Experiences of Neighbourhood Walkability Among Older Australians Living in High Density Inner-City Areas

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Abstract

Walking as an out-of-home mobility activity is recognised for its contribution to healthy and active ageing. The environment can have a powerful effect on the amount of walking activity undertaken by older people, thereby influencing their capacity to maintain their wellbeing and independence. This paper reports the findings from research examining the experiences of neighbourhood walking for 12 older people from six different inner-city high density suburbs, through analysis of data derived from travel diaries, individual time/space activity maps (created via GPS tracking over a seven-day period and GIS technology), and in-depth interviews. Reliance on motor vehicles, the competing interests of

pedestrians and cyclists on shared pathways and problems associated with transit systems, public transport, and pedestrian infrastructure emerged as key barriers to older people venturing out of home on foot. GPS and GIS technology provide new opportunities for furthering understanding of the out-of-home mobility of older populations.

Key Words: walkability, out-of-home mobility, high density, neighbourhood, older people, active ageing, global positioning systems.

Introduction

The need to improve the quality of cities and neighbourhoods is recognised worldwide as a way of supporting the out-of-home mobility of an ever-increasing ageing population. This issue is prominent within the discourse surrounding healthy and active ageing and the building of "age-friendly cities" (World Health Organization, 2002, 2007; Zeigler & Schwanen, 2011). While the concepts *healthy ageing* and *active ageing* differ from each other in subtle ways, both are conceived to encompass vitality, activity and minimization of the negative consequences of biological ageing (Schwanen & Ziegler, 2011). With the losses in functioning that occur in later life as a consequence of the ageing process, the type and quality of the surrounding environment becomes a significant determinant of older people's wellbeing and independence (Phillipson, 2004). Older people who are unable to move around freely because of a physical disability or environmental limitations have been shown to have a lower quality of life than those without these constraints (Mollenkopf *et al.*, 2002; White *et al.*, 2010). The capacity of neighbourhood environments to hinder older people's out-of-home mobility - and marginalize them as a consequence - is a social justice issue (Day, 2010). It is crucial therefore, that factors within the neighbourhood environment which affect out-of-home mobility are fully understood so that they can be properly addressed. This paper adds to the empirical literature related to the neighbourhood environment

and its influence on older urban residents' walking behaviour as one component of out-of-home mobility.

The study of older people and their socio-spatial environment

Environmental gerontology is concerned with describing, explaining and modifying or optimizing 'the relation between elderly persons and socio-spatial surroundings' (Wahl & Weisman, 2003, p. 616). As a subfield of gerontology, its focus of enquiry encompasses differing levels of social organisation and forms of environment, both at a micro- (i.e. individuals in private and institutional settings) and macro-scale (i.e. groups and populations within neighbourhoods, rural regions, and cities) (Wahl & Weisman, 2003). While environmental gerontology is widely acknowledged for making a major contribution to our present understanding of the person-environment relationship, it has also attracted substantial criticism. It has been described as relying too heavily on quantitative methods (Wahl & Weisman, 2003), focusing predominantly on micro-environments (Kendig, 2003), and failing to adopt new approaches that advance understanding of the person-environment relationship beyond that which grew in the 1970s and 1980s (Smith, 2009).

In the early 2000s, Kendig (2003, p. 612) emphasised the need for research to extend beyond micro-environments to neighbourhoods, cities and regions, – those 'spatial units that are changing in their populations and built forms'. In the last few years, much more research attention has been directed at the neighbourhood environments of older people, not only within gerontology but other disciplines as well (including geography, urban design and public health) (Day, 2010). This cross-disciplinary interest is fuelled by awareness of the interrelatedness of increasing urbanisation and population ageing (Lui *et al.*, 2009; Smith, 2009; Beard & Petitot, 2010) and the significant challenges these trends pose for planning, policy and practice. This development has served to both expand the body of knowledge pertaining to older people's environments and their influence on out-of home mobility and extend the methods used to study this topic area.

Out-of-home mobility

Research undertaken over the past decade indicates that whether or not an older person's potential for movement is realised, depends upon a wide range of aspects including urban design characteristics (Koepsell *et al.*, 2002; Blackman *et al.*, 2003; Li *et al.*, 2005; Burton & Mitchell, 2006; Alves *et al.*, 2008; White *et al.*, 2010; King *et al.*, 2011; Shendell *et al.*, 2011), house attributes and upkeep (Foster *et al.*, 2011), open (Sugiyama *et al.*, 2009; Aspinall *et al.*, 2010) and green (Maas *et al.*, 2006) spaces, driving status (Mollenkopf *et al.*, 2002) and quality of, and access to, public transport (Banister & Bowling, 2004; Broome *et al.*, 2009). With respect to the latter, a review of the evidence related to bus use among older people by Broome and colleagues (2009) suggests that bus design, service provision and performance, information, attitudes of staff and the community all affect the use of buses by this segment of the population.

Methodological advances that have been made in recent years include the development of operational definitions that can be used to quantitatively measure the subjective qualities of urban street design characteristics (see Ewing & Handy, 2009), as well as tools that enable the auditing of environmental features as people walk through their neighbourhoods (see Chaudhury *et al.*, 2011). Validation studies of walkability scoring instruments have also been undertaken (see for example Duncan *et al.*, 2011). While these developments have been particularly useful for investigating the walkability of urban environments in terms of their physical features, Ewing and Handy (2009, p. 66) highlight the inability of quantitative measures to capture the *experience* of walking – that is, 'people's overall perceptions of the street environment, perceptions that may have complex or subtle relationships to physical features'. In the last few years however, a number of studies have used either qualitative methods (Michael *et al.*, 2006; Day, 2008, 2010) or a mixed-methods approach (Lord & Luxembourg, 2007; Lord *et al.*, 2011; Shoval *et al.*, 2011) to explore older people's experiences of mobility within their neighbourhood environments. This particular body of research has yielded rich data, thereby providing insight into the dynamic interplay of

individuals' preferences and personal characteristics, features of the built and natural environment, as well as cultural norms around car use, in determining the out-of-home mobility of older people.

Day (2010) for example, interviewed retirees (n= 45; aged 62 to 90 years) from three different areas in western Scotland (an inner-city neighbourhood, a suburban estate, and a small coastal town), using open-ended questions to investigate features of the urban environment that older people felt were important to their wellbeing. Neighbourhood walkability, along with cleanliness and lack of pollution, peace and quiet, as well as having an environment that is emotionally uplifting (as a consequence of elements of both the built and natural environment) and which promotes informal social interaction, were the key dimensions that emerged as being important across all three study locations (Day, 2010). Focus groups with seniors aged 55 years and over from 10 different neighbourhoods in Portland, Oregon, revealed that access to shops and services were crucial for older people to walk, meet others and move within their neighbourhoods without relying on cars, that poor quality pedestrian infrastructure and traffic limited their walking, that the overall attractiveness of the neighbourhood encouraged walking for both exercise and pleasure, and that adequate transportation was essential to the maintenance of older people's independence and their ongoing engagement with the wider community (Michael *et al.*, 2006). Lord and Luxembourg (2007) on the other hand, used in-depth interviews and geographic information systems (GIS) software to study the mobility practices of older adults living in two different countries (Post-War suburbs in Canada and France) by geocoding their residences and typical out-of-home consumption patterns. Participants from both Canada and France were found to be highly reliant on motor vehicles for transportation, but for different reasons. The former seemed to regard their motor cars as part of their identity and used their cars extensively (despite the availability of public transport and nearby amenities), while the latter appeared to value their vehicles for instrumental reasons (as a way to access services that would otherwise be unavailable to them as they were living in a low-density area with limited public transport and commercial facilities). For both groups, it was also evident that loss of

the ability to drive a car would mean a loss of opportunity for participation outside of home. Similarly, a combination of in-depth interviews and geographic technology (in this case geographic positioning system [GPS]) was used by Shoval and colleagues (2011) to investigate the mobility patterns of older persons with and without cognitive impairment. Participants with mild dementia were found to travel smaller distances than those with mild cognitive impairment, and both of these groups were found to have a smaller spatial out-of-home range of activity than healthy controls. The non-impaired controls also demonstrated greater fluctuation in the timing of their out-of-home activity than either the mild dementia or the mildly cognitively impaired groups.

Changes in older people's experience of mobility over time have also been investigated by analysing data derived from a survey conducted in 1999 and from in-depth, semi-structured interviews in 2006. Lord and colleagues (2011) found that although study participants (n=22) living in suburbs within Quebec City were highly reliant on cars for transportation, they adopted various adaptive strategies as they aged so as to allow them to age in place. Fears about their "action space" shrinking as they aged emerged as their main overall concern, rather than worries about loss of either their vehicles, homes or neighbourhoods (Lord *et al.*, 2011, p.59).

The findings from this group of studies highlight three key issues related to older people and their out-of home mobility. Firstly, the qualitative approaches used in these studies help to highlight the diverse circumstances and needs of older people. The flawed assumption that older people are a homogenous group has been identified as having traditionally underpinned transport planning for older people (Alsnih & Hensher, 2003). Secondly, there are multiple reasons for older people's heavy reliance on cars for their out-of-home mobility, not simply the unavailability of public transport and/or lack of close proximity to amenities. Thirdly, the lack of walkability of their neighbourhoods continues to discourage walking for either transport or leisure purposes and thereby reinforces their reliance on the motor car. These sorts of studies help to explain why the idea that modifications to the built environment such as

higher density living, greater street connectivity and greater mix of land-use will serve to shorten trip distances, increase travel options (including walking and public transport) and thus reduce older people's need for owning a vehicle (Behan *et al.*, 2008; Judd *et al.*, 2010), remains the subject of debate (see Alsnih & Hensher, 2003; Therese *et al.*, 2010). Established norms surrounding vehicle use act as a major obstacle to decreasing people's reliance on motor vehicles and increasing their levels of walking (Lee & Moudon, 2004; Therese *et al.*, 2010). Numerous studies have shown that the car is the preferred mode of transport for older people (aged 65 years and over) (see Alsnih & Hensher, 2003, p. 906). This is especially the case in countries like Australia and North America, which have been described as places where 'the "logic" of a mass car-owning population has been allowed its full expression' (Headicar, 2003, p. 207).

While motor vehicles are widely used among all those of driving age upwards, the car is especially important to older people in terms of both their mobility and their overall wellbeing. Driving cessation is connected to reduced quality of life (Gabriel & Bowling, 2004), reduced out-of-home activity and life satisfaction (Harrison & Ragland, 2003) and is also a strong predictor of worsening depressive symptoms (Fonda *et al.*, 2001). Car use is crucial for those with waning physical strength and sensory abilities to meet the demands of everyday life and for maintaining their participation in social and cultural activities (Mollenkopf *et al.*, 2002, p. 231). The reasons why many older people give up driving appear to be the same reasons why they avoid using busses (Broome *et al.*, 2009). The inability to drive or use public transport leaves older people with little option other than to travel by car as passengers if and when the opportunity becomes available (Judd *et al.*, 2010). While it has been argued that strategies for preventing driving cessation among older people need to be implemented as a means of helping them to maintain their affective wellbeing (Fonda *et al.*, 2001), this proposal runs counter to efforts aimed at solving whole-of-society problems like environmental sustainability and physical inactivity. Reduced car use through the provision of walkable environments is now being prioritised within both urban planning

and public health agendas to ensure environmental sustainability (Kenworthy, 2006) and the prevention of physical inactivity-related diseases across all age groups (Woodcock *et al.*, 2009) respectively. The inherent conflict between the proposition that driving cessation should be prevented as long as possible among older people as a means to prolong the many benefits that cars provide this group, and agendas that seek to discourage car use for the purpose of increasing physical activity and environmental sustainability, requires the attention of policymakers. It would seem important that they give due consideration to the diverse needs of older populations, with a key aim being the maximization of older people's opportunities for active transport while remaining mindful that the motor vehicle is especially important to this segment of the population. Given that the spatial movement of older people is known to shrink to the vicinity of their homes and immediate environments as they age (Weiss *et al.*, 2010), it is imperative that factors that deter them from walking in their local areas in particular, are understood and addressed so as to maximize their opportunities for walking.

Neighbourhood walkability

Living in a location where the surrounding environment is walkable is especially important for older people. This type of environment provides the necessary pathways by which they can access public transport (see Besser & Dannenberg, 2005), nearby goods and services (Glaeser *et al.*, 2001), a setting that is conducive to walking for leisure purposes (thereby providing them with the potential for numerous health benefits from engagement in physical exercise) (Berke *et al.*, 2007) as well as ongoing opportunities for social interaction and engagement in the wider community. Southworth (2005, p. 248) describes walkability as:

> …the extent to which the built environment supports and encourages walking by providing for pedestrian comfort and safety, connecting people with varied destinations within a reasonable amount of time and effort, and offering visual interest in journeys throughout the network.

The importance of social interaction and connections made as older people move through their communities is highlighted by research undertaken by Gray (2009), who found that among a large sample of older adults aged 60 years or more living in Great Britain, neighbourhood contacts and frequency of meeting people each had a stronger effect on self-perceived social support than personal characteristics such as partner status, having had children or being active. The link between social support and psychological wellbeing has long been established (see Turner, 1981). Research into characteristics of the built environment that promote walking among older people demonstrates that a wide range of factors have to be addressed if the ambulatory members of this group are to increase their walking activity.

The built environment and its contribution to walkability for older people

The study of the built environment and its influence on the physical activity of seniors is in its infancy. Researchers in this area have tended to use disparate theoretical models and concepts, with inconsistent findings emerging across studies as a result (Cunningham & Michael, 2008). Three components of the built environment that have been identified as essential for the promotion of physical activity among the general population from a public health perspective include the presence of: street networks, transit systems and systems for non-motorised users; land use patterns including density and mixed uses; and urban design characteristics (including aesthetics and safety) (Frank *et al.*, 2003). This model has recently been applied to older populations in reviewing the empirical literature based on objective measures of the built environment and older people's walking behaviour. In considering the inconsistencies in both the

methodological approaches between studies published between 1990 and 2010 and their respective findings, the authors concluded that the aspects of the built environment that are most likely to have a direct effect on older people's mobility are high density of intersections, street and traffic conditions, and proximity to select destinations and green space (Rosso *et al.*, 2011, p. 7). The dynamic relationship between the many aspects encompassed by the components of Frank's and colleagues' (2003) model and older people's walking behaviour is suggested by research findings based on the use of walkability indexes (involving the calculation of scores based on land use and slope, vehicular traffic, public transit data, and park, street, foot and bike trail information). Higher walkability scores are associated with increased walking for exercise among older men and women (Berke *et al.*, 2007) and with greater levels of walking for transport (doing errands) and engagement in moderate and vigorous exercise (King *et al.*, 2011).

With respect to density, close proximity to a wide variety of goods and services, a setting that allows speed of movement (Glaeser *et al.*, 2001), and the presence of public leisure spaces (Lloyd & Auld, 2003) are all conceived to be critical for maintaining quality of life and thus satisfaction with higher density living. These same features are linked to walking decisions - especially proximity of neighbourhood facilities, which has been found to be a more salient factor in decisions to walk than physical difficulty, safety, fear of crime or weather (Southworth, 2005). Walking decisions can also be affected by factors such as personal enjoyment. Population-based research indicates that enjoyment of unstructured physical activity is a very strong predictor of walking 2.5 hours or more per week (Salmon *et al.*, 2003), The presence of walkable green spaces (parks and tree-lined streets) within walking distance of home has also been found to positively influence the longevity of seniors living in high density areas (Takano *et al.*, 2002). One emerging problem with cyclist/pedestrian pathways in high density settings is however, that older people are particularly vulnerable to sustaining injuries from collisions with cyclists (Chong *et al.*, 2010).

Neighbourhood design features have been shown to exert substantial influence on the outdoor physical activity of older persons (Booth *et al.*, 2000; Lui *et al.*, 2009). Judd and his colleagues (2010) found that inadequate provision or poor quality of paths of travel, transport nodes, public open space, access to public buildings, street furniture, local cafes and public toilets, as well as fear of crime and anti-social behaviour all have an effect on older people's walking decisions. The quality of pedestrian paths are particularly important to older people as walking difficulty and fear of falling are known to inhibit outside activity among older people (Weuve *et al.*, 2004; Jacobs *et al.*, 2008). Attention to streets and streetscape amenities can thus facilitate older people's mobility and participation in community life (Booth *et al.*, 2000). Day's (2010, p. 2662) qualitative study identified high kerbs, large bins, heavy traffic, shop displays and adverse natural terrain (especially slopes) as compromising walkability for older people, while public seating, cafes, toilets, routes away from traffic, and an aesthetically pleasing environment served to promote and support walking.

Context of the current study

In Australia, the creation of walkable neighbourhoods is a central feature of initiatives taken by government and non-government agencies in response to the challenges posed by either the ageing of the population (Australian Local Government Association, 2006; Department of Health and Ageing, 2006) or the rising levels of physical inactivity-related disease within the whole population (Giles-Corti, 2006; National Heart Foundation of Australia, 2009). The creation of 'higher density communities with mixed use zoning (i.e., a combination of commercial and residential development); interconnected streets; and access to public transport', representing a return to traditional planning principles, and known as New Urbanism (Giles-Corti, 2006, para 8) is currently being promoted by the Australian Federal Government as being key to improving public health. The extent that higher density living actually encourages walking and reduces car use among older people within Australia is unclear. The current study focuses

exclusively on older people living in high density areas for this reason, in order to explore neighbourhood walkability as they experience this phenomenon through time and space. This research adds to the small but growing number of studies pertaining to the walkability of older urban residents' environments, which do not rely on objective measures of walkability.

Methods

The data used for this study comprises a sub-set of data related to the experiences of older Australians residing in inner-urban, high density suburbs, which were gathered as part of a larger project exploring active ageing and liveability in rural, regional and urban locations. The research methodology used for the current study involves several different data collection methods: time-use diaries, survey responses, GPS tracking and GIS mapping, and in-depth qualitative interviews. Ethical approval for this project was obtained from a university Human Research Ethics Committee, and all case study participants provided written informed consent prior to their participation in the current study.

Participants

A total of 12 participants (6 men, 6 women) living in selected high density areas were used for this research, with all but one of the sample drawn from a database of a past project ('*Living in the City'*) (see Table 1 for a profile of participants' neighbourhoods). This previous study utilised a proportionate sampling technique for a postal survey completed by 636 inner urban residents (28% response rate) in 2007, involving research that focussed on the social, environmental and economic aspects of inner-city life. Using this database, participants who had indicated a willingness to participate in further research and were now aged 55 years or older were contacted and invited to participate, ensuring that those recruited allowed exploration of differences that might emerge as a function of age or gender. Since the original sample from which these participants were drawn lacked any persons of low socioeconomic

status, the twelfth participant was recruited through a community group to facilitate inclusion of a case study within this particular demographic.

[INSERT TABLE 1 ABOUT HERE]

Case Study Location

The location for all 12 case studies was Brisbane, Queensland, one of the fastest growing cities in Australia and in the western world. Brisbane has a sub-tropical climate with undulating topography. The study was undertaken in late March to early April at the start of autumn (normally characterised by pleasant outdoor weather conditions) in order to minimise possible weather-related bias in the results, given that summer is usually warm, humid and wet in Brisbane. The findings are thus considered to provide an indication of the typical activity level of participants. The greater Brisbane area is under the jurisdiction of the Brisbane City Council, which reports that this city's population is expected to increase from 991,000 (2009) to 1,270,000 people by 2031, and that in 2006, around 231,526 people and 105,783 dwellings were located in the inner five kilometres of Brisbane (Brisbane City Council & Queensland Government, 2010). Participants in this study were selected from six inner-city higher density areas (defined as 30 or more dwellings per hectare) within five kilometres of the Central Business District. Figure 1 shows the location of the high density areas included in this study.

[INSERT FIGURE 1 ABOUT HERE]

Procedure

Participants were telephoned prior to them being sent a paper travel diary, a GPS device and recharger, and a typed set of instructions about the use and re-charging of the GPS devices (previously trialled for ease of use and comprehension). Completed diaries and GPS devices and rechargers were posted back to the research team prior to interview. The recorded GPS data and diary information were analysed and merged using GIS technology for the purpose of creating individual 'time/space activity maps' for use during in-depth interviews with each of the participants. These maps were then reviewed and compared

with information in the travel diaries to identify any key patterns, issues, missing diary data or anomalies so that these could be discussed and resolved (where necessary) at interview.

Apparatus

Global Positioning Systems

Objective measures of each participant's travel over a seven-day period were obtained via a person-based GPS device (lightweight portable *TSI GPS Trip Recorder Model 747A*), which was used to track all of their out-of-home movement. The accuracy of the GPS device is reported to be +-3 metres (TranSystem Incorporated, 2008); this level of error can increase significantly however, depending on the level of signal interference caused by buildings, canopy cover, indoor environments, and so on. Participants placed the GPS device into a handbag or pocket during waking hours and charged the battery each night. The GPS devices were programmed to record position, time, date, speed and altitude at a time interval of one minute. This allowed for accurate tracking of each participant's outdoor movements, although the GPS would not record points when no signal was available (for instance, if the participant travelled underground for a period of time).

GIS Data Preparation and Analysis

Data from the GPS devices were downloaded using software specific to the GPS device (included in the purchased package). Using this software, the raw data were then exported as spreadsheets using a comma-delineated file format with each row representing a logged position (one each minute). These spreadsheets were converted to Google Earth files using an online converter and mapped in Google Earth. The different tracks of each participant's travel on the yielded maps were colour-coded by mode of travel used, according to information entered in participants' travel diaries (see Daily Diaries below). The creation of each participant's time/space activity maps (involving day-by-day and total weekly travels) took approximately 6 hours per diagram and was accompanied by tabulated information relevant

to each journey and destination. For the purposes of this research, 'neighbourhood' was defined as the area within 10 minutes walking distance of home.

Daily Diaries

Participants kept a daily diary for the same week that they were using the GPS tracking device. The diary had space to record their daily travel, destinations, activities and reflections upon issues pertaining to their environment or any undertaken activity. The diary also included a brief survey which captured demographic information, use of transport, volunteering and aspects of community liveability and engagement. The diaries offered an efficient and affordable way to assess specific details about activity (i.e., duration, frequency, social context, travel mode, and location), thereby supplementing information derived from the GPS devices.

In-depth Interviews

As the computer used at interview was large and difficult to move, the semi-structured interviews were conducted predominantly at a central location (the university) and, on occasion, in participants' homes. Each interview took place around two weeks after the GPS device and diary were returned to the research team, and lasted approximately 90 minutes on average. Residents' perceptions of place were elicited through their responses to open-ended questions focussed on both the positive and negative experiences and features of their respective neighbourhoods. The importance of the 'ordinary knowledge' of residents for providing insight into local issues and the functioning of daily life in place is crucial in effective liveability research (Myers, 1987). The interviews were sequenced so that initial discussion centred on participants' general pattern of movement over the tracking period, followed by a day-by-day review of each participant's trips and activities. This enabled exploration of the nature and level of activity of each participant within their respective immediate urban environments. The diary and map information acted as basis for generating further discussion to examine participants' experience of out-of-home mobility and the factors that facilitate and hinder their walking behaviour (both for transport

and leisure purposes). In this way, their potential and realised out-of-home mobility could be examined. Interviews also provided an opportunity for the accuracy of the GPS data and created maps to be verified by participants. All interviews were recorded and subsequently transcribed verbatim.

Data Analysis

With the initial stage of analysis of GPS and travel diary data having been undertaken prior to interview (as described above), additional analysis of the GPS data was undertaken in order to assess the proportion of total time spent travelling out-of-home on foot, relative to other forms of transport. The qualitative data derived from interview were analysed as individual case studies to determine patterns of travel and activity for each participant, as well as their experiences within their neighbourhood environments. The theoretical model of the built environment's influence on physical activity proposed by Frank *et al.* and used subsequently by Rosso *et al*. (2011) with respect to older people's mobility, was used as a basis for exploring the relationship between the built environment and neighbourhood walkability for each case study. The interview transcripts were read and re-read, and manually coded with 'chunks' of data being assigned to categories that correspond to the main components of the built environment that Frank *et al.* (2003) conceive to act as determinants of physical activity. This method of aggregating the data enabled detection of similarities and differences between the experiences of older people when walking in their respective neighbourhood environments. Findings related to participants' use of different modes of transport is reported initially in the results section below so as to provide context to the findings from the qualitative analysis of interview data - which are summarized under the subheadings: *Street networks, transit systems, and non-motorised user systems, Density and mixed land use*, and *Urban design characteristics.*

Results

The majority of older people in this study were found to do little walking as a means of transport or for either exercise or leisure. Three (CS6, CS8, CS9) did not use any means of transport other than their motor vehicle, and another four (CS3, CS4, CS10, CS12) spent most of their travelling time in cars. Use of public transport was low for all of the cases examined. Only three (CS2, CS7, CS11) spent more time walking than they did using non-active modes, one (CS1) spent more of his time travelling by public transport or on foot than by car, and another (CS5) spent the majority of his travel time riding his bicycle. See Figure 2 below for the proportion of total time each participant spent using different modes of transport over a seven-day period.

[INSERT FIGURE 2 ABOUT HERE]

Street networks, transit systems, and non-motorised user systems

All participants were found to live within a 5- to10-minute walking distance of a public transport node. There was however, considerable inconsistency in the amount of available public transport across the study locations. Some urban neighbourhoods appear to be poorly serviced, while others appear to be over-serviced. Reaching a preferred destination by public transport emerged as a particular issue for older people, exemplified by the experience of one woman who reported that she would need to change busses three times to get to her therapy pool – despite it being situated in an adjacent suburb. This led to her to cease making trips to the pool. The relative location of her home to the pool is shown below in Figure 3. The provision of direct routes to some destinations, but not to others, may help to explain the finding that any use of public transport among participants was city-centric.

Information supplied at interview indicated that choice of travel mode was largely affected by perceptions of convenience related to time efficiency, seamless journeys and journey destination or purpose. For the most part, it was the car that fulfilled all of these objectives simultaneously. Having access to a car appeared to remove the need to consider public transportation as an alternative means of reaching destinations. As CS9 (male) explained: ‘[Using the car] - it's just pleasant; no problem at all. I

think there must be busses you [can catch] but I don't know where they go to.' See Figure 4 for the weekly activity map belonging to this participant.

[INSERT FIGURES 3 & 4 ABOUT HERE]

The majority of participants appeared to have a strong attachment to their motor vehicles, and indicated that their vehicles gave them a feeling of freedom and safety. For one male (CS9, aged 78 years) however, it was the sheer pleasure of driving (especially a large vehicle) that led to him to using his vehicle for all of his out-of home travel:

> [I drive] because I want to. You know, I like my car and I enjoy driving. It's so easy anyway...so, yes, it's easy and fun and I have got a nice - a ridiculously big car…I like a big car with lots of spare umph and capacity.

Whether by car or other means, transportation was highlighted by participants as being essential for maintaining their independence within their respective neighbourhoods, visiting family and friends, and remaining active within the wider community. The key barriers to using public transport identified by participants included: public transport services being perceived as irregular or unreliable; experience of difficulty in physical access onto buses or ferries; experience of excessive distance or steep topography when travelling to transit nodes; excessive waiting including transfer times between changes of transport; finding timetable and route information confusing; and health issues such as urinary incontinence because of the associated fear of not having access to toilets while in transit. In one particular neighbourhood, residents had banded together to protest the local council's proposed cancellation of ferry services in their area. This was of major concern to older residents, given that this was the only available form of public transport in their immediate vicinity.

Problems with the non-motorised user systems in some locations were identified by participants as deterring them from walking in their local areas. Hilly topography and conflict between pedestrians and cyclists on shared pathways were highlighted as being factors that undermine the walkability of these

systems. Places where vehicular transit systems and non-motorised user pathways merged were found to be particularly troublesome. Insufficient time being set for older people to cross the road at intersections where traffic lights are situated was a major concern for one participant (CS12 - male), who reported that there had already been a fatality at one such intersection in his area (see Figure 5). He also noted that the major arterial where this intersection is located is earmarked for further widening (another two lanes), which will exacerbate the problem of crossing the road before the change of lights. Confusion about right of way protocol among motorists and pedestrians when they meet at zebra crossings was also cited as an issue in this same neighbourhood. CS1 (male) described some footpaths in his neighbourhood as being "too narrow" and close to busy roads – especially when shared by both cyclists and pedestrians (see Figure 6).

[INSERT FIGURES 5 & 6 ABOUT HERE]

Participants' verbatim comments that pertain to the various transportation systems in their respective neighbourhoods are provided below in Table 2.

[INSERT TABLE 2 ABOUT HERE]

Density and mixed land use

During interviews, participants identified local shops and services as places where they could walk to get their daily requirements and to meet others and stay active without a car, highlighting the importance of both mixed land use patterns and proximity to neighbourhood walkability. Inspection of the individual time/space maps revealed however, that the majority of participants used very few or no local services and travelled by car well outside a two-kilometre radius from their homes for both goods (mostly from large shopping centres) and services. Figure 7 below shows the weekly activity map of CS4 (female), who accessed goods and services both within and well outside of her local neighbourhood. Separate

symbols are used on the map to distinguish retail and trade services from community/health/leisure services accessed by her during the week.

[INSERT FIGURE 7 ABOUT HERE]

One notable exception to the overall pattern of behaviour with respect to travelling outside of local neighbourhoods for accessing most goods and services was CS2 (female), who walked extensively throughout her immediate and surrounding neighbourhood (within 10 minutes walking distance from home and beyond) for a variety of purposes, including travelling to and from work, and for leisure, exercise, shopping and accessing services. A map showing her walking activity over the monitored week is shown in Figure 8. CS2 reported during her interview, that a lack of local amenities was one of the key reasons for her having moved from another inner-city area to her present location ('I used to live at Kangaroo Point…It doesn't have a heart or soul. It's what I call a dormitory suburb. People go there to sleep. There are no amenities there'). She also spoke of her belief in the need for people to reduce their reliance on cars, and that the walkability of her neighbourhood provides her with the lifestyle she seeks, especially the many opportunities it gives her to interact and keep in touch with others living in her area.

Considerable variation was found to exist with respect to locally available amenities across the study locations. Participants experienced different realities in terms of what high-density living provides in this regard. Residents from two areas in particular (Kangaroo Point and Newstead) were found to have minimal amenity choice and were therefore forced to travel out of their neighbourhoods in order to access most services. This lack of proximity to amenities appeared to be offset by having homes with river views for those living at Kangaroo Point however.

Urban design characteristics

Imminent change in the character of their urban neighbourhoods (because of development aimed at increasing the residential population in their vicinity) emerged as a major concern for some participants.

They voiced this concern within the context of this development already being underway or their neighbourhoods having been earmarked for future development. They perceived that changes to the built environment will inevitably compromise the liveability of their neighbourhoods. Matters that prompted their fears included: loss of what they consider to be important neighbourhood community infrastructure; the proposed widening of roads and resultant increase in vehicular traffic; and the exacerbation of existing difficulties in physically negotiating pedestrian crossings by the presence of even more expansive and congested roads. They also spoke about increasing density of urban areas having reduced the amount of local green space and increased the pedestrian and bicycling traffic along shared pedestrian/bicycle paths. As a consequence, residents were finding that they needed to stagger walking times away from peak times because of the volume of users on pedestrian paths and within available green-space. This often led them to walk during the hottest part of the day or after dark – a time about which some held concerns with respect to their safety.

The lack of necessary green space to meet the needs of a substantially increased local population was a predominant concern of CS12 (male), who was living in a location where a new high-rise development was currently underway:

> Unfortunately, what's going to happen, they are widening Kingsford Smith Drive to six lanes, so they are going to take – that's a community hall… They are going to put another [building]…right in front of our place. So we used to meet in that little park [to protest the development]. That little park is going to be a smaller park...We have no right of appeal of any planning in that area [immediately abutting the resident's building], which frightens me terribly. They are putting 15,000 people in that area, 15,000. They say they have got a park. Yes, they have got a park; you can't swing a cat in it. The rest is high-rise (CS12).

Insufficient green space was highlighted as being a current problem in another location by CS2 (female):

> There aren't enough parks. Even the German lady that I talk to, she's got a dog. She said, 'I have to now take my dog for a walk at 2 o'clock in the afternoon because if I go early/late, there's just no room. It's just so full'…That personally worries me...You have got to have green space. Now, they are talking about bringing back community gardens, which I think are great, but you have got to have green space to even put a community garden.

While quantitative data gathered from the brief surveys included in travel diaries indicated that all of the 12 participants "loved" living in their current neighbourhoods, the qualitative data gathered at interview revealed personal safety was a key factor in constraining their decisions to walk. Their fears were based on physical characteristics of the built environment that they believed placed them at risk of injury, such as poorly maintained pedestrian infrastructure and streetscapes. While some of the threats to personal safety mentioned by participants have already been described (see beginning of Results section), additional issues were identified that related to upkeep (poorly maintained pavements) and insufficient street lighting where new non-motorised user pathways were being built:

> Street lighting, pavement maintenance; these are the odd things that come up…Pavement maintenance, in terms of people being likely to have falls and that sort of thing...I mean, they are not being repaired and they get things wrong with them. They are building these new footpaths, shared footpaths for cyclists and things, but not putting the lights up quick enough (CS10 - male).

The quality of pedestrian footpaths varied between urban neighbourhoods. Some were well maintained with even surfaces and hand rails being provided adjacent to any steps along the path, while others had uneven surfaces with no handrail support for stairs. Lack of shade and street seating for those living in Brisbane's subtropical climate were raised as being issues in some of the study locations, as was the availability of clean and safe public toilets. One participant's comment suggested that he perceived lack of shading and public seating as a failure to consider the particular needs of older people:

> It has got no shade. It's got no seating for older people…so it's for, you know, the 15 to 50 age group, but they forget about the [ages] beyond that (CS12 - male).

Overall, the results indicate that the built environments within each of the six high density areas in which the study participants resided, presented them with numerous obstacles that served to either discourage them from walking or to feel unsafe or stressed when they did walk within their neighbourhoods.

Discussion

The purpose of this paper was to investigate older people's experience of neighbourhood walkability within high density settings as means to further understanding of the relationship between this form of neighbourhood and walking behaviour. While the current study is based on the experiences of a small number of older people, thereby precluding the generalisability of its findings, all of the factors identified by Rosso et al., (2011) as being most likely to impact upon older people's walking behaviour (namely, high density intersections, street and traffic conditions, proximity to select destinations, and green space) emerged as having an influence on the walking decisions of the older people who took part in this research. The current study therefore provides qualitative-based support for evidence from quantitative studies. Most notable is that this study found that the impact of problems with traffic and pedestrian infrastructure upon participants' travel mode choices was framed in terms of the risks these posed to their physical safety. Dangerous pedestrian crossings, shared cyclist/pedestrian pathways that are either overcrowded or too close to busy roads, poorly maintained footpaths, and a lack of available shading and public seating were all identified as factors that undermine their sense of safety when venturing out of home on foot. These aspects of the built environment have been identified previously as issues that affect older people's out-of-home mobility (Booth *et al.*, 2000; Weuve *et al.*, 2004; Michael *et al.*, 2006; Jacobs *et al.*, 2008; Judd *et al.*, 2010). The availability of adequate green space was also highlighted by several

participants as being important to the walkability of their neighbourhoods, corroborating evidence of the value of green space to older Australians gathered from previous research based on a large national sample drawn from all Australian states and territories (Judd *et al.*, 2010).

The current study also found that most of the older people living in high-density locations within inner-city Brisbane had very low levels of out-of-home activity within walking distance of their residences, despite the fact that none of them had any disability that prevented them from walking in their local areas. The out-of-home activities in which they did engage were predominantly found to take place outside of their local neighbourhoods, thereby requiring extensive use of their private motor vehicle for transportation. While quality of public transport and non-motorised user systems, land use patterns, and urban design characteristics (especially access to public toilets) are all implicated as plausible reasons for this pattern of behaviour, so too are established norms surrounding driving, and the intrinsic and instrumental value of cars to older people as a consequence of the pleasure derived from the act of driving itself, as well as the freedom and convenience of movement they provide. These same reasons for reliance on cars among older people have been identified in low and high density areas in France and Canada (Lord & Luxembourg, 2007). This raises the question of whether or not a substantial reduction in older people's reliance on motor vehicles for out-of-home mobility would naturally follow substantial improvements to the walkability of neighbourhoods, unless accompanied by campaigns aimed at changing norms around car use.

This study's findings are also consistent with previous research with respect to the nature of barriers to older people using public transport. The current research revealed that only two of the five older people who reported using public transport during the monitored seven-day period travelled by bus, and public transport accounted for only a small proportion of the overall travel time of each of all five participants. Reasons given for non-use of busses in the current study are consistent with those found by studies reviewed by Broome *et al*. (2009). Continuing improvement in public transport services, access

and infrastructure is needed if older people are to find public transport more attractive and voluntarily abandon use of their motor vehicle.

The finding that older urban residents had very low levels of locally-based activity and that they are using their motor vehicles to access everyday goods and services (e.g., retail shopping, hairdressers, medical services and so on) outside of their local neighbourhood environment also raises questions about whether or not high density development provides easy and nearby access to everyday goods and services for older people, and thus the opportunity to increase their walking activity and reduce their car use. Given that declines in health and functioning form part of the ageing process, the provision of nearby shops that stock goods which meet everyday needs as well as medical services would appear to be essential for high density settings.

Analysis of the experiences of walking for older people living in high density locations in this study suggest that for most, walking was associated with several stressful or unpleasant conditions or events. The negative connotations of walking were attributable to characteristics of the built environment as well as social interactions that took place on shared pedestrian/cyclist pathways. Given that enjoyment of unstructured physical activity has been found to be a strong predictor of regular walking (Salmon *et al.*, 2003), the capacity of these negative experiences to undermine older people's enjoyment of walking and thus deter them from walking into the future is a matter for concern. Attention to the built environment and to community attitudes and behaviour towards the sharing of pedestrian/cyclist pathways will be needed if older people are to feel safe when walking in their neighbourhoods. Population density in inner-city suburbs in Australia and elsewhere is bound to increase, as is active transport (both cycling and walking) if public health and environmental sustainability objectives are achieved. It is possible that growing numbers of both pedestrians and cyclists in shared spaces will create new and unforeseen problems. The competing interests of shared spaces between these two groups, as indicated by the experiences of participants

in this study, and evidence based on hospitalisation data that older people are at increased risk of injury from collisions with bicycles (Chong *et al.*, 2010) - suggest that this issue warrants research attention within the sub-field of environmental gerontology in the future. Fears about using shared pedestrian/cyclist pathways could potentially become an important determinant of the difference between potential and realised out-of-home mobility for older people living in settings where these pathways form part of their local neighbourhoods.

Overall, the findings from this study highlight the salience of objectives outlined by the National Heart Foundation of Australia if older Australians are to change their behaviour by walking more and driving less. Specifically, these entail the need to 'build and retrofit existing neighbourhoods to increase pedestrian and cyclist access to shops, workplaces, public transport' and also to 'consider the mobility, access and recreational needs of older adults when planning road crossings, pedestrian infrastructure, public transport access, public open space and recreational infrastructure' (NHF, 2009, pp. 12, 27). This consideration needs to extend beyond the planning phase however, to ensuring that pavements, intersections, and pedestrian crossings are properly maintained. Their lack of upkeep has been shown repeatedly to undermine older people's potential for mobility (Weuve *et al.*, 2004; Southworth, 2005; Michael *et al.*, 2006; Judd *et al.*, 2010).

Finally, this study used an innovative, mixed-methods approach in investigating the experiences of older people living in high density suburbs when walking in their neighbourhoods. The use of GPS tracking and GIS mapping, in conjunction with daily diaries and in-depth interviews provided a means of gathering objective data on older adults' walking behaviour relative to their use of other means of transport. The creation and use of individualised space/time maps at interview created opportunities for both verifying the data derived from GPS devices and travel diaries, and exploring the walking experiences of older people. The visual display of the space/time maps served to prompt interviewees' recall of these experiences as well as aspects of the built environment that caused them difficulty as they

moved around their neighbourhoods. For the benefit of other researchers who plan to use travel diaries to explore the person-environment relationship, it is worth noting that although participants were asked to write down the nature of built environment features that affected the walkability of their neighbourhood, they tended not to do so and instead only gave details of the nature of their destinations, activities and the mode of transport used for each trip. It may be that the need to carry a GPS device, recharge it overnight, and make daily entries into a travel diary limits the amount of writing participants are prepared (or remember) to do. The in-depth interviews were therefore found to be essential for gaining detailed information on aspects of the built environment that help to shape older people's walking decisions. GPS and GIS technologies would appear to hold great potential for both expanding the methodological approaches used for studying the person-environment relationship and furthering our understanding of out-of-home mobility among older people.

References

Alsnih, R. & Hensher, D.A. (2003) The mobility and accessibility expectations of seniors in an aging population. *Transportation Research Part A*, 37, pp. 903-916.

Alves, S., Aspinall, P.A., Thompson, C.W., Sugiyama, T., Brice, R. & Vickers, A. (2008) Preferences of older people for environment attributes of local parks: the use of choice-based conjoint analysis. *Facilities*, 26, pp. 433-453.

Aspinall, P.A., Ward Thompson, C., Alves, S., Sugiyama, T., Brice, R. & Vickers, A. (2010) Preference and relative importance for environmental attributes of neighbourhood open space in older people. *Environment and Planning B: Planning and Design*, 37, pp. 1022-1039.

Australian Bureau of Statistics (2008) *Population Projections, Australia, 2006 to 2101* (Canberra, ABS).

Australian Local Government Association (2006) *Age-friendly Built Environment: Opportunities for Local Government* (Canberra, ALGA).

Banister, D. & Bowling, A. (2004) Quality of life for the elderly: the transport dimension. *Transport Policy*, 11, pp. 105-115.

Barclays Wealth, 2010, Volume 12: The Age Illusion: How the Wealthy are Redefining their Retirement. Available online at: http://www.barclayswealth.com/insights/assets/pdf/BW12_UK__ForWeb.pdf (accessed 31 December 2011).

Beard, J.R. & Petitot, C. (2010) Ageing and urbanization: can cities be designed to foster active ageing? *Public Health Reviews*, 32, pp. 427-450.

Behan, K., Maoh, H. & Kanaroglou, P. (2008) Smart growth strategies, transportation and urban sprawl: simulated futures for Hamilton, Ontario. *Canadian Geographer*, 52, pp. 291-308.

Berke, E.M., Koepsell, T.D., Moudon, A.V., Hoskins, R.E. & Larson, E.B. (2007) Association of the built environment with physical activity and obesity in older persons. *American Journal of Public Health*, 97, pp. 486-492.

Besser, L.M. & Dannenberg, A.L. (2005) Walking to public transit: steps to help meet physical activity recommendations. *American Journal of Preventive Medicine*, 29, pp. 273-280.

Blackman, T., Mitchell, L., Burton, E., Jenks, M., Parsons, M., Raman, S. & Williams, K. (2003) The accessibility of public spaces for people with dementia: a new priority for the 'open city'. *Disability & Society*, 18, pp. 357-371.

Booth, M.L., Owen, N., Bauman, A., Clavisi, O. & Leslie, E. (2000) Social-cognitive and perceived environment influences associated with physical activity in older Australians. *Preventive Medicine*, 31, pp. 15-22.

Brisbane City Council & Queensland Government (2010) *River City Blueprint - Background Paper* (Brisbane, BBC & Queensland Government).

Broome, K., McKenna, K., Fleming, J. & Worrall, L. (2009) Bus use and older people: a literature review applying the Person-Environment-Occupation model in macro practice. *Scandinavian Journal of Occupational Therapy*, 16, pp. 3-12.

Burton, E. & Mitchell, L. (2006) *Inclusive Urban Design: Streets for Life* (Oxford, Architectural Press).

Chaudhury, H., Sarte, A.F.I., Michael, Y.L., Mahmood, A., Keast, E.M., Dogaru, C. & Wister, A. (2011) Use of a systematic observational measure to assess and compare walkability for older adults in Vancouver, British Columbia and Portland, Oregon neighbourhoods. *Journal of Urban Design*, 16, pp. 433-454.

Chong, S., Poulo, R., Olivier, J., Watson, W.L. & Grzeibieta, R. (2010) Relative injury severity among vulnerable non-motorised road users: comparative analysis of injury arising from bicycle-motor vehicle and bicycle-pedestrian collisions. *Accident Analysis & Prevention*, 42, pp. 290-296.

Cunningham, G. & Michael, Y.L. (2008) Concepts guiding the study of the impact of the impact of the environment on physical activity for older adults: a review of the literature. *American Journal of Health Promotion*, 18, pp. 435-443.

Day, R. (2008) Local environments and older people's health: dimensions from a comparative qualitative study in Scotland. *Health & Place*, 14, pp. 299-312.

Day, R. (2010) Environmental justice and older age: consideration of a qualitative neighbourhood-based study. *Environment and Planning A*, 42, pp. 2658-2673.

Department of Health and Ageing (2006) *A Community for All Ages: Building the Future* (Canberra.

Duncan, D.T., Aldstadt, J., Whalen, J., Melly, S.J. & Gortmaker, S.L. (2011) Validation of Walk Score for estimating neighborhood walkability: an analysis of four US metropolitan areas. *International Journal of Environmental Research and Public Health*, 8, pp. 4160-4179.

Ewing, R. & Handy, S. (2009) Measuring the unmeasurable: urban design qualities related to walkability. *Journal of Urban Design*, 14, pp. 65-84.

Fonda, S.J., Wallace, R.B. & Herzog, A.R. (2001) Changes in driving patterns and worsening depressive symptoms among older adults. *Journal of Gerontology: Series B*, 56B, pp. S343-S351.

Foster, S., Giles-Corti, B. & Knuiman, M. (2011) Creating safe walkable streetscapes: does house design and upkeep discourage incivilities in suburban neighbourhoods? *Journal of Environmental Psychology*, 31, pp. 79-88.

Frank, L.D., Engelke, P.O. & Schmid, T.L. (2003) *Health and Community Design: The Impact of the Built Environment on Physical Activity* (Washington, DC; London Island Press).

Gabriel, Z. & Bowling, A. (2004) Quality of life from the perspectives of older people. *Ageing & Society*, 24, pp. 675-691.

Giles-Corti, B. (2006) *The Impact of Urban Form on Public Health* (Canberra.

Glaeser, E.L., Kolko, J. & Saiz, A. (2001) Consumer city. *Journal of Economic Geography*, 1, pp. 27-50.

Gray, A. (2009) The social capital of older people. *Ageing & Society*, 29, pp. 5-31.

Harrison, A. & Ragland, D.R. (2003) Consequences of driving reduction or cessation for older adults. *Transportation Research Record: Journal of the Transportation Research Board*, 1843, pp. 96-104.

Headicar, P. (2003) Land use planning and the management of transport demand, in: J. Hine and J. Preston (Eds) *Integrated Futures and Transport Choices*, pp. 205-224 (Ashgate, Aldershot).

Jacobs, J.M., Cohen, A., Hammerman-Rozenberg, R., Azoulay, D., Maaravi, Y. & Stessman, J. (2008) Going outdoors daily predicts long-term functional and health benefits among ambulatory older people. *Journal of Aging and Health*, 24, pp. 258-272.

Judd, B., Olsberg, D., Quinn, J., Groenhart, L. & Demirbilek, O. (2010) *Dwelling, Land and Neighbourhood Use by Older Home Owners* (Melbourne.

Kendig, H. (2003) Directions in Environmental Gerontology: a multidisciplinary field. *Gerontologist*, 43, pp. 611-614.

Kenworthy, J.R. (2006) The eco-city: then key transport and planning dimensions for sustainable city development. *Environment and Urbanization*, 18, pp. 67-85.

King, A.C., Sallis, J.F., Frank, L.D., Saelens, B.E., Cain, K., Conway, T.L., Chapman, J.E., Ahn, D.K. & Kerr, J. (2011) Aging in neighborhoods differing in walkability and income: associations with physical activity and obesity in older adults. *Social Science & Medicine*, 73, pp. 1525-1533.

Koepsell, T., McCloskey, L., Wolf, M., Moudon, A.V., Buchner, D., Kraus, J. & Patterson, M. (2002) Crosswalk markings and the risk of pedestrian-motor vehicle collisions in older pedestrians. *JAMA*, 288, pp. 2136-2143.

Lee, C. & Moudon, A.V. (2004) Physical activity and environment research in the health field: implications for urban and transportation planning practice and research. *Journal of Planning Literature*, 19, pp. 147-181.

Li, F., Fisher, K.J., Brownson, R.C. & Bosworth, M. (2005) Multilevel modelling of built environment characteristics related to neighbourhood walking activity in older adults. *Journal of Epidemiology & Community Health*, 59, pp. 558-564.

Lloyd, K. & Auld, C. (2003) Leisure, public space and quality of life in the urban environment. *Urban Policy and Research*, 21, pp. 339 - 356.

Lord, S., Després, C. & Ramadier, T. (2011) When mobility makes sense: a qualitative and longitudinal study of the daily mobility of the elderly. *Journal of Environmental Psychology*, 31, pp. 52-61.

Lord, S. & Luxembourg, N. (2007) The mobility of elderly residents living in surburban territories. *Journal of Housing for the Elderly*, 20, pp. 103-121.

Lui, C.-W., Everingham, J.-A., Warburton, J., Cuthill, M. & Bartlett, H. (2009) What makes a community age-friendly: a review of international literature. *Australasian Journal on Ageing*, 28, pp. 116-121.

Maas, J., Verheij, R.A., Groenewegen, P.P., de Vries, S. & Spreeuwenberg, P. (2006) Green space, urbanity and health: how strong is the relationship? *Journal of Epidemiology and Community Health*, 60, pp. 587 - 592.

Michael, Y.L., Green, M.K. & Farquhar, S.A. (2006) Neighborhood design and active aging. *Health & Place*, 12, pp. 734-740.

Mollenkopf, H., Marcellini, F., Ruoppila, I., Szeman, Z., Tacken, M. & Kaspar, M. (2002) The role of driving in maintaining mobility in later life: a European view. *Gerontechnology*, 2, pp. 231-250.

Myers, D. (1987) Community-relevant measurement of quality of life: a focus on local trends. *Urban Affairs Quarterly*, 23, pp. 108-125.
National Heart Foundation of Australia (2009) *Blueprint for an Active Australia* (Melbourne, NHF).
Phillipson, C. (2004) Urbanisation and ageing: towards a new environmental gerontology. *Ageing & Society*, 24, pp. 963-972.
Rosso, A.L., Auchincloss, A.H. & Michael, Y.L. (2011) The urban built environment and mobility in older adults: a comprehensive review. *Journal of Aging Research*, 10 pages, doi:10.4061/2011/816106.
Salmon, J., Owen, N., Crawford, D., Bauman, A. & Sallis, J.F. (2003) Physical activity and sedentary behavior: a population-based study of barriers, enjoyment, and preference. *Health Psychology*, 22, pp. 178-188.
Schwanen, T. & Ziegler, F. (2011) Wellbeing, independence and mobility: an introduction. *Ageing & Society*, 31, pp. 719-733.
Shendell, D.G., Johnson, M.L., Sanders, D.L., Nowakowski, A.C., Yang, J., Jeffries, C.D., Weisman, J.E. & Moulding, M. (2011) Community built environment and mobility around senior wellness centers: the concept of "safe senior zones". *Journal of Environmental Health*, 73, pp. 9-18.
Shoval, N., Wahl, H.-W., Auslander, G., Isaacson, M., Oswald, F., Edry, T., Landau, R. & Heinik, J. (2011) Use of the global positioning system to measure the out-of-home mobility of older adults with differing cognitive functioning. *Ageing & Society*, 31, pp. 849-869.
Smith, A.E. (2009) *Ageing in Urban Neighbourhoods: Place Attachment and Social Exclusion* (Bristol, UK, Policy Press).
Southworth, M. (2005) Designing the walkable city. *Journal of Urban Planning and Development*, 131, pp. 246-257.
Sugiyama, T., Thompson, C. & Alves, S. (2009) Associations between neighborhood open space attributes and quality of life for older people in Britain. *Environment and Behavior*, 41, pp. 3-21.
Takano, T., Nakamura, K. & Watanabe, M. (2002) Urban residential environments and senior citizens' longevity in megacity areas: the importance of walkable green spaces. *Journal of Epidemiology and Community Health*, 56, pp. 913-918.

Therese, S.A., Buys, L., Bell, L. & Miller, E. (2010) The role of land use and psycho-social factors in high density residents' work travel mode choices: implications for sustainable transport policy. *World Review of Intermodal Transportation Research*, 3, pp. 46-72.

TranSystem Incorporated, 2008, 747 A+ GPS Trip Recorder, User's Manual. Available online at: http://www.transystem.com.tw/product/59/747%20A+%20User%20Manual%20v1.1.pdf (accessed 3 March 2010).

Turner, R.J. (1981) Social support as a contingency in psychological well-being. *Journal of Health and Social Behavior*, 22, pp. 357-367.

Wahl, H.-W. & Weisman, G., D. (2003) Environmental gerontology at the beginning of the new millennium: reflections on its historical, empirical, and theoretical development. *Gerontologist*, 43, pp. 616-627.

Weiss, R., Maantay, J.A. & Fahs, M. (2010) Promoting active urban aging: a measurement approach to neighborhood walkability for older adults. *Cities and the Environment*, 3, pp. 1-17.

Weuve, J., Kang, J.H., Manson, J.E., Breteler, M.M.B., Ware, J.H. & Grodstein, F. (2004) Physical activity, including walking, and cognitive function in older women. *JAMA*, 292, pp. 1454-1461.

White, D.K., Jette, A.M., Felson, D.T., Lavalley, M.P., Lewis, C.E., Torner, J.C., Nevitt, M.C. & Keysor, J.J. (2010) Are features of the neighborhood environment associated with disability in older adults? *Disability and Rehabilitation*, 32, pp. 639-645.

Woodcock, J., Edwards, P., Armstrong, B.G., Ashiru, O., Banister, D., Beevers, S., Chalabi, Z., Chowdhury, Z., Cohen, A., Franco, O.H., Haines, A., Hickman, R., Lindsay, G., Mittal, I., Mohan, D., Tiwari, G., Woodward, A. & Roberts, I. (2009) Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport. *Lancet*, 374, pp. 1930-1943.

World Health Organization (2002) *Active Ageing: A Policy Framework* (Geneva, WHO).

World Health Organization (2007) *Global Age-friendly Cities: A Guide* (Geneva, WHO).

Zeigler, F. & Schwanen, T. (2011) 'I like to go out to be energised by different people': an exploratory analysis of mobility and wellbeing in later life. *Ageing & Society*, 31, pp. 758-781.

Table 1: Summary Table of Case Study (CS) Respondents and Location Profile

Person	Age	Gender	Marital Status	Income[¥]	Working/ Retired	Length of time in residence	Location[#]	Population*	Land mass	Distance from Brisbane GPO
CS1	57	Male	Married	>70K	Works**	> 11 years	Newstead[+]	4818	1.3km^2	3kms NE
CS2	62	Female	Single	>70K	Works**	> 9 years	West End^	6206	1.9km^2	3kms SW
CS3	64	Female	Married	40-50K	Retired	2 years	Kelvin Grove Urban Village+	4246 (for whole of Kelvin Grove area)	Urban Village 16ha	3kms NW
CS4	65	Female	Married	>70K	Retired	> 6 years	Kangaroo Point[+]	6868	1.3km^2	0.75km SW
CS5	70	Male	Single	>70K	Works**	8 years	Highgate Hill^	5428	1.2km^2	2kms SE
CS6	72	Female	Widowed	<20K	Retired	49 years	West End^	6206	1.9km^2	3kms SW
CS7	73	Male	Single	>70K	Retired	9 years	Hamilton^	4366	1.7kms^2	5kms NE
CS8	75	Female	Widowed	Unknown[†]	Retired	35 years	Highgate Hill^	5428	1.2km^2	2kms SE
CS9	78	Male	Married	Unknown[†]	Retired	10 years	Kangaroo Point[+]	6868	1.3km^2	0.75km SW
CS10	79	Male	Married	>70K	Retired	9 years	Kangaroo Point[+]	6868	1.3km^2	0.75km SW
CS11	80	Female	Married	50-70K	Retired	10 years	Kangaroo Point[+]	6868	1.3km^2	0.75km SW
CS12	80	Male	Married	>70K	Retired	> 6 years	Hamilton^	4366	1.7kms^2	5kms NE

[¥] 1EUR = 1.24975 AUS (average over 8 days of January 2012
*Population data from 2006 Census, gathered by the Australian Bureau of Statistics (2008)
[†] Income not disclosed
[#] Each of these areas are targeted for further urban renewal and being developed specifically for high density living. The different inner-urban areas have different topography and varying levels of infrastructure and available services
^Hamilton, Highgate Hill, West End, (well established residential areas)
[+]Newstead, Kangaroo Point and Kelvin Grove Urban Village (areas which have undergone massive transformation from semi-industrial to high residential density)
**Three of the respondents were in full- or part-time work. They are representative of a growing and new breed of wealthy workers who reject retirement, coined 'neveretirees' (Barclays Wealth, 2010)

Table 2: Transport systems and associated problems

Transport system	Identified problem	Verbatim comments
Bus services	Bus routes do not correspond with intended destinations	They don't all go the right way that you want to go, the busses, but there's nothing that we can do about that (CS8 - female) Most places I would have to go to the city and go and get another bus out (CS6 - female)
	Physical accessibility	I can get on a bus but I can't get off the bus. It depends how - if it's a good driver and he goes right to the kerb, I can get off easily, but usually they don't (CS6 - female)
	Inconsistency in provision of services (under- and over-servicing)	I have heard this place referred to as Kangaroo Island [rather than the suburb name of Kangaroo Point] because of how bad public transport is (CS10 - male) Well, coming in this morning… there were five busses there besides ours …Now, this is absolutely ridiculous (CS8 - female)
Ferry services	Proposed cancelling of service by local council (only available public transport in the immediate location)	We have got a thousand signatures because I fought it on the basis that it would prevent older people from going out at night…so we have safety issues and everything else (CS11 – female)
Non-motorised user systems	Conflicting needs of pedestrians and cyclists	Yes, cyclists. They are the biggest one. It's becoming very frightening. A lot of them are very abusive…Most of them don't have bell, so you get frightened for your life, even though you are keeping to the left and everything. What I am really concerned about, is that I feel there's animosity that's developing between walkers and cyclists (CS11 - female)
	Timing of traffic light changes	That is the problem, crossing Kingsford Smith Drive…There's lights on the corner with the pedestrian crossing. I try to get across as fast as I can and I can't get across in one change of the lights. People on walking sticks haven't got a hope...we have taken it up with the council. They have increased the time to 2 seconds, but that's still not enough time...Yes, these lights – we have had one [person], at our tower, hit by a truck (CS12 - male)
	Confusion caused by zebra crossings	The inconvenient road crossing, that's outside the bank It's one of these road crossings where, you know, it's not a zebra crossing, not lights; it's where pedestrians give way to traffic but the traffic don't know this. So they stop or they don't stop. So you are never sure if you should cross or not…If they had one or the other, it would be easier. If they put a zebra crossing for people having the rights to cross. Nobody knows what it is (CS12 - male)
	Topography of pathways	I would do a lot more walking if I could walk uphill and down hills (CS3 - female) The big walkability problem is that…hill (CS12 - male)