in support of Fredrickson's theory, happiness moderated these relationships, suggesting that happiness had the power to "undo" the detrimental effects of loneliness on activity and mortality.
Robins, Brown et al., (2018)	Australia	Cohort study	The aim of this study is to examine the relationships between household-based physical activity, recreational physical activity, and physical capacity with social isolation	N = 311, older adults discharged home after an extended hospital stay. Hospitalization diagnoses included but not limited to stroke, falls, and heart and lung conditions.	78.42 (7.69), range 65-97	Over six months, improvements in physical capacity were related to reduced social isolation (−0.65, CI = −1.21, −0.09). Increased total (0.02, CI = 0.004, 0.04) and household-based physical activity (0.03, CI = 0.001, 0.06) were related to contact with more relatives. Higher baseline household-based physical activity was related to contact with fewer relatives (−0.01, CI = −0.02, −0.001). Along with physical capacity and activity, household-based physical activity appears to be strongly related to social isolation.
Robins, Hill, et al., (2018)	Australia	Cross sectional	To determine whether a relationship exists between physical activity (recreational and/or household based) and social	N = 245, community dwelling adults, 66% female	77 (6)	Factors found to be significantly associated with reduced social isolation in multivariable analysis included living with a partner/spouse, reporting better general health, higher levels of household-based

			isolation in community-dwelling adults			physical activity (OR D 1.03, CI D 1.01–1.05) and feeling less downhearted/ depressed. Being more socially isolated was associated with symptoms of depression and a diagnosis of congestive heart failure (pseudo R2 D 0.104).
Schrempft et al., (2019)	England	Cross sectional observation: survey	To investigate the associations between social relationships, in the form of social isolation, and loneliness, and accelerometer-based measures of PA. This study tested the hypothesis that social isolation and loneliness are associated with less objective PA and more sedentary behaviour in adults.	N = 267, Community dwelling men and women aged 50 years and older from the English Longitudinal Study of Ageing (ELSA)	Age 66.01 (7.81) range 50-81	Total 24 h activity counts were lower in isolated compared with non-isolated respondents independently of gender, age, socioeconomic status, marital status, smoking, alcohol consumption, self-rated health, limiting longstanding illness, mobility limitations, depressive symptoms, and loneliness (β = − 0.130,p = 0.028). Time spent in sedentary behaviour over the day and evening was greater in isolated participants (β = 0.143,p = 0.013), while light (β = − 0.143,p = 0.015) and moderate/vigorous (β = − 0.112,p = 0.051) physical activity were less frequent. Physical activity was greater on weekdays than weekend days, but associations with social isolation were similar. Loneliness was not associated with physical activity or sedentary behaviour in multivariable analysis.
Shankar et al., (2011)	England	Cross sectional observation: survey	To examine the impact of social isolation and loneliness on two health-risk behaviours: smoking and low physical activity.	N = 8688, 46.1% male from the English Longitudinal Study of Ageing (ELSA)	66.9 (10.4)	Fewer than 2% of participants reported being lonely all the time, while nearly 7% had the highest possible scores on social isolation. Both social isolation and loneliness were associated with a greater risk of being inactive, smoking, as well as reporting multiple health-risk behaviours. Social isolation was also positively associated with blood pressure, C-reactive protein, and fibrinogen levels
Vancampfort et al., (2019)	China, Ghana, India, Mexico, Russia and South Africa	Cross sectional observation: survey	To assess the cross-sectional associations between loneliness and not meeting the international recommendation of at least 150 minutes of moderate to vigorous intensity PA in middle aged and older people in six low and middle-income countries	N = 34129, individuals aged 50 years and over	China 62.6 (16.7), Ghana 64.4 (19.9), India 61.5 (13.7), Mexico 63.0 (18.9), Russia 63.9 (15.4), South Africa 61.6 (18.4)	The prevalence of loneliness and not meeting the physical activity recommendation ranged from 5.5% (China) to 17.8% (India) and 20.2% (Russia) to 50.9% (South Africa), respectively. In all countries, the prevalence of loneliness was higher among those not meeting the physical activity recommendation, although this difference was not statistically significant in Mexico and South Africa
Ward et al., (2020)	Ireland	Cross sectional observation: survey	To examine the relationship between physical activity and the local social and built environments among older community-dwelling adults in Ireland	N = 10,540, Community dwelling older adults, 52.7% female	Aged 55-64 (46.5%), 65-74 (31.5%), >75 (22%)	Loneliness, community participation, and difficulty in accessing green spaces partially explained the differences in the number of minutes that respondents were physically active.

(SSRS- Social Support Rate Scale, SI- social isolation)

Appendix 2: Chapter 4 publication

Location Monitoring of physical activity and participation in community dwelling older people: a scoping review https://doi.org/10.1080/09638288.2019.1618928

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RESEARCH ARTICLE   **Open Access**

Community participation of community dwelling older adults: a cross-sectional study

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Abstract

Background: With the advancing age of the population, and increasing demands on healthcare services, community participation has become an important consideration for healthy ageing. Low levels of community participation have been linked to increased mortality and social isolation. The extent to which community participation has been measured objectively in older adults remains scarce. This study aims to describe where and how older adults participate in the community and determine the feasibility of measurement methods for community participation.

Methods: This observational cross-sectional study obtained data from 46 community dwelling older adults. A combination of Global Positioning Systems (GPS), accelerometry, and self-reported diaries were used over a 7-day monitoring period. Feasibility of methods were determined by calculating the loss of GPS data, questionnaires, and comparison of self-reported locations with GPS co-ordinates. Relationships between community participation, physical activity, social interactions, health related quality of life, sleep quality and loneliness were explored.

Results: Older adults took a median (IQR) of 15 (9.25–18.75) trips out of home over the 7-day monitoring period, most frequently visiting commercial and recreational locations. In-home activities were mainly sedentary in nature, with out of home activities dependent on location type. Self-reported and GPS measures of trips out of home and the locations visited were significantly correlated (self-report 15.7 (5.6) GPS 14.4 (5.8) (r = 0.94)). Significant correlations between both the number of trips taken from home, with social interactions (r = 0.62) and the minutes of moderate to vigorous physical activity (MVPA) (r = 0.43) were observed. Daily MVPA was higher in participants who visited local walk/greenspaces (r = 0.48).

Conclusion: Participants performed more activities with social interactions out of home and visited commercial locations most frequently. The combination of GPS, accelerometry and self-report methods provided a detailed picture of community participation for older adults. Further research is required with older adults of varying health status to generalise the relationships between community participation, location and physical activity.

Trial registration: Ethical approval was gained from the Flinders University Social and Behavioural Research Ethics Committee (protocol no. 8176).

Keywords: Community participation, Older adults, Global positioning system, Accelerometry

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Background

With the increasing age of the population and high prevalence of chronic disease, the demands on healthcare systems continue to grow [1]. By 2057, it is estimated that 22% of the Australian population will be aged 65 years and older [2], with costs of ageing expected to rise from $18 billion in 1996, to $24 billion in 2051 [3]. Despite increasing life expectancy, there is no guarantee of 'healthy' ageing or quality of life in the latter years [4, 5]. Therefore, the importance of facilitating healthy ageing has increased.

The term 'community participation' is defined as *'engagement in activities occurring outside the home that are complex in nature, social and nondomestic* [6].' These activities may include, meeting with family or friends, taking part in recreational activities, volunteering and cultural or social activities [7, 8]. 'Social participation' is defined as *'a person's involvement in activities that provide interaction with others in society or the community* [9].' Older adults who participate in such activities have a lower risk of functional disability, increased health related quality of life (HRQOL) and report lower usage of formal healthcare [10, 11]. Community and social participation are therefore key components of healthy ageing [12] and an important consideration for future healthcare delivery [13].

Participating in the community becomes more difficult with increasing age due to increasing frailty and reduced mobility [6]. In order to remain active out of their homes, older adults need to maintain functional mobility, and overcome personal and environmental barriers [14, 15]. Many older adults become dependent on community resources and planned activities for meaningful engagement and social interactions [16]. Despite the benefits of community participation, the evidence is sparse regarding how and where older people participate in their communities. Understanding these factors mayallow for support and interventions specifically targeting the promotion of participation through the latter stages of life.

Factors that determine community participation are not yet fully understood [17]. However, levels of physical activity (PA) and the preservation of functional mobility is vital for participation in community activities [14]. The World Health Organization defines PA 'as *any bodily movement produced by skeletal muscles that requires energy expenditure* [18].' Adults aged over 65 years are recommended to engage in at least 30 min of moderate intensity PA, five times per week, or 75 min of vigorous activity per week [19–21]. Despite these guidelines, levels of PA remain particularly low in this age group [22] with reports older people can spend up to 80% of their day sedentary [23]. High levels of sedentary time have been associated with older individuals with chronic conditions and/or walking difficulties [24]. Therefore, increasing or maintaining PA levels allows older adults to participate in and contribute to society, with active community participation in turn leading to increased levels of PA [25].

Furthermore, the social components of activity are important in keeping older adults motivated and engaged, with social isolation and loneliness known to reduce engagement in both the community and PA [26, 27]. Social isolation is defined as an *'objective lack of relationships and social interaction'* and loneliness as *'a subjective and distressing feeling* [28].'Older adults have an increased risk of social isolation and loneliness stemming from events such as transitioning into retirement [29]. The risks are also linked to poor sleep quality [28], increased blood pressure [30], impaired cognitive function [31] and depression [32]. Social integration of older adults via community participation has been demonstrated to improve quality of life (QoL) [33]. There is a need to explore the factors associated with community participation for older adults, to inform interventions which can maximise QoL and wellbeing.

When developing strategies to increase community participation in older adults, objective measures are required to gain a detailed picture of baseline levels [34]. Despite this, self-reported methods that lack objectivity and often analyse a specific activity rather than daily patterns, continue to be used [34–37]. With advances in health monitoring technology, there is the potential to use objective measures to measure components related to community participation [36]. Previous research has successfully combined Global Positioning Systems (GPS) with accelerometry allowing for the assessment of indoor and outdoor PA, reflecting unstructured activity in a normal day [38]. Previous recommendations have combined objective measures of PA and outdoor time [39]. Accelerometers measure body movement in real-time, specifically the intensity, frequency, duration and total volume of activity [40]. GPS is a satellite based navigation system, which allows receivers to calculate exact locations [41]. It has the potential to be applied to the assessment of community participation in older adults by measuring the number of outings away from home as a representation of community participation [42–44]. The use of GPS combined with accelerometry can determine specific community locations and intensity of activity, despite this, objective reports of community participation for older adults are lacking [45].

Therefore, the primary aim of this study was to describe community participation (specifically by location type and frequency) in community-dwelling older adults and characterise the types of activities in which they engaged. The secondary aim was to investigate the factors associated with community participation, including PA,

social interaction, HRQOL, sleep quality and loneliness. The tertiary aim was to determine feasibility of a 7-day monitoring protocol using GPS, accelerometry and self-reported diaries with older adults, and to determine the validity of associated quantitative and qualitative measures.

Methods

This study used an observational cross-sectional design. Ethical approval was gained from the Flinders University Social and Behavioural Research Ethics Committee (protocol no. 8176). Written informed consent was obtained from all participants. Data were collected from November 2018 to May 2019. Methods combined quantitative and qualitative measures of community participation and physical activity, to provide a data rich picture of participation [46].

Participants

For inclusion, participants had to live in metropolitan Adelaide, be able to walk independently (+/− walking aids), speak and understand English, have sufficient cognition to understand the study information and be aged 65 years or over. Individuals were excluded if they were living in residential care facilities. Participants were recruited using flyers advertising the study through local Councils, community centres, social media forums and organisations for older adults. Interested individuals were invited to contact the Principal Researcher (CG) who screened potential participants for eligibility over the phone. The Standardised Mini Mental State Examination (SMMSE) was completed with potential participants to determine whether they had sufficient cognitive capacity to participate in the study, with a score above 25 required for participation [47].

Outcomes

Community participation

Community participation was measured using GPS (Qstarz BT1000XT) to calculate the number of trips away from home, type of location visited and the number of in- and out-of-home activities. The Qstarz BT1000XT device is deemed to be accurate to within 10 m for 79% of ≈68,000 GPS points [48] and a popular device with researchers [42]. GPS data provided co-ordinates of the beginning and end locations of identified 'loops' for individual trips. The co-ordinates were viewed on the street view of Google maps [49] to identify the location visited. The types of location were then grouped into the following categories: residential, recreational, commercial, health, local walk/ greenspace, central business district (CBD) and place of worship [8] (Table 1). For each type of location visited out of home, activity diaries were cross-referenced to ascertain the

Table 1 Community Participation category definitions [8]

Residential	Housing other than own home
Recreational	Sports centre, community hall, swimming pool
Commercial	Shopping centres, local shops
Health	Hospital, GP clinic, physiotherapist, blood clinic
Local walk/ Greenspace	Local area, park space (beach), or greenery close to home
Central Business district	Adelaide Central Business District (CBD)
Place of worship	A location designed for congregation of faith

purpose of the visit and to identify possible social interactions. For example, in a commercial location, grocery shopping was identified as a domestic task, yet attending a walking group in a shopping centre was deemed an important social component of community participation.

Self-reported participation diaries were completed by participants to provide the context of community participation. Diaries reported the time, activity, duration, location and social interactions out of the home. Participants recorded sleep and device non-wear. An excerpt is provided in Additional file 3. This information was used to cross-check with the objective data, the accuracy of location where GPS data were missing, and report participation in specific activities.

Community participation- influencing factors

Physical activity was objectively measured with GeneActiv wrist-worn accelerometers, fitted to the non-dominant wrist. GeneActiv accelerometers have been deemed reliable and valid for classifying the intensity of PA in adults [50]. Accelerometer data were used to determine times participants were sedentary, and engaging in light, moderate or vigorous activity. To determine overall daily PA, GeneActiv .bin files were converted to 60-s epoch files and analysed using Cobra software (Francois Frayasse, University of South Australia). Cut points developed by Esliger [50] were used (adjusted for the sampling frequency and epochs) to identify activity intensity (light 283, moderate 605 and vigorous 1697). Sleep was identified using a combination of visual analysis of the activity trace, and self-reported sleep diaries, and subsequently excluded from the analysis.

The *number of social interactions* experienced were self-reported by participants in participation diaries (Additional file 3), with the total number and location of social interactions identified. *HRQOL* was measured using the AQOL-8D questionnaire, deemed valid and reliable with larger samples [40]. AQOL-8D utility algorithm was used to calculate scores [51] which were compared with the general population [52], across the following categories: Independent living (IL), Pain, Senses, Mental health, Happiness, Coping, Self-worth

and Relationships, with higher scores indicative of greater quality of life. *Sleep quality* was measured using the Pittsburgh Sleep Quality Index (PSQI), an instrument used to measure the quality and patterns of sleep in older adults [53]. PSQI scores were calculated manually, with scores of 6 and above used to identify poor sleep quality [53]. Levels of *loneliness* were measured using the De Jong Gierveld loneliness scale which has been validated to measure general, emotional and social loneliness [54]. Scores were calculated, with a score of 6 representing 'most lonely' (on a scale of 0–6) [54].

Feasibility of community participation measurement

Loss of GPS hours were calculated to determine the completeness of data collection, according to the expected number of cells recorded [$n = 120,960$ (5 s epochs)] [44]. The self-reported locations and number of trips out-of-home (total) were manually checked against GPS co-ordinates to determine the accuracy of self-reported location (community participation). Data were linked to Google Maps [49] for graphic representation of where participants were in the community. A maximum time-difference of 10 min was accepted for reported location analysis [55]. On study completion, a 15-item feasibility questionnaire to determine participant experiences of wearing the deviceswas completed [56].

Procedure

Eligible participants attended a face-to-face meeting with the researcher, either in their own home or at the university. At this meeting, participants completed demographic, AQOL-8D, PSQI and De Jong Gierveld loneliness questionnaires and were measured for height and weight using standardised procedures.

Participants were fitted with a Qstarz BT1000XT GPS device (Fig. 1) and GeneActiv triaxial accelerometer (Fig. 2) with device instructions. The researcher explained how to use the devices and assisted with setup for each participant. The GPS device was worn on a lanyard around the neck, attached to a belt loop, on a waist belt or in the participant's pocket (depending on preference and comfort). The device measured 72.2 mm (L) × 46.5 mm (W) × 20.0 mm (H), weighed 8.5 g and had a battery life of 42 h. The GeneActiv accelerometer was fitted comfortably to the participant's non-dominant wrist. The device measured 43 mm (L) × 40 mm (W) × 13 mm (H) and weighed 16 g.

Participants were asked to wear the GeneActiv device continually for the 7-day monitoring period (inclusive of sleeping, showering and swimming- as the devices were waterproof). GPS devices were to be worn whenever participants left their home and were removed for water-based activities and overnight for charging. Participants were asked to carry out their normal daily routines

Fig. 1 Qstarz BT1000XT GPS device

whilst wearing the devices. Devices were synchronised to begin recording and obtain 7-days of 24-h data, recording at 5-s epochs, with GeneActiv devices recording at a frequency of 75 Hz. Reminder signs were provided to the participants; the first was to be placed near the bed to prompt charging of the GPS device each night, the second was meant to be placed near the exit to the home to prompt participants to take the GPS device with them.

Participants were provided with the option to receive daily reminders to charge the GPS device via text message during the monitoring period. On day three, all participants were contacted via telephone to discuss any

Fig. 2 GeneActiv triaxial accelerometer

issues and to provide a reminder to charge the GPS device. During the monitoring period, participants kept a written diary detailing their activities. On completion of the study, participants attended an exit meeting where the researcher collected the devices and participation diaries. Participants were then invited to complete the feasibility questionnaire.

Data processing

Signal loss from GPS devices is a common and well-documented issue [43, 44, 57], therefore quality measures were prospectively determined for the inclusion of data sets in the analysis. To be included, GPS data required a minimum of 8- h (480 min) for each day, complete for five of the seven days monitored [58]. For the accelerometer data, to be included in the analysis, a minimum of four valid days, defined as the recording of at least 8-h of waking time, with at least one weekend day required [59, 60].

For the determination of community participation, GPS data were downloaded as .csv files using QSTARZ DataViewer Version 1.37.000 software [61]. GPS data were cleaned to remove title lines that were recorded when GPS signal had been interrupted. GPS data recorded prior to the start of accelerometry monitoring were also removed. Accelerometry data were downloaded using GeneActiv PC Software version 3.2 as .bin files and converted into 5-s epoch .csv files. GPS and accelerometry files were then combined using time stamps with Python coding software version 2.7.14 [62]. These methods allowed for the detection of when and where participants participated in community activity, following recommendations for proper data handling and maintenance of correct time stamps [63]. Self-reported diary entries were recorded in an Excel spreadsheet, where locations reported were grouped into residential, recreational, commercial, health, local walk/greenspace, CBD and place of worship [44]. Activities such as gardening were noted as in-home activities, and reports of social interaction were identified according to location.

Data analysis

Data were entered and analysed using the Statistical Package for Social Sciences (SPSS) [64] with identifying information removed. Questionnaire responses were entered by a researcher and crosschecked by a research assistant. Descriptive analyses were performed for participant demographic data. The normality of data was determined using Z scores [65] with means and standard deviations (SD) reported for normally distributed data, and median and IQR for non-normally distributed data. Spearman correlations were performed to identify the relationships between the number of social interactions, the

number of minutes of MVPA, HRQOL, loneliness, and sleep quality scores with the total number of trips away from home and with the number of trips to different locations [66]. Paired t-tests (significance set to alpha of 0.05) were used to determine the accuracy of self-reported location with GPS locations with significance set at < 0.01 for Spearman's, due to multiple correlations [67, 68].

Results

Participant characteristics

A total of 46 participants (n = 33, 72% female), mean age 74 years (SD 5) participated in the study. The sample demonstrated 'normal' cognition [47] with a mean SMMSE score of 29.2 out of 30 (SD 1.3). Thirty-nine percent of participants were married/in de facto relationships and 61 percent were either single, separated or widowed. Participants self-reported an average of two chronic conditions each and all participants reported their general health as good or above (Table 2).

Valid Data sets were obtained for 44 of the 46 recruited participants. Data were excluded from one participant due to equipment malfunction (GeneActiv device). One further data set was excluded as the participation diary was not completed and therefore could not be included in comparisons of self-reported and GPS locations. Following exclusions, of the 7392 h of expected GPS data, 6983 h were recorded. Two participants requested reminders to charge the GPS device and received text messages on days 1, 2, 4, 5 and 6.

Community participation

Overall, participants reported a median (IQR) of 15 (8–18) in-home activities and 18 (14–25) out-of-home activities over the 7-day period, with median (IQR) of 15 (9–19) GPS trips out-of-home. Nine participants reported a single day where they did not leave the house. The median (IQR) number of locations visited outside of the home are presented in Fig. 3, with commercial locations the most frequently visited location type (median 6, range: 3–7), followed by recreational 4 (2–6), local walk/greenspaces 2 (0–6), residential 2 (0–4), CBD 1 (0–2), health 0 (0–1) and place of worship 0 (0–1).

The type of in-home activities reported are detailed in Additional file 1and were mainly sedentary in nature, including reading the paper, computer work, watching television and listening to the radio. The type of out-of-home activities varied with the location (Additional file 1).

Community participation- influencing factors

Physical activity varied between participants, with a daily median of 67 min of moderate-vigorous physical activity (MVPA) (IQR 38–89). A daily median (IQR) of 223 (195–294) minutes were spent performing light activity, 65 (36–89) minutes moderate intensity activity and 20 s

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Table 2 Participant characteristics

Characteristic	Participants (*n* = 46)
Gender (M:F) n (%)	13:33 (72:28)
Age mean (SD) years	74 (5)
BMI mean (SD)	28 (5)
Underweight n (%)	0 (0)
Normal n (%)	16 (34)
Overweight n (%)	15 (33)
Obese n (%)	15 (33)
Marital status n (%)	
Single/never married	2 (4)
Separated/divorced	10 (22)
Widowed	16 (35)
Married/defacto	18 (39)
Education level n (%)	
High-school	9 (19)
Post-secondary	16 (35)
Bachelor degree	11 (24)
Post-graduate	10 (22)
Index of Relative socio-economic advantage and disadvantage score (IRSAD) n (%)	
1	4 (9)
2	4 (9)
3	14 (30)
4	15 (33)
5	9 (20)
Employment status n (%)	
Employed	2 (4)
Retired	44 (96)
Volunteer n (%)	28 (61)
No. of volunteer hours per week mean (SD)	4 (7)
Pet owner n (%)	13 (28)
No. of co-morbidities mean (SD)	2 (1)
Self-rated general health n (%)	
Excellent	8 (17)
Very good	25 (54)
Good	13 (28)
Fair	0 (0)
Poor	0 (0)
SMMSE mean (SD)	29 (1)

Standard deviation (SD), Body mass index (BMI), Index of relative socio-economic advantage and disadvantage score (IRSAD) (higher score indicative of lack of disadvantage and greater advantage in general), Standardised Mini Mental State Examination (SMMSE), IRSAD score, low score denotes greater disadvantage and lack of advantage in general

(0–117) of vigorous activity. Twenty-seven (**61%**) participants performed no vigorous activity. The mean sleep time was 480 (SD 58) minutes per night andon average,

participants spent 659 min (SD 91) per day sedentary. Wear time was examined for each participant by manually reviewing the GeneActiv activity trace for each day of data collection. There was 100% compliance for the 24 h/d, 7d monitoring protocol for the GeneActiv devices (1440 min/d wear time each day for all participants).

Overall, participants reported a median (IQR) of 2 (0–7) in-home social interactions and 11.5 (8–17) out-of-home social interactions over the 7-days. A median (IQR) of 16.5 (10–21) social interactions were reported over the 7-days (positively skewed 0.24). The median (IQR) number of locations of social interactions over the 7-days is presented in Fig. 4. The most common location type for social interactions was recreational, median (IQR) 3 (1–4) and commercial 3 (1–5) followed by residential 2 (0–4). No social interactions were reported at health, local walk/greenspaces, CBDor places of worship.

The mean (SD) AQOL-8D score for the HRQOL for the general population aged between 65 to 74 years old is 0.83 (0.22) [52], which is matched closely by the participant mean (SD) 0.84 (0.75) in this sample. The study sample reported higher Mental Super Dimension (MSD) scores, mean (SD) 0.84 (0.77), when compared with the general population 0.50 (0.01) which combined mental health, coping, self-worth and relationships [69]. Sleep quality ranged from 1 to 14 on the PSQI with a mean of 5.41 (SD 3) with higher scores indicative of poor sleep quality, 19 (43%) participants scored over 6 [53] indicating poor sleep quality. The study sample detected two participants who scored five out of six on the De Jong Gierveld Loneliness Scale, suggesting feelings of loneliness. The overall mean of the sample was 1.4 (SD 1.4), representing a non-lonely group.

Positive correlations were found between both the trips away from home and social interactions (0.62) and trips away from home and minutes of daily MVPA (0.43) (Table 3). There was a positive correlation between visits to local walk/greenspaces and minutes of daily MVPA (0.48). Increasing age was correlated with reduced minutes of MVPA (0.42). No significant associations were found between trips away from home and HRQOL, loneliness or sleep quality.

Feasibility of community participation measurement

Loss of GPS data ranged from 0 to 91 h (0–54%) per participant, after excluding one data set that did not meet the quality standards for analysis, the overall range was 0 to 50 h lost with a mean of 9.3 h (SD 11.8) over the 7-day monitoring period. The responses to the feasibility questionnaire indicated that devices were easy to carry (82%), comfortable to wear (54%), easy to remember to charge (54%) and remember when leaving the house (59%). Participants also reported that the

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Fig. 3 GPS out of home activity locations visited over the 7 day monitoring period. (● represents outliers, ★ represents extreme outlier)

Fig. 4 Locations of social interactions over the 7 d monitoring period. (● represents outliers, ★ represents extreme outlier)

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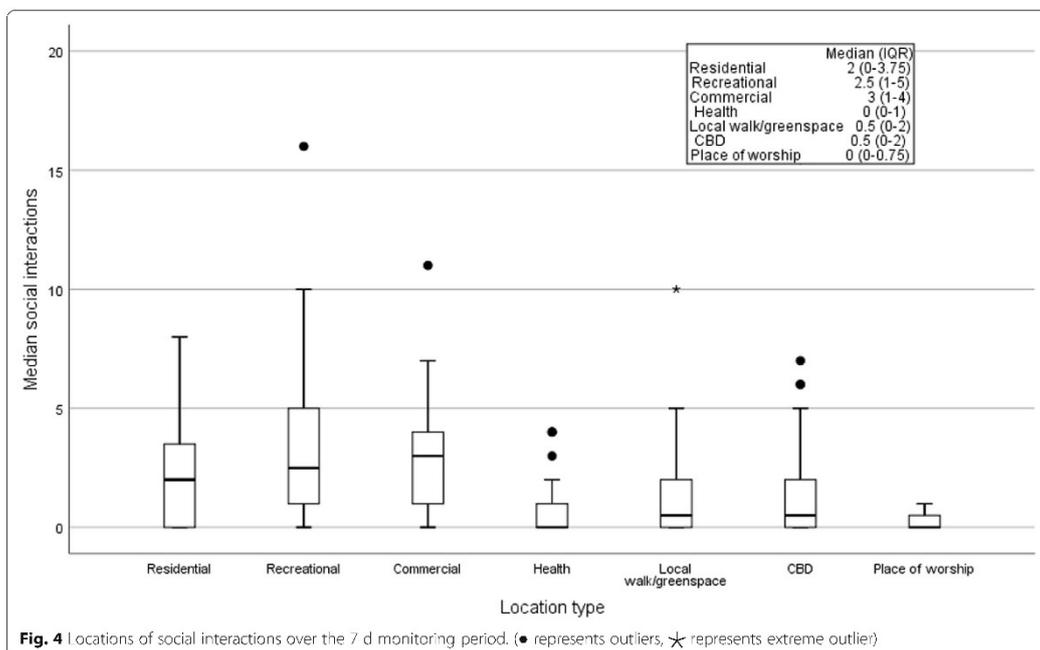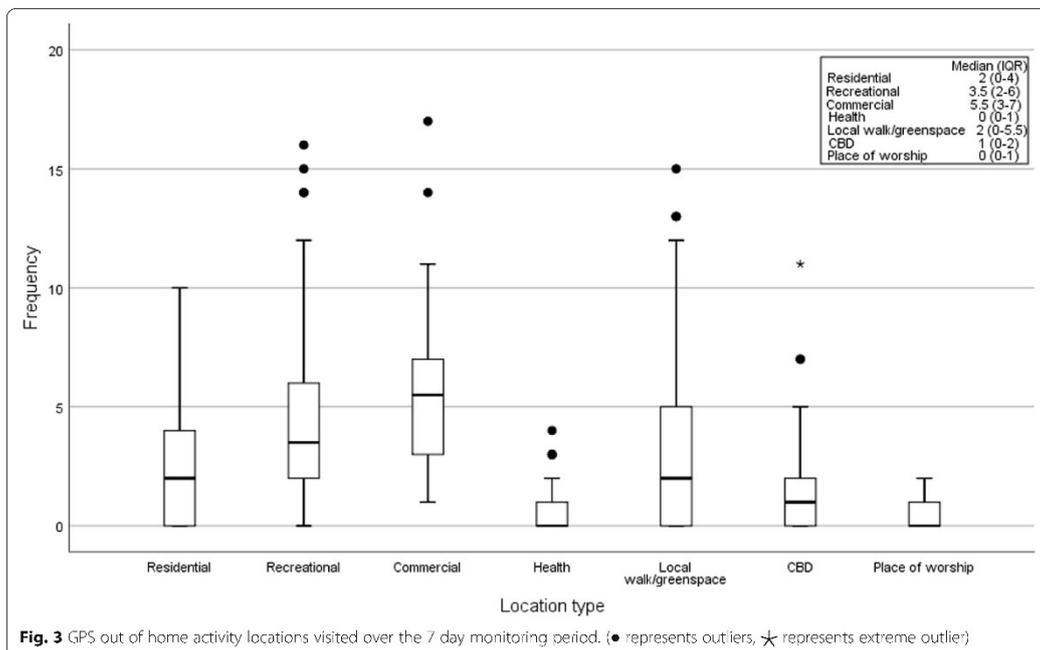
Table 3 Correlation between the number of social interactions, the number of minutes MVPA, HRQOL, loneliness and sleep quality scores with the total number of trips away from home and with the number of trips to different location types (*n* = 44)

Spearman's rho	Social interactions	MVPA	HRQOL	Loneliness	Sleep quality
Trips away from home	0.615[b]	0.434[b]	0.006	−0.134	−0.240
Residential	0.322[a]	0.133	−0.206	−0.210	0.034
Recreational	0.384[a]	0.267	−0.205	0.016	0.114
Commercial	0.260	0.118	0.146	−0.144	−0.272
Health	0.142	0.033	−0.133	0.106	0.144
Local walk/greenspace	0.196	0.477[b]	−0.076	0.002	−0.204
CBD	0.151	0.026	−0.239	0.260	0.095
Place of worship	0.144	−0.069	−0.128	−0.061	0.116

[b]. Correlation is significant at the 0.01 level (2-tailed)
[a]. Correlation is significant at the 0.05 level (2-tailed)

reminder flyers were useful to assist with charging and remembering devices. Participants reported that participating in the study did not impact their normal routine (78%), disrupt sleep (100%) and was not time consuming (89%).

To determine whether there were differences between out-of-home self-reported locations and GPS coordinates, paired t-tests were performed (Table 4). Participants self-reported a significantly higher number of trips out of the home compared with GPS data (*p* < 0.001). Participant differences between GPS and self-reported trips out of home is provided in Fig. 5. Participants also self-reported a higher number of out-of-home trips to recreational (*p* = 0.005) and commercial (*p* = 0.002) locations than observed in the GPS data (Table 4) (t(43) = 3.284, p = 0.002).

Discussion

This study describes the community participation of older adults living in the community, including the types of activities engaged in, and factors associated with participation. Feasibility of monitoring community participation using both objective (GPS, GeneActiv) and self-reported methods (diary) was also explored. Participants

performed more activities with social interactions out of home and visited commercial locations most frequently. Additionally, they were very active in terms of daily MVPA, with visits to local walk/greenspaces positively associated with increased activity. The combination of monitoring methods used in this study was feasible with this group of community dwelling older adults.

The self-reported general health of the older adults in this study was good or better, similar to 70% of older adults in Australia [2]. The participants in this study were active, engaging in over an hour of at least moderate intensity PA per day. Interestingly this is slightly higher than that demonstrated in community dwelling older adults in Germany who recorded 49 (± 39) minutes per day (mean age of 65–89) [70] using triaxial GT3X accelerometers are comparable to the Esliger cut points as per this study analysis [50]. Overall, participants HRQOL scores matched Australian population norms for adults aged 65 and over [3, 52], and demonstrated higher Mental Super Dimension (MSD) scores, which could reflect the health status, independence and social participation demonstrated by the participantsin this study [69].

Participants in our study had a lower sleep quality compared to a Chinese cohort when measured using the

Table 4 Difference between self-reported location and GPS location accuracy

Location	Self-report n (mean) (SD)	GPS n (mean) (SD)	Mean difference	T-test	Significance
Total trips out of home	15.7 (5.6)	14.4 (5.8)	1.3	4.3	**< 0.001**
Residential	2.5 (2.7)	2.5 (2.6)	0.0	0.0	1.000
Recreational	5.5 (4.2)	4.9 (4.1)	0.6	3.0	**0.005**
Commercial	6.3 (3.4)	5.6 (3.3)	0.7	3.3	**0.002**
Health	0.8 (1.2)	0.7 (1.1)	0.7	1.0	0.323
Local walk/greenspace	3.8 (4.5)	3.6 (4.4)	0.2	1.8	0.071
CBD	1.7 (2.2)	1.7 (2.3)	0.0	−1.0	0.323
Place of worship	0.2 (.49)	0.3 (.51)	−0.1	−1.4	0.160

(Bolding denotes significant *p* < 0.05)

Fig. 5 Bland-Altman plot of GPS vs self-reported total trips out of home
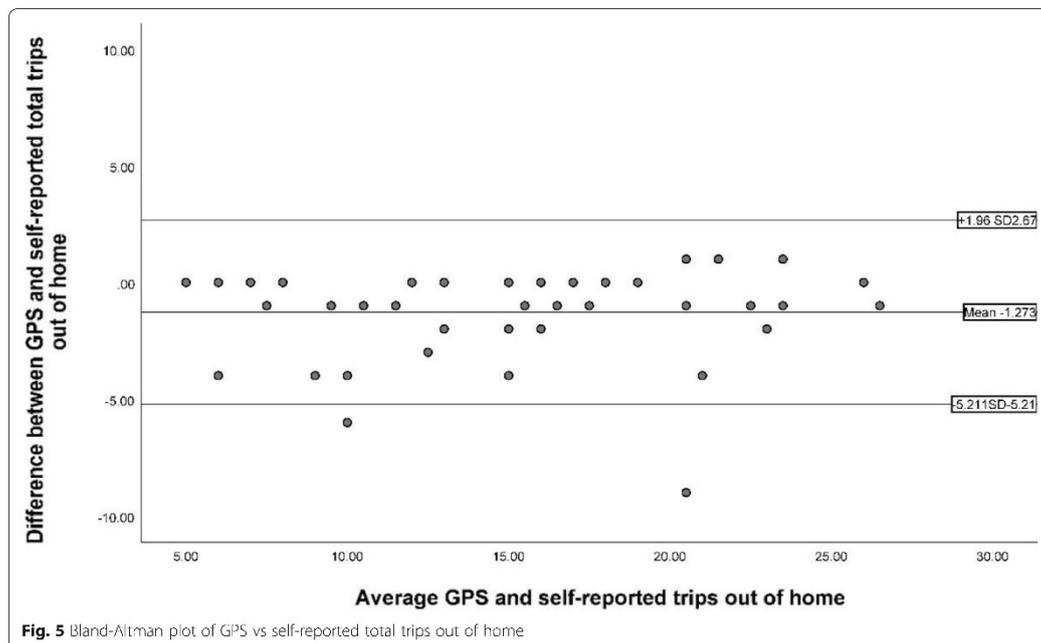
PSQI outcome measure [71]. This study sample deemed themselves healthier than the general population and were more active than other samples of older adults, measured with comparable methods [70, 72]. Sample bias could have contributed to the high levels of community participation described in this study. It is more likely that a healthy group would self-nominate for a study measuring community participation and physical activity, than would be experienced by the general population and less healthy groups. Thus, the need for interventions and awareness of the importance of community participation could therefore be more urgent than indicated from this sample.

Community participation

The majority of reported social interactions experienced out of home, at recreational and commercial locations, may reflect the high numbers of people and interactions required to access services in these locations (i.e. gaining access to leisure facilities through a receptionist). These results suggest older adults participate in more activities and social interactions out of home than in residential settings. Social interaction is important for keeping older adults motivated and engaged [26] and maintaining cognitive function [31]. Services promoting trips to residential and recreational locations could increase social interactions to promote healthy ageing. Interventions providing social interactions for people who are unable to participate in the community are an important consideration to maximise healthy ageing and should also be considered.

Our findings suggest that higher numbers of trips out of home are related to increased MVPA, with visits to local walk/greenspaces inclusive of PA which reflects previous findings [73]. Services promoting visits to local walk/greenspaces could assist with increasing the physical activity levels of older adults. In-home activities were mainly sedentary in nature, with sedentary time high in this active group, accounting for over 10 h per day [74]. These findings agree with previous research where older adults were found to spend 80% (534 min) of their day sitting [56]. Self-reported diaries highlighted activities that participants engaged in between eating an evening meal and going to bed were predominantly sedentary, concurring with previous research that this time of day can be problematic for accruing sedentary time, with television watching commonly occurring during this time of the day [75–77]. Despite participants meeting the MVPA recommendations [19], they spent a lot of time sedentary which suggests there is an opportunity to increase activity and reduce sedentary time even in an active community-dwelling population. Presumably less active older adults with varying levels of health participate in the community far less, which demonstrates the need to increase PA both in and outside of the home.

Feasibility of community participation measurement

Valid data sets were obtained from all participants except two, with self-reported and GPS locations similar on analysis, providing a detail rich picture of community participation. GPS data loss for this study was approximately 6%, acceptable data loss of 13% has previously been reported with a population of stroke survivors [57]. The compliance with the 24 h, 7d wear protocol with the GeneActiv accelerometer was excellent, with none of the participants removing the device during data collection. The successful retrieval of full data sets could be due to high levels of cognition and motivation to follow the protocol, or the reminders included in the protocol to ensure participant adherence. Participants reported that the flyers were useful as a reminder to charge the GPS device and take the devices when leaving the house. Self-reported diaries provided a backup, to determine location and often provided detailed descriptions of the location and activity performed that could not be interpreted from GPS or accelerometry alone [78].

The number of trips out of home were significantly higher when self-reported than detected by GPS, as were trips to recreational and commercial locations. Differences could be due to short-duration trips taken which were not detected by the GPS device, or signal drop out. Despite being significantly different, the difference in visits to recreational and commercial locations equates to half a trip more over the 7-days, which accounts for the difference in self-reported total visits out of home. Clinically these differences would not be important when considering the planning of interventions. The combination of GPS, accelerometry and self-report was feasible with community dwelling older adults and can provide detailed information.

Study strengths and limitations

This study has several methodological strengths and limitations. The study used a cross-sectional design so was unable to determine causal relationships of factors contributing to community participation. The study sample was very active and living independently in the community, with all participants capable of walking independently, therefore the results are not generalisable to all older adults. The potential impact of social desirability bias with potential changes in behaviour of participants as they were wearing monitoring devices and knew the aim of the study was to measure community participation, also needs to be considered.

Sleep scores, as well as other variables may have been affected by the extreme temperatures experienced during data collection. Weather conditions have previously been identified as an important consideration when using this methodology [16]. In this study, monitoring occurred over Summer and Autumn in Adelaide, between the 17th of November 2018 and the 10th of May 2019. As a result, 22 participants carried devices on days with maximum temperatures over 35 degrees Celsius. It is possible that the hot weather may have impacted on daily activity, as well as the types and frequency of trips out of the home. Despite strict protocol, we are unable to guarantee that participants carried the GPS devices for the duration of the monitoring period. However, cross checking GPS data against diary entries were performed to reduce this limitation.

Participants self-reported their social interactions which limits the study, as we are unable to be certain that all participants recorded social interaction in the same way. However, as a measure of social interaction, diaries provided details of social experiences and were analysed as best possible. As far as the authors are aware is the first study to combine GPS, accelerometry and self-reported diaries to determine community participation in community-dwelling older adults.

Conclusion

This study suggests that community dwelling older adults are more socially and physically active out of home. Despite self-reported community participation and GPS locations being similar on analysis, the use of combined methods to provide data rich pictures of community participation is recommended for future studies. This active sample demonstrates the opportunity to increase PA and minimise sedentary behaviour at home, with considerations for both in home activity and community participation required in less active groups to increase PA. Further research is required with other groups of older adults of varying health status (e.g. transitional or residential care) in order to establish possible relationships between community participation, location and PA, in order to design interventions that promote active healthy ageing.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-021-10592-4.

Additional file 1. In-home and out of home activities (Sedentary and active).

Additional file 2. Process of data analysis.

Additional file 3. Participant diary excerpt.

Declarations

Ethics approval and consent to participate
Ethical approval was gained from the Flinders University Social and Behavioural Research Ethics Committee (protocol no. 8176). Written informed consent was obtained from all participants.

Consent for publication
Consent for publication of results was obtained.

Competing interests
The authors declare that they have no competing interests.

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Publisher's Note

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**INSPIRING
ACHIEVEMENT**

Before you go to sleep…

Please put me on charge

☺ Thanks

CRICOS No. 00114A

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Before you go….

Have you got both of your devices with you?

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Appendix 6: Participant diary excerpt

<div align="center">Day 1</div>

(Date- __/__/__)

Time	Activity	Duration	Location	Who with?
710	Woke up			
1000	Ballroom dancing	.2.5 hour	(Name redacted) community centre	Friends
12noon	Lunch			
1300	Sewing	2hours	Home	Alone
1630	Dinner and TV watching		Home	Alone
1900	Ballroom dancing	3 hours	(Name redacted) community centre	Friends
2320	Bed		Home	Alone

Sleep   Time woke up from sleep (in the morning)_710_____.

Times of sleep during the day: Time_ N/A_____ Duration_N/A

.

Time _N/A_____ Duration_N?A

.

Time went to sleep (at night)   Time_2320_____.

Times of non- wear (device was taken off): Time N/A_____.   Duration_N/A

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Appendix 7: In-home and out of home activities (sedentary and active)

In-home activities	
Sedentary activities reported	**Active activities reported**
Read the paper, computer work, watching television, listening to radio, writing letters, relaxing, napping, phone calls, painting, socialising, friends and/or family visiting, sewing, crosswords, cooking, admin, taking medications, playing on iPhone/iPad, having a haircut, making jewellery, puzzles, volunteer work (admin), knitting, playing the piano and meditating.	Gardening, domestic chores, feeding pets, tidying, watering plants, bowling practice, exercises (following a DVD/You Tube), playing with grandchild, playing with kitten, house maintenance, renovations and preparing for dinner party.

Out of home activities	
Residential activities	
Sedentary activities reported	**Active activities reported**
Visiting family, visiting friends/for coffee, dinner with friends, attending retirees club meeting, waiting for building inspector, afternoon tea with neighbour, pick up granddaughter, delivering things for neighbourhood watch, meal with family, lunch with friends, having a haircut, acting as Justice of the Peace, tutoring, jewellery making, watching phone technician, meeting with friend, visiting friend in care home.	Assisting client (volunteer work), looking after grandchildren, maintenance of rental property, housework and domestics for son, laundry at friend's house, feed daughters' cat and visit daughter to help with housework.

Recreational activities	
Sedentary activities reported	**Active activities reported**
Visited the library, art gallery visit, had lunch at the golf club, attended a meeting at the golf club, took grandson to basketball, returned library books, had a music lesson, attended a seniors meeting, neighbourhood watch dinner, scrabble group, book club, festival theatre show, volunteer at the theatre, U3A group (University of the third age), Fringe volunteer induction, quiz night, went to the movies, watching tennis, volunteered at the art gallery, played the pokies, Majhong (board game), computer education session, attended COTA group (Older Australians group), attended writers week, watched the ballet, floral art session, attended a wedding, choir rehearsal, art group, computer work at the library, retirement club, attended seniors on screen, training for St Johns Ambulance and attended science group	Walked to library, delivered butterflies to wildlife park, golf, picked up grandchildren from school (walk), gym, ballroom dancing, line dancing, aqua, cricket, tennis, walked around museum, belly dancing class, body balance, strength for life, Pryme movers group, yoga, live music dance, volunteer at Animal Welfare, swim, play lawn bowls, exercise class, table tennis, walked around the zoo, volunteered at the zoo (walking), Pilates, spinners group, Zumba, scouts group, circle dancing, active ageing program.

Commercial activities	
Sedentary activities reported	**Active activities reported**
Appointment at the bank, pay accounts, went through car wash, eating out, have coffee, eat at McDonalds and read the paper, visit recycling centre, lunch with friends, dinner out, took car for service, visit hairdresser, pick up wife from airport, and charity lunch.	Shopping, fill up with petrol, supermarket shopping, laundromat, garden shop, took client shopping (volunteering), visited post office, visit chemist, walk to shops, walk around DIY shop, 'op' shopping, working in studio, window shopping (walking), picked up fish and chips, walked around flower market and plasma donation.

Health activities	
Sedentary activities reported	**Active activities reported**
Physiotherapy appointment, podiatrist appointment, chemist appointment, doctor's appointment, XRAY at hospital, blood tests, hospital appointment, dentist, eye test, massage, chiropractor, flu shot and participated in clinical trial at the Hospital.	Hydrotherapy rehab, gym strengthening (rehab) session and St John's first aid training

Local walk/greenspace activities	
Sedentary activities reported	**Active activities reported**
None reported	Walked to library, shop, in park, walking, walked dog, walk along beach, walked to beach and back, walked to visit friend, walking group, Park run 5k walk, walk to bus stop, walk to tram, walk to get coffee, morning, afternoon and evening walks, bike ride, walked to gym and walked home

CBD activities	
Sedentary activities reported	**Active activities reported**
Piano recital, watched cricket, city meeting, dinner, Proms concert, Festival Theatre show, Fringe show, attend writer's week event, massage, watched ballet and attended Seniors group	Took grandchild to school, attended the Pageant, trip to city, Central markets visit, visited art gallery, voluntary work, Seniors group activity, shopping and walked around the zoo

Place of worship activities	
Sedentary activities reported	**Active activities reported**
Watched choir concert, dinner, funeral, lunch and attended service.	Active ageing program

Appendix 8: Semi-structured interview guide (Community dwelling older adults)

Semi-Structured Interview Guide

These open-ended questions will guide patient interviews.
This session is to discuss your community participation, prior to and during the COViD-19 pandemic. I will be asking you to think about your physical and social activities or participation in the community over this time. This interview will ask you to think about things that motivated or helped you to be physically and socially active and get out into the community, whilst considering the things that prevented you from doing so.

1. How did you find out about the COViD-19 restrictions? Were they easy for you to understand?

2. How did you go about following the guidelines in your own life?

3. Can you describe ways you did things differently to keep active physically and socially during the COViD-19 restrictions?

4. Will you continue any of these different ways to keep physically and socially active after the lifting of COViD-19 restrictions?

5. Do you think that your activities have returned to levels prior to the introductions of COViD-19 social distancing restrictions?

6. Did you experience feelings of loneliness or social isolation during times of social distancing restrictions?

7. If yes, were these levels more or less than you experienced before COViD-19?

8. If you used technology or social media to communicate with others during this time, how did these experiences meet your need for social interaction?

9. Were there any changes you made to your community participation following the easing of COViD-19 restrictions?

10. What would you like to see in place to help you keep in touch with people and maintain your physical activity should we experience a second lockdown?

Probing questions:
a. What about your ability to participate in the community?
b. Did these changes affect your mood?
c. What aspects did you find easy/difficult?
d. Do you think this will change in the future?
e. How did you overcome this?
f. What would your approach be?

Can use prompts like "you mentioned" Tell me more about...

Thank you very much for participating in this interview, you will be sent a typed copy of the transcript and given the opportunity to provide comments.

Appendix 9: Chapter 9 publication

Integrating community participation in the transition of older adults from hospital to home: a scoping review https://doi.org/10.1080/09638288.2021.1912197

Transition from hospital to home during COVID-19: A case report from an Australian transitional care program

Gough, C.[1,2,3*]; Hutchinson, C.[1,3]; Barr, C.[1,2,3]; Maeder, A.[1,2,3] & George, S. [1,2,3]

Abstract

Aim and Background: With the ongoing COVID-19 global pandemic, consideration for vulnerable groups, including our ageing population has been of great concern. Social isolation has been recommended to protect older adults with chronic diseases and reduce the spread of the virus, as well as to prevent healthcare services becoming overwhelmed. Yet social isolation presents its own health risks. **Methods:** In this paper, we provide commentary on the lived experience of returning home from hospital prior to and during the COVID-19 pandemic. This case report details the experience of an 83-year-old female, who was living and mobilising independently in her own home, prior to hospital admission following a fall and resultant head injury. **Results:** The participant returned home prior to the COVID-19 pandemic with a government funded community transition care program which included assistance with cleaning tasks, shopping, and Physiotherapy over a 45-day period. Her transition into the community continued through measures of social distancing. Barriers and

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facilitators to community participation such as lack of transport and assistance with shopping, were identified. COVID-19 has illuminated the issue of social isolation and increased awareness of its negative health effects at a global level. As society eases restrictions and returns to a new 'normal', many older adults will remain socially isolated. Ongoing allied health intervention is required to ensure quality of life through the latter years and to support older adults through periods of social distancing.

Keywords: transition care; COVID-19, social isolation, community participation

Introduction

With the world's population ageing, healthcare systems are under increased pressure to care for older people (United Nations, 2015). This strain has been exacerbated on a global level during the COVID-19 pandemic. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is a novel virus that causes the COVID-19 infection (Shahid et al., 2020). Australia confirmed its first case of COVID-19 on the 25th of January 2020, and COVID-19 was declared a global pandemic by the World Health Organization on the 11th of March 2020. On the 15th of March 2020, Australia, like many other countries (Canada, Spain, UK, Belgium, Germany, Greece, Italy, Netherlands, Portugal, China, Denmark, France, Hong Kong, Lithuania and Singapore) adopted a social distancing approach to prevent community transmission (Armitage & Nellums, 2020). Australians were advised to stay at home unless performing essential activities and to maintain a social distance of at least 1.5 meters from others. A maximum of 10 people were permitted indoors and hotels, gyms, entertainment venues, galleries, museums, and libraries were closed. The higher risks to individuals over the age of 65 years was highlighted by the government (Australian Government Department of Health, 2020).

Evidence suggests that individuals aged 65 years and over and those with a higher number of chronic diseases such as cardiovascular disease (CVD) and type II diabetes (Beard et al., 2016) are at a higher risk of contracting the virus and experiencing poorer health outcomes and increased mortality rates (Shahid et al., 2020). In an attempt to reduce transmission and prevent healthcare systems becoming overwhelmed, many countries have recommended that people avoid contact with others through social and physical distancing, potentially intensifying social isolation for vulnerable groups, including older adults (Armitage & Nellums, 2020).

Social isolation is defined as an *'objective lack of relationships and social interaction'* and loneliness as *'a subjective and distressing feeling'* (Coyle & Dugan, 2012). Despite the benefits of reduced transmission of COVID-19, isolating older adults and the ensuing loneliness experienced presents its own health risks such as poor sleep quality (Coyle & Dugan, 2012), increased blood pressure (Hawkley et al., 2010), impaired cognitive function (Wilson et al., 2007) and depression (Cacioppo et al., 2010). Individuals are likely to be fearful of the virus and experience increased feelings of anxiety. Socially isolated older adults have been identified as more likely to seek medical assistance to satisfy the need for social interaction (Gerst-Emerson & Jayawardhana, 2015). Yet during the COVID-19 pandemic it has been perceived that these individuals are not seeking medical assistance when required, for fear of contracting the virus.

Furthermore, the impact of the COVID-19 pandemic on the utilisation of multidisciplinary health services, targeting restorative care of people over 65 years of age, also warrants investigation. The Australian Transition Care Program (TCP) emphasises transition between acute and community care, with the aim to reduce hospital stays and enable people to return to their own homes, rather than residential aged care facilities (Gray et al., 2013; Kim & Thyer, 2015). TCPs offer a multidisciplinary coordinated discharge,

support and allied health therapy in their home or residential care setting. They aim to provide care that is 'goal-oriented, short term, therapy focused and necessary to complete the care recipient's restorative process, optimise their functional capacity' (Gray et al., 2013 p. 2) and to provide patients and families additional time to make long term plans when required (Couzner et al., 2013).

Despite the best intentions of supportive services following hospital discharge, some older adults prior to COVID-19 restrictions described themselves *'like prisoner's in your own home'* (Taylor et al., 2010 p. 1287). When older adults are presented with challenges such as returning home from hospital, it is unclear how the addition of social distancing guidelines due to COVID-19 may impact upon the transition home from hospital, and the subsequent health of older adults.

Aims

The original aim of this study was to explore community participation, physical activity, barriers and facilitators for participation in older adults during and after community transition care programs (CTCPs), answering the question *'do transition care programs promote active community participation?'* Due to the global pandemic, the study aim was adjusted to explore community participation, physical activity, barriers and facilitators for participation of an older adult receiving a TCP, prior-to and during social distancing restrictions (COVID-19). The specific research question was, *'Can an older adult returning home from hospital prior to and during social distancing restrictions maintain community participation?'*

Ethical approval

Ethical approval was gained from Southern Adelaide Clinical Human Research Ethics Committee (SAC HREC) (OFR number 182.19). An amendment to carry out a telephone

interview and publish the account of a single participant was sought and approved. Research

was carried out following the rules of the Declaration of Helsinki of 1975. Informed written

consent was obtained.

Case Presentation

The participant, 'Kathy,' was an 83-year-old female, who was living alone in her own

home. She reported no chronic health conditions and 'good' overall health. She was admitted

to hospital with a head injury following a fall and received a residential transition care

program (RTCP) in a rehabilitation facility prior to returning to her own home with a

community transition care program (CTCP). Her services were approved for 45 days,

including assistance with cleaning tasks, shopping, and Physiotherapy. Following hospital

admission, Kathy demonstrated reduced mobility, and was reliant on a rollator frame at

home, and four wheeled walker outside of home. She was no longer able to drive due to the

nature of her injury, although referrals had been made for reassessment.

Timeline

Kathy's CTCP began prior to social distancing restrictions on the 24th of January 2020

and concluded on the 9th of March 2020. A timeline of data collection and COVID-19

restrictions across South Australia is provided in Figure 1.
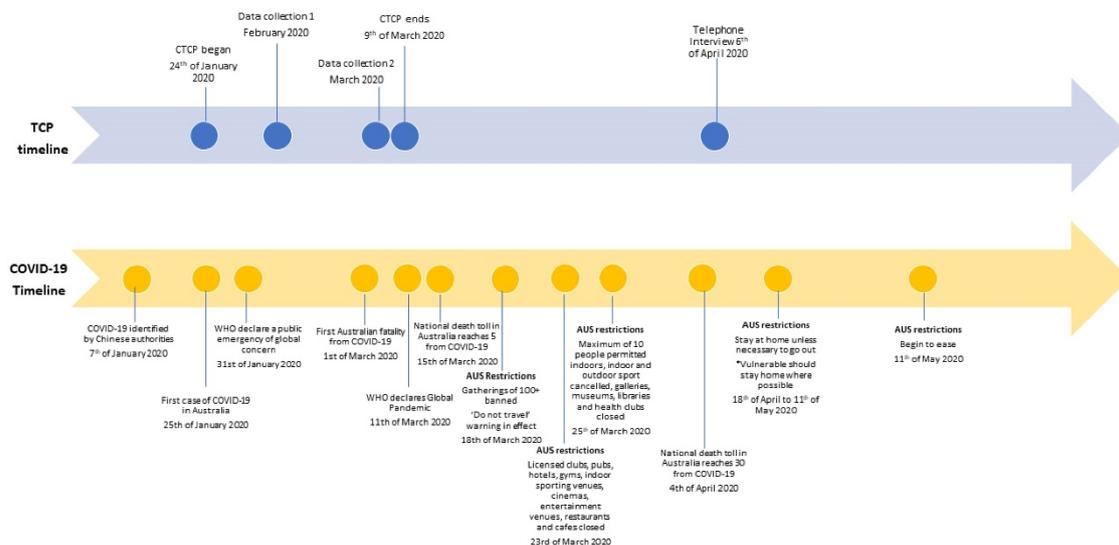
Figure 1 Timeline of TCP and COVID-19 in South Australia

Methods

Recruitment

Individuals referred to Southern Adelaide Local Health Network (SALHN) transition care services were assessed by an external clinician to determine their eligibility and service requirements. To be eligible, participants needed to be aged 65 years or over, receiving a community transition care package (CTCP), live in metropolitan Adelaide, mobilise independently (+/- walking aids) and be able to communicate in English. If the individual was interested in participating, consent was obtained to pass on their contact details to the Lead Investigator (CG), who then made contact, confirmed eligibility, provided further study information and obtained informed written consent where appropriate. The sample size for the original study was 40 participants. Due to the COVID-19 disruption only one participant was recruited.

Data collection

Prior to discharge home with a CTCP, and on completion of the CTCP external assessors carried out the modified Barthel Index to measure functional independence. All other data were collected on returning home with a CTCP and repeated on completion of the CTCP, prior to COVID-19 social distancing restrictions. The participant was asked to complete a demographic questionnaire, the Assessment of Quality of Life -8D (AQOL-8D) questionnaire (Richardson et al, 2013) to measure health related quality of life (HRQoL) and the De Jong Gierveld loneliness scale (Tomás et al, 2017). The participant was asked to carry a GeneActiv triaxial accelerometer to measure minutes of moderate to vigorous physical activity (MVPA), and a Qstarz BT1000XT GPS device to measure community participation, whilst keeping a self-reported diary of community activities for two separate seven-day monitoring periods as recommended in previous studies (Hirsch et al., 2016; Hordacre et al., 2014; Schipperijn & Etroelsen, 2014). The GENEActiv device was worn 24 hours a day (inclusive of sleeping, showering and swimming- as the devices are waterproof) and the GPS device was removed for water-based activities as well as overnight so the device could be charged.

A semi-structured interview lasting approximately 37 minutes was carried out via telephone on the 6th of April 2020 during social restrictions, to gain the participant's perspective of community participation following hospital discharge, prior to and during social distancing measures (COVID-19). Questions included *'what are the greatest difficulties or barriers you face when attempting to be actively involved in the community?'* and *'what things helped you to be actively involved in the community in the way that you want to?'* The interview was recorded and transcribed verbatim. Content analysis (Bengtsson, 2016) was driven by the research aims. For reporting purposes, the participant was given a pseudonym to maintain anonymity.

Data analysis

Physical activity: was objectively measured using wrist worn GeneActiv accelerometers. Accelerometer data were used to detect times spent sedentary, engaging in light, moderate or vigorous activity, using cut points developed by Esliger adjusted for the sampling frequency and epochs (light 283, moderate 605 and vigorous 1697) (Esliger et al., 2011). To determine overall daily PA, GeneActiv .bin files were converted to 60-second epoch files and analysed using Cobra software (Francois Frayasse, University of South Australia). Sleep was excluded from the analysis, detected using visual analysis of the activity trace combined with self-reported sleep diaries.

Community participation: GPS (Qstarz BT1000XT) data were used to calculate the number of trips away from home. GPS data provided co-ordinates of the beginning and end locations and total number of trips were recorded. Activity diaries were used to cross-check with the objective data, where GPS data were missing.

Interview data: Transcript data were imported into NVIVO 12 Pro and analysed for examples of facilitators and barriers to community participation.

Results

Quantitative data

Outcome measures completed on entry to and exit from the CTCP program are summarised in Table 1. Kathy's levels of functional independence and HRQoL increased, and levels of loneliness decreased over the course of the CTCP. An overview of community participation is provided in Table 2, Kathy's total trips out of home, minutes of MVPA and sleep time had increased on exit from the CTCP. Social interactions decreased, as did minutes spent sedentary.

Table 1 Outcome measures

	Outcome measure	Total score (interpretation)	Data collected by	Score on entry to CTCP	Score on exit from CTCP
Functional Independence	Modified Barthel Index [19]	100 (fully dependent)	SALHN	88	95
Health Related Quality of life (HRQoL)	AQOL-8D [20] Independent living Happiness Mental health Coping Relationships Self-worth Pain Senses PSD score MSD score	100 (High quality of life)	CG	58 28 37 67 50 59 67 80 85 59 58	63 50 44 64 58 67 58 90 85 71 60
Loneliness	De Jong Gierveld Loneliness Scale [21, 22]	6 (most lonely)	CG	4	3

Note. [1]Southern Adelaide Local Health Network (SALHN), [2]CG researcher

Table 2 Measures of community participation

Community participation	Entry to CTCP (% of day)	Exit from CTCP (% of day)
Trips out of home (per week)	1	7
Social interactions (per week)	11	10
MVPA (mean per day)	8 minutes (0.5)	12 minutes (0.8)
Sedentary time (mean per day)	822 minutes (57)	793 minutes (55)
Sleep time (mean per day)	494 minutes (34)	517 minutes (36)

Qualitative data

Kathy discussed her experience of the transition home from hospital in depth, identifying

barriers and facilitators to resuming previous activities. The perceived barriers and facilitators

are outlined below, followed by a discussion of how COVID-19 restrictions further

contributed to these barriers.

Barriers of community participation

Kathy reported that going out of home to carry out activities of daily living (ADL) such as shopping were difficult because of the need for a walker, *'the walker limits me to how far I can go because I haven't much stamina.'* Stamina and fatigue following hospital admission prevented visiting the shops as, *'it was too far for me to walk.'* Shopping was also limited by the amount of shopping she could fit into her walker, combined with environmental challenges, such as a, *'funny little ramp at the end of my road. It's been badly done'*. Windy weather conditions meant that she was unable to go out altogether, *'so that means that I'm virtually housebound on a windy day'* unless she asked for her sister to take her out in her car, which she considered being a burden.

When asked what prevented her from participating in her community as she used to, the answer was direct, *'A lack of transport really.'* With specific reference to a choir group Kathy was involved in:

'You see I wouldn't have been able to get there if I had to walk. Probably one of the others would have picked me up. But trouble is, I haven't really been strong enough. Well, I got too tired too quickly. I can't actually be away more than a couple of hours. That makes it a bit awkward if you're sort of socialising and you know, you really need to be a (group of) three or more.'

Facilitators of community participation

Kathy described the benefits of her CTCP services in facilitating community participation on returning home from hospital. Her experience of receiving assistance to the local shopping centre was positive and facilitated community participation. She also found Physiotherapy useful to reduce her dependency on mobility aids and increase her independence:

'Well, I think they instigated I had a physio coming. And she particularly the last one was a very active person. And it was very encouraging in what she was wanting me to do. She asked me what my goals were and I said, ultimately I wanted to get rid of the walker. Just walk with a stick. And so she was trying to get me to be active with a walker and get more confidence that way. And then giving me exercise up my passage, you know, without the walker and using my stick and things like that. Yeah. So that person was very motivated. So that was good.'

COVID-19

The changes in daily life due to COVID-19 ran throughout the interview with isolation and restrictions at the forefront of answers related to community participation, *'At the moment you can't go out anyway. As we are supposed to be isolated.'* Normal behaviours and places that were visited previously were no-longer an option, *'the library is closed anyway, but what isn't closed?'* Deciding to follow the recommendations was quite definite with comments such as *'I won't be going out'* and *'I won't be visiting anybody'* repeated. However, the awareness that remaining home might not be feasible for long periods caused Kathy to state that she, *'might just walk around the block'* to maintain normality. The GPS data recorded one visit out of home during the first week of CTCP and seven in the last week of CTCP (see Table 2). Indicating that Kathy was becoming more active in the community prior to COVID-19 restrictions being enforced.

Kathy expressed the feeling she was starting to get some control of her life back following hospital admission, *'I was getting stronger each day.'* This comment was supported by an average increase of 4 minutes MVPA (50%) per day and decrease in sedentary time by 29 minutes. She also felt able to go shopping with a support person, only for this activity to be terminated *'you can't ride in the car anymore, the next time you have to*

give us a list.' Not knowing whether she would be able to access supportive services was a

real concern, that resulted in fear that support services would be ceased, *'I am expecting them*

to ring up and say, no, you can't have anybody!' The possibility of contracting the virus was

described as *'frightening'.* Despite an overall improvement in HRQoL, components of mental

health and self-worth declined (see Table 1).

A more positive aspect of COVID-19 restrictions was an increase in neighbourly

support. Neighbours who were previously strangers made a concerted effort to provide

contact details and knock when visiting the shops to ask, *'is there anything you need?'*

Neighbours rallied during the times that *'the shelves were being stripped of toilet paper.'*

Very aware that the shops were quite *'bereft'*, Kathy was almost surprised when her

neighbour returned with the jam that she had asked for.

Deciding to preserve health but also be involved in social interactions became a priority

which was extensively planned, *'I can observe the rules and we can sit on the front veranda.'*

'We had coffee, she brought her own - and I turned the kettle on!' *'We had a lovely visit.'* In

the first week of CTCP Kathy reported 11 social interactions, which decreased to 10 in the

final week of the CTCP (See Table 2). However, the majority of the visits in the first week

involved service set up and home adaptations, rather than the social visits which were more

apparent following CTCP.

Discussion

Reintegration into the community following hospital discharge has previously presented

barriers for older adults. Kathy was no exception, she identified barriers including mobility

restrictions, the environment, weather, reliance on others, lack of transport and fatigue that

prevented her from resuming previous activities. Yet services provided as part of her CTCP

such as Physiotherapy and assistance shopping, acted to facilitate community participation.

During this transition, COVID-19 was declared a global pandemic and social distancing guidelines were gradually escalated, further increasing the barriers to active community participation.

Experiences of social isolation and loneliness were present throughout the interview, with community participation limited by access to transport, feeling a burden, and levels of fatigue, preventing Kathy from attending activities of longer duration where potentially transport with friends could have been arranged. Her experiences are supported by previous research, that suggest a lack of individualised treatment left older adults returning home from acute care unable to attend activities they would have previously (Reay et al., 2015), frustrated by reduced mobility, and lack of transport which limited the opportunities to socialise on returning home (Martinsen et al., 2015). For Kathy, these limitations in the environment of restrictions, exacerbated isolation and loneliness from her family and community connections.

Behaviour change for this participant and those around her were evident prior to and following the introduction of social distancing measures. There was a sense of trying to preserve 'normality' despite the fear of the unknown, contracting COVID-19 and feelings of loneliness. The intent of taking a walk, just to get out of the house was an attempt to feel a sense of purpose and change the environment. Receiving a guest on the front veranda, with visitors bringing their own tea, was an important coping mechanism for Kathy to meet the need for social interaction. Neighbours also changed their behaviours by taking the time to offer their help and reach out to support others, which has previously been deemed important in providing a sense of belonging for older adults (Stanley et al, 2010). Neighbourly support was possibly a benefit of the high number of individuals furloughed at home, with additional time on their hands to consider the more vulnerable individuals living nearby.

The Australian government acknowledged in June 2020, that during COVID-19 TCP clients may not be able to receive the services they need (Australian Government, 2020). Service disruptions may be due to isolation or quarantine restrictions, directions by a GP, client's personal preference or staff shortages of TCP providers. The case presented, describes the experience of Kathy, whose CTCP program was not disrupted, yet she still demonstrated low levels of physical activity and community participation. Consideration for individuals who are unable to commence or continue with TCP services, in the context of restrictions, whilst transitioning from hospital to home requires urgent consideration to negate the potential negative health consequences.

Implications for future practice

The value of supportive services such as TCPs should not be underestimated for older people returning home from hospital. Standard services such as Physiotherapy/Occupational Therapy and assistance shopping may not merely act to assist ADLs and facilitate active community participation but promote feelings of motivation, confidence, control and increasing independence. The experiences presented in this case study highlight how important setting goals and adaptation can be, for example enabling online shopping when unable to visit the shops provides independence and feelings of control. During a global pandemic, periods of social isolation may become increasingly frequent. Promoting physical and social adaptations during community-wise restrictions i.e. taking tea outside on the front veranda and walking around the block for a change of scenery, may be a useful consideration in the practical care of older adults.

Limitations

This paper is limited by reporting on a single case. Data collection to determine community participation of older adults transitioning from hospital to home was restricted by the global pandemic. This lived experience provides useful insight into transitions during a pandemic, where social distancing and isolation are promoted for older adults.

Conclusion

COVID-19 has thrust social isolation into the spotlight and increased awareness for the negative effects on health at a global level. As society returns to a new 'normal' following the easing of restrictions, social isolation of older adults will remain, and requires ongoing intervention. This paper has highlighted how an older adult receiving a CTCP, and those around her, adapted their behaviours to meet their social needs. Neighbourhood support will hopefully continue long after the acute phase of COVID-19 has passed. But more importantly, methods to assist with positive behaviour changes to prevent social isolation during transition care and during times of social distancing needs to be considered by allied health professionals. Despite supportive services, levels of physical activity were low for this individual. Older adults may require assistance to maintain their physical and social activity, particularly at vulnerable times such as on discharge to the community from hospital, or a second wave requiring lockdown.

Key messages

- COVID-19 has highlighted the issue of social isolation of older adults and increased awareness of its negative health effects at a global level. As society eases restrictions and returns to a new 'normal', support of socially isolated older adults and those who could not access TCP services will require urgent attention.

- Allied Health services can support positive behaviour changes to prevent social isolation during both transition care and times of social distancing.

- Transition care services should consider the individual's specific barriers and facilitators in order to provide programs that promote an active return to previous activities and community participation.

Funding: This research received no external funding

Conflicts of Interest: The Authors declare that there is no conflict of interest.

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