

ACCESSIBILITY TO ESSENTIAL SERVICES AND FACILITIES BY A SPATIALLY DISPERSED AGING POPULATION IN SUBURBAN MELBOURNE, AUSTRALIA

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ABSTRACT

Spatially dispersed ageing population is a challenging issue for public policy makers in many developed countries. Australia have opted to deal with this unprecedented ageing issue via an ‘ageing in place’ strategy, encouraging the elderly or seniors to live in their own housing for as long as possible, with only minimal support from public authorities. This strategy has been widely supported by the community but poses a number of serious challenges for both policy makers and seniors alike, including the issue of personal mobility and being able to access outside of the home those things that are deemed essential to ones well-being and quality of life. The elderly or seniors are often identified as being subject to social exclusion because of difficulties associated with travelling outside their homes to access services and facilities, especially towards the outskirts of major urban centres, where services and facilities are generally only readily accessible by car. As drivers age and are required to surrender their driving licences, accessibility to a range of services and facilities either in their immediate neighbourhood or surrounding region will become a major issue especially in those locales where public transport infrastructure is inadequate. This paper explores this issue through an empirical assessment and visualisation of micro level manifestations of location disadvantage within residential suburbs of Melbourne using GIS-based spatial analytical procedures and fine spatial resolution data sets. The paper presents the spatial patterns in accessibility to some essential services and facilities in terms of the shortest network distance travelled from residential locations to the nearest medical centre, pharmacy, bank, library, church, shopping centre, bus stop, train station, social club, etc., by a spatially dispersed aging population who live in or on the outskirts of metropolitan Melbourne, where large spatial concentrations of seniors are to be found, some of whom do not have ready access to a car or public transport service. The case study reveals that the possible existence of social exclusion amongst non-car driving seniors is being reinforced by a regional public transport system that can not adequately service the entire municipality, as too much reliance continues to be placed on the ownership and usage of cars. The approaches taken and the findings made in this study should be useful to public policy makers in many countries who will all be confronted by this same policy problem within the next two decades.

KEYWORDS

aged population, Melbourne, accessibility, public transportation, social exclusion, GIS, network analysis, spatial variation.

1. INTRODUCTION

Location advantages and disadvantages ‘emerges when other benefits or penalties compound the advantages or disadvantages of particular groups by virtue of where they live’ (Smith, 1977: 112) due to the uneven distribution of public and private provisions of services and facilities across urban space (Coates, B., et al., 1977; Herbert, D., and Smith, D., 1979; Kirby, 1982; Knox, 1995). Social exclusion occurs in circumstances that prevent individuals, households and even entire communities from fully participating in and better integrating with mainstream society (Vinson, 2009). People can be disadvantaged if they are living in communities that have a shortage of jobs, services or facilities (Littlewood, 1999; Percy-Smith, 2000; Favreau and Spear, 2001; Mayes and Salais, 2001; Pantazis, et al., 2006). Social exclusion and location disadvantage can be intertwined because inadequate transport and access to services and facilities might contribute to location disadvantage (Hine and Mitchell, 2003). An ability to freely travel beyond the home is essential to maintaining ones quality of life (Alsnih and Hensher, 2003; Banister and Bowling, 2004; Golob and Hensher, 2007; Schmocker, et al., 2008).

As the size of major cities continue to grow and sprawl, residents are compelled to become reliant upon cars (Dodson and Sipe, 2008), especially in the expanding outer and fringe areas where housing is relatively cheap but services like public transport are quite limited (Buchanan, et al., 2005; Currie, 2004; Dodson et al., 2004; Hurni, 2006). Not being able to drive can diminish ones quality of life and lead to feeling socially excluded particularly when the typical post-war Australian suburb was designed around the car and a capacity of residents to drive, and upgrading public transport can ameliorate select aspects of locality based forms of social exclusion, particularly for non-car owning households (DETR, 2000;

Mollenkopf, et al., 2005). The most frequently identified households found to be living in transport disadvantaged locales and suffering from transport related social exclusion were non-car owning groups including the unemployed, working poor, the disabled, newly arrived migrants, children, single parent families and the elderly (Church et al., 2001; Hine and Mitchell, 2001; Hine and Grieco, 2003; SEU, 2003).

Seniors experience social exclusion because they are restricted in their capacity to travel outside the home. The need to travel can increase as illness requires seniors to visit more regularly a doctor, chemist and even a hospital and the car is often identified as the preferred mode of travel (Morris and Rosenbloom, 1997; Berry, 2007). Not all seniors will have access to a car and poor public transport services can compound the location disadvantage for non-driving seniors. When their physical capacities to drive safely begin to decrease in their mid 70s, many seniors surrender driver licences in their late 70s and early 80s (Burns, 1999; Rosenbloom, 2001; Foley, et al., 2002; Browning and Sims, 2007), putting all members of effected elderly households at risk of social exclusion unless alternate modes of travel are available.

This becomes an even more acute problem as the number of persons who already have or are about to retire in most western societies is going to dramatically surge in the coming decade. The proportion of person aged 65 years and older for metropolitan Melbourne, for example, stood at 12.8 per cent of the total population in 2006 and it is projected to reach 26 per cent by 2030 (ABS, 2006). This will become a significant social issue for policy makers in the next two decades as the number of non-driving seniors will significantly expand.

In addition, there are many more seniors who have chosen to remain living in their homes for as long as possible, rather than in retirement villages or other forms of aged care accommodation that may have better access to services. As a result, seniors are now more widely dispersed than ever before in Australia's sprawling cities, encountering difficulties when they have to travel in order to access services and facilities (Browning and Sims, 2007; Currie, 2009; Hensher, 2007), and making it more difficult to ensure that they have adequate access to both private and publicly supplied services and facilities.

To understand location disadvantage and associated social exclusion for non-driving seniors it is necessary to have an understanding of the relative location of the main services and facilities that they use. To be able to positively age and keep living in ones home will be conditional upon whether it is easy to access a whole range of necessary services and facilities. This would include doing the weekly grocery shopping, withdraw the fortnightly pension payment from a bank, visit the doctor, collect medicine from a chemist, post a letter, borrow a library book, attend a church service, maintain regular social contact or seek support from persons outside the immediate and extended family (Cantor, 1979; Lawton, 1980; Golant, 1984). While some of these services (e.g. banking and communicating) can be accessed over the internet, there is still a need for most seniors to travel outside the home in order to access necessary services and facilities (e.g. to visit a doctor, a chemist or priest).

This paper reports on a GIS-based approach to identifying and measuring the existence of transport related social exclusion amongst a cohort of non-driving seniors who currently live in a middle distant suburban municipality of Melbourne.

2. CASE STUDY AREA

Melbourne is the capital and largest city of the state of Victoria. It is the second most populous city in Australia after Sydney with almost 4 million inhabitants. The metropolitan area is large by conventional standards, covering 2152.8 km², but with low population densities. It is divided into 31 local government areas, including the municipality of Monash. Until the early 1950s a majority of intra-urban travel in Melbourne was done by train, tram or bus, and suburban development was clung to the outwardly radiating train and tram lines (Wilkinson, 1984). With car ownership levels rose in the late 1950s (Davison, 2004), Melbourne sprawled extensively through the 1960s and 1970s, and house building occurred further away from the fixed tram and train routes, exceeding 30 km from the CBD in some directions, but with little extension of the existing tram and rail network (Mees, 2000). The journey to work length for many Melbournians increased (King, 1979; Maher and O'Connor, 1978), as did the trip to other amenities including shops, health and welfare services (Beed, 1981). By the early 1980s continued urban sprawl became recognized as a problem as the price of petrol rose alongside the cost of providing new public infrastructure to outlying areas (King, 1981).

Cheal (2003) found that 82 percent of Melbourne's population lived outside the 'transit rich areas' or the inner suburbs surrounding the CBD, and that middle and outer suburbs serviced by trains and buses experienced varying levels of 'transit poverty', with the highest levels being recorded in the outer fringe areas; some were more than 40 kilometers from the CBD. Some recent investigations on transport related

social exclusion in Melbourne (Currie and Senbergs, 2007; Currie et al., 2007; Currie, et al., 2009; Currie and Delbosc, 2010) revealed that there was a clear mismatch between public transport supply and potential need in fringe and outer suburban areas of Melbourne whereas the level of discrepancy was much lower in most middle and inner areas, 'forced car ownership' in the outer and fringe areas is largely due to a shortage of public transport despite the financial stress car ownership imposes upon low income households, and non-car owning households in these outer and fringe areas had to live near activity centres that contained shops and other services.

The Monash municipality consists of 12 discrete suburbs located some 20 km south-east of the city centre and covering an area of 81.4 km². It is a quintessential example of the type of residential development that occurred in Melbourne at wars end (Gobbi, 2004). At the end of WWII, this area was largely rural consisting of orchards and market gardens with half a dozen small townships that had sprung up near railway stations located on two electrified railway lines that dissected the area and connected it to the centre of urban Melbourne. This area grew rapidly from the early 1950s because it had been designated as a major growth corridor that would absorb large quantities of Melbourne's post war industrial and residential expansion. Until car ownership became more widespread in the mid 1960s, travel within this area of Melbourne was either by foot or bicycle, as buses were expensive and operated on restricted routes. The purchasing of a car in these then outer areas of Melbourne was not just a matter of necessity but it was also influenced by a rapidly emerging suburban culture based around the car (Davison, 2004).

By the mid 1970s, population growth had begun to slow and by the early 1980s, 3 post offices had closed with several schools following suite in the mid 1990s as the need for these facilities declined because the population profile of the area had now started to age. At the 2006 census, 16 per cent of the total municipal population was found to be over the age of 64 years, whereas the metropolitan average was only 12.8 per cent. In fact, the municipality of Monash has numerically the single largest number of persons aged 65 years and older, within the south-eastern region of metropolitan Melbourne. Like any area that was progressively settled over an extended period of time, there is an uneven spatial distribution of its older occupants over the study area. Glen Waverly and Mount Waverley had the largest concentrations with smaller but significant numbers also to be found in Oakleigh – Oakleigh, Oakleigh east and Oakleigh south – as well as parts of Wheelers Hill. For the purposes of the current study the proportion of this population without a car is a critical concern.

There are a large number of public and privately supplied services and facilities for seniors in the municipality. Altogether, there are 257 different kinds of medical services, including doctor surgeries, dentists, pharmacies and a major public hospital. There are 15 shopping centres including 4 large shopping malls that account for some of the 84 hairdressers and barbers, 31 banks, 21 newsagents, 22 post offices, 30 butchers and 13 opportunity shops. There are many types of social and cultural facilities available to seniors, including 189 social clubs and activity groups, 26 culturally-specific social clubs and 37 service clubs, 5 libraries, 62 churches, temples, worship centres and meeting halls that can cater for the religious needs of seniors, as well as 4 cinema complexes, 23 pubs, as well as 16 approved gambling venues.

Consistent with findings made elsewhere in Australia and around the world, a disproportionate number of young seniors living in Monash are still driving cars, but this begins to decline by their late 70s and early 80s particularly for women. An examination of the 2006 census revealed that 95.1 per cent of all non-driving seniors living in Monash were not users of the internet (ABS, 2006). In other words, the vast majority of non-driving seniors living in Monash still need to travel outside the home either by walking or using the bus to do their grocery shopping, visit a doctor or chemist, attend a church service or play bingo at their preferred community social club. These features make it an ideal choice as a case study of a middle distant Australian municipality.

3. DATA SETS, METHODS AND RESULTS

3.1 Data Sets

Four key data sets were collected and used in this study. First, a survey was undertaken in late 2007 and early 2008 of 16 senior groups that were all active in the municipality. These groups were randomly selected from a community service directory and identical questionnaires were administered to the respondents at the venue where they meet for their designated weekly activities. The questionnaire required respondents to provide information about themselves, what local services and facilities they used, how far they are willing to travel in order to reach certain services and facilities, plus the mode of transport they regularly used. In total, 187 seniors completed the questionnaire, all of whom were residing in the municipality at the time of the study.

Second, the 2006 population census was consulted to establish, at the census collector district (CD) level, how many persons were aged 65 years and older, plus how many of them do not drive a car. There are a total of 230 CDs in the Monash municipality, and each CD consists of about 200 households and provides the population sample from which socially excluded seniors experiencing transport disadvantage will be drawn from.

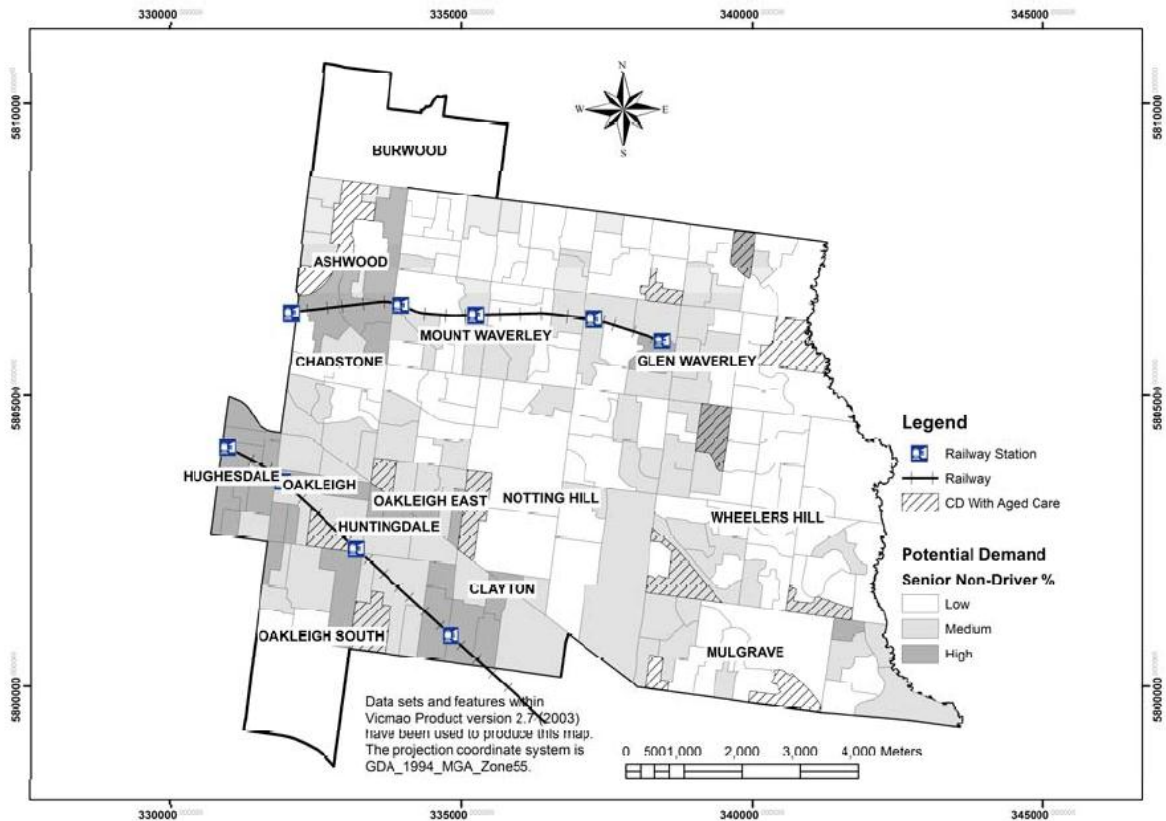
Third, through site visits as well as checking on-line data bases and various directories, a detailed land use audit of the Monash municipality was undertaken in 2007 and early 2008 to identify the location of 10 different types of private and public services and facilities found within the municipality that seniors might have a need to travel too, such as medical services, emergency services, municipal facilities, social and cultural facilities, retail and other shopping, and entertainment. It was simply beyond the scope of this study to investigate all different types of services and facilities found in the Monash municipality so only 10 types of services and facilities that were regarded as essential to positive ageing by the cohort of seniors who completed the questionnaire were included in the subsequent analysis, including a number of commercial services – shopping centre, bank and post office, medical services – doctor, chemist and hospital, plus social or recreational facilities – library, social club, religious organisation and park. The nomination of these services and facilities is reflected in how often they are used at different time intervals by the survey respondents (see Table 2). Community centres and social clubs are used most frequently which is not surprising as all the respondents undertook the survey questionnaire at such a venue. The next most frequently used are shopping centres, doctors, banks, chemists and post offices. These are usually located in close proximity to each other but their usage pattern does vary. Shopping is frequently done on a weekly basis whereas a visit to the doctor and a chemist is done more on a monthly basis. Churches are visited weekly whereas libraries and parks prove to be popular at several time intervals during an average month. The least frequently visited facility is the regional public hospital which offers out-patient services to the general public including the treatment of seniors for ongoing illnesses.

Fourth, the location of each of the 28 bus routes and 277 stops that fall within the municipality and run by different private bus companies was ascertained from data supplied by the Victorian Department of Transport, and other relevant spatial datasets were adopted from the 1:25k VICMAP database, such as the addresses and road network.

3.2 Methods and Results

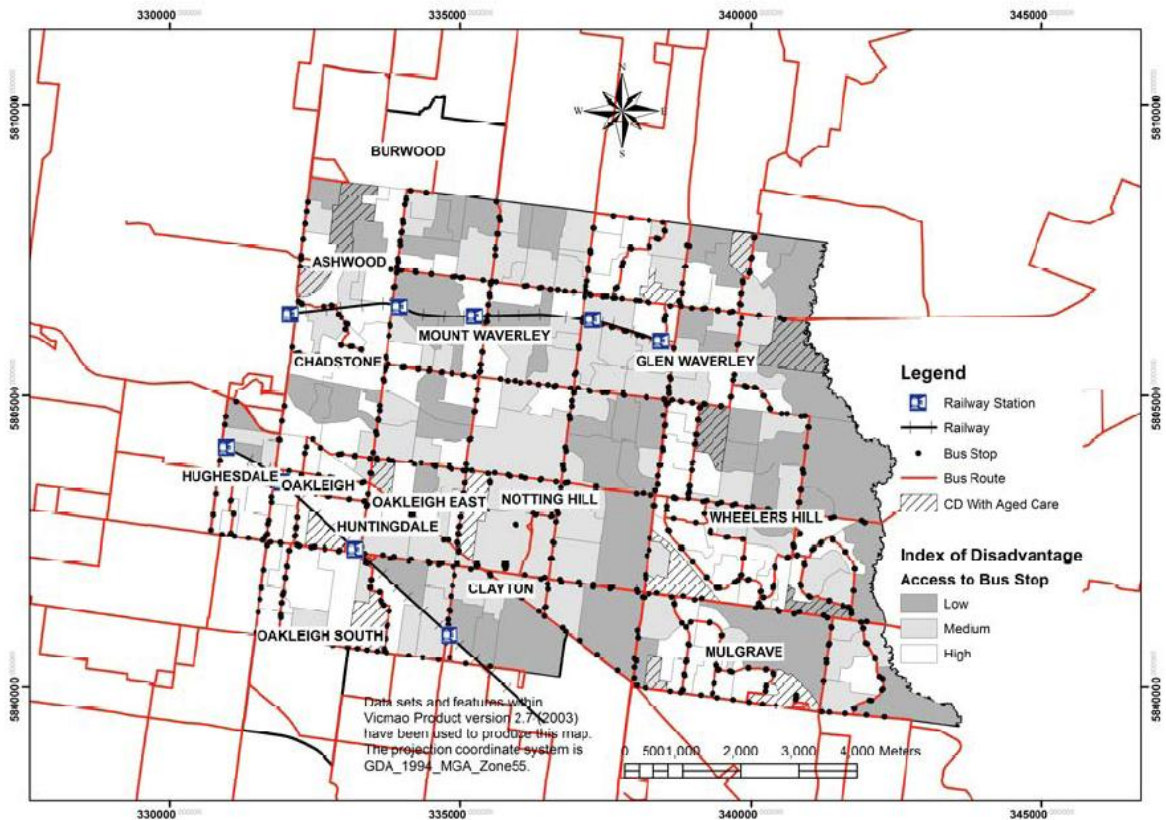
With these key datasets, a GIS-based approach has been developed to derive for each of the 230 CDs values of the following three indicators: senior non-driver concentration, bus access, service access, and an overall index representing the relative spatial accessibility to the set of selected services by senior non-drivers residing in the different CDs using public transportation.

The concentration of senior non-driver is defined as % of CD-level senior population (> 65 years old) without a driver's license and is derived directly from ABS 2006 census data, or as the proportion of CD-level senior non-drivers to the total CD-level seniors (> 65 years old), with all values fall between 0 and 1: larger values indicate higher concentration of senior non-drivers (who could have accessibility problems) and smaller values indicate lower concentration of senior non-drivers which means lower demand for accessing public transport and the selected services. Map 1 shows the spatial pattern of senior non-driver concentration over the study area. Small but significant clusters of non-driving seniors in Monash municipality are found in Hughesdale, Oakleigh, Clayton, Ashwood, Chadstone, Mount Waverley and Glen Waverley. These senior non-drivers would have to largely rely upon public transport to undertake their regular out-of-home travel, the most convenient being the bus.



Map1. The spatial pattern of senior non-driver concentration over the study area, showing three categories based on natural breaks

Based on distance travel thresholds set by Victorian government planning authorities such as one should not be more than 400 m from a bus stop, 800 m from a train station and 1 km from other basic services including a shopping centre (Victorian Department of Sustainability and Environment, 2006: 6.12-13), and as a surrogate to public transport access, bus access is defined as % of CD-level population within 400 m of nearest bus stop, or as the proportion of CD-level population that is within 400 m of nearest bus stop to the total CD-level population, and is approximated by the % of residential address points within 400 m of nearest bus stop based on the road network distance measured within a GIS. All bus access values fall between 0 and 1: higher values indicate more accessibility to public transportation, and smaller values indicate less accessibility to public transportation. Map 2 shows the spatial pattern of bus access over the study area.



Map 2. The spatial pattern of bus access over the study area, showing three categories based on natural breaks

For each of the 10 selected types of services and facilities (i.e. doctor, chemist, public hospital, shopping centre, bank, post office, library, church, social club and park), road network distances in metres between the population centre of each CD to its nearest service facility is calculated as d_{ij} , which is then standardized into D_{ij} using the following equation:

Where d_{ij} is the road network distances between the population centre of CD i to its nearest type j service facility, while $d_{min,j}$ and $d_{max,j}$ are the shortest and longest road network distances between all CD population centre to their respective nearest type j service facility, as listed in table 1

Table 1 <i>Service type j</i>	$d_{min,j}$	$d_{max,j}$
Social Club	121.27	4069.05
Shopping	304.95	3507.14
Doctor	26.94	2404.29
Chemist	228.51	3316.31
Bank	250.26	4747.95
Post Office	189.97	5119.15
Church	48.19	2528.58
Park	0.00	1707.69
Library	350.18	5942.16
Hospital	308.10	11301.56

This analysis assumes that people will choose to access their nearest service or facility using the existing road and footpath network— whether travelling by car, bus, bike, foot or a combination - in order to reach their chosen destination, although for those seniors who have access to a car they may travel beyond their immediate neighbourhood (Smith, 1988; Fober and Grotz, 2006).

The service access SA_i is defined as follows

Where $w_j = 1$ and w_j is the weight value for type j service determined statistically from the survey data. SA_i is distance-based. Its normalised values fall between 0 and 1: smaller values indicate closeness or more convenient locations, larger values indicate remoteness or less convenient locations. The procedure used for determining w_j is as follows:

For each service type, the number of person indicating specific use frequency (daily, weekly, fortnightly, monthly, 6-monthly, 12-monthly, or other - never or missing) p_{jk} were summarized in Table 2.

Each cell value in table 2 p_{jk} was then divided by its respective column sum kp_{jk} to derive the relative significance of each service type for specific frequency r_{jk} which are summarized in table 3

Table 3: The relative significance of each service type for specific use frequency

Service/Facility r_{jk}	daily%	weekly%	fortnightly%	monthly%	halfy%	yearly%	w_j
Community Centre/Club	0.133	0.205	0.030	0.097	0.142	0.211	0.1330
Shopping Centre	0.422	0.300	0.072	0.020	0.000	0.000	0.1298
Doctor	0.000	0.015	0.084	0.229	0.373	0.078	0.1298
Chemist	0.000	0.033	0.181	0.249	0.052	0.000	0.1194
Bank	0.022	0.110	0.274	0.103	0.007	0.011	0.1178
Post Office	0.044	0.098	0.156	0.140	0.097	0.056	0.1154
Church	0.133	0.148	0.030	0.014	0.037	0.100	0.0725
Park	0.222	0.048	0.072	0.051	0.082	0.089	0.0661
Library	0.022	0.033	0.097	0.080	0.052	0.078	0.0629
Hospital	0.000	0.013	0.004	0.017	0.157	0.378	0.0533
	1.000	1.000	1.000	1.000	1.000	1.000	1.0000

Each column sum in table 2 kp_{jk} was divided by their total $k_j p_{jk}$ (which is 1256 in this case) to derive the relative significance value for each specific use frequency R_k which sum to 1

The weight value for type j service w_j is calculated by summing up the products of the relative significance of each service type for specific frequency r_{jk} and the relative significance value for each specific use frequency R_k

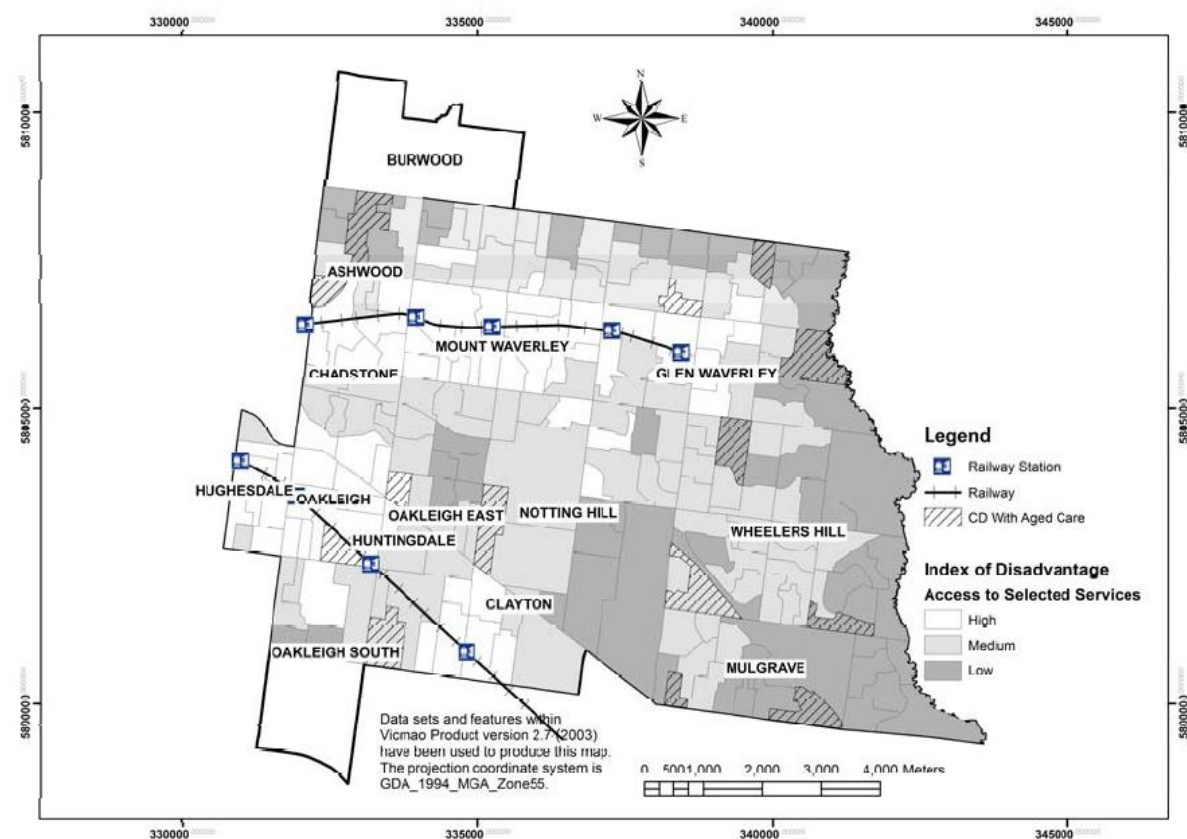
Service/Facility p_{jk}	Daily	Weekly	Fortnightly	Monthly	Half Yearly	Yearly	Other (Never, Missing)
Community Centre/Club	6	82	7	34	19	19	20
Shopping Centre	19	120	17	7	0	0	24
Doctor	0	6	20	80	50	7	24
Chemist	0	13	43	87	7	0	37
Bank	1	44	65	36	1	1	39
Post Office	2	39	37	49	13	5	42
Church	6	59	7	5	5	9	96
Park	10	19	17	18	11	8	104
Library	1	13	23	28	7	7	108
Hospital	0	5	1	6	21	34	119
$\sum_k p_{jk}$	45	400	237	350	134	90	613
R_k	0.036	0.318	0.189	0.279	0.107	0.072	

Table 2: Usage patterns of services and facilities by a sample of seniors

in the City of Monash compiled from authors survey (2008)

Service/Facility p_{jk} Daily Weekly Fortnightly Monthly Half Yearly Yearly Other (Never, Missing)

Map 3 shows the spatial pattern of service access over the study area.

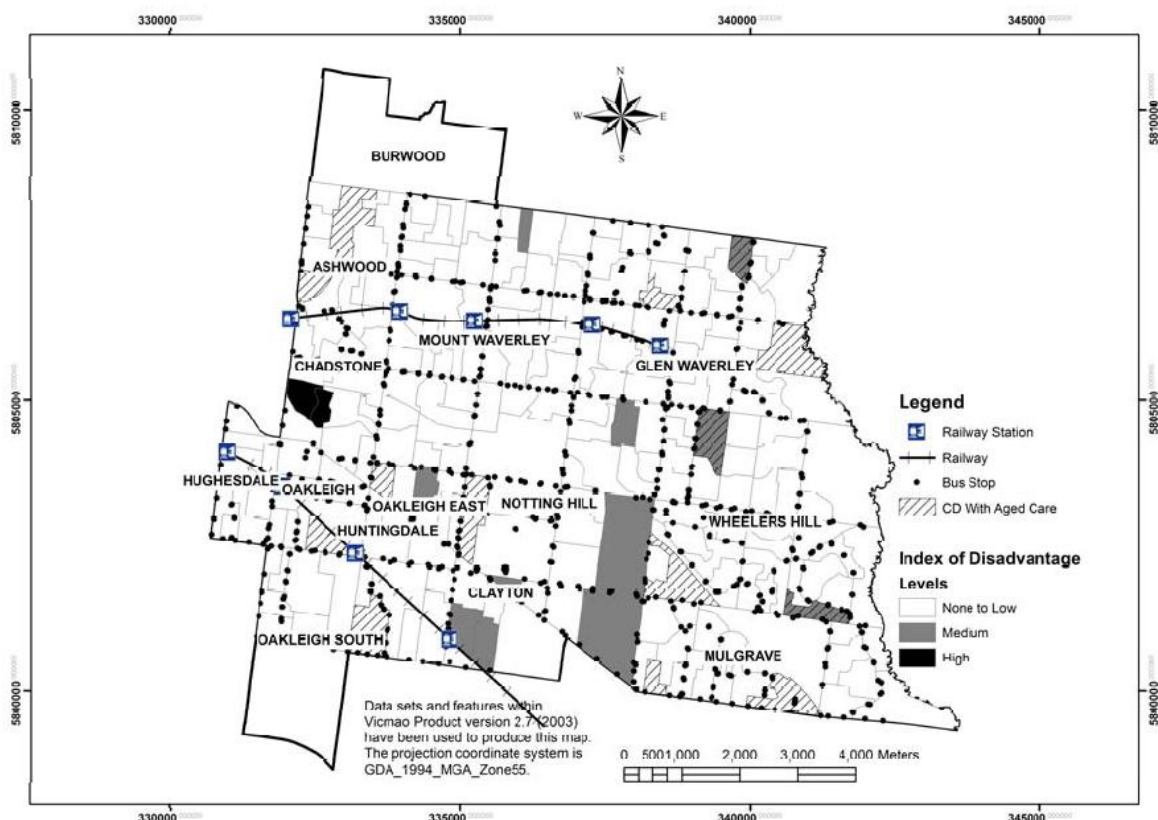


Map 3. The spatial pattern of service access over the study area, showing three categories based on natural breaks

Spatially, those seniors who continue to live within close proximity to the older shopping areas that had sprung up around the railway stations usually proved to possess location advantage, with easy access to shopping centres, doctor surgeries, chemists, banks, post offices and other services. Seniors who live in car dependent suburbs (which includes parts of Wheelers Hill, Mulgrave, Glen Waverley and Notting Hill) have location disadvantages. Although retailing facilities expanded with the building of new car based shopping malls - The Glen, Waverley Gardens and Brandon Park – as population numbers increased during the 1960s and early 1970s, a pre-existing landscape of retail-service nodes continues to create transport advantages for seniors in some parts of Monash. Certain public facilities – hospital, churches and libraries - were located to serve large catchment areas. In some cases these were sited close to other facilities and have reinforced the existing concentrations of services around the railway stations. Some facilities were deliberately dispersed across the municipality for easy and regular use such as parks, community centres and social clubs. Very few areas of the municipality are disadvantaged with respect to them except parts of Mulgrave, Notting Hill and South Oakleigh.

The merger of all three indicators of disadvantage – location of non-driving seniors, poor access to the bus routes and distance from basic services and facilities – using GIS software allowed for the identification of those locales where location based transport disadvantage exists amongst non-driving seniors. To represent the relative spatial accessibility to the set of selected services by senior non-drivers residing in the different CDs using public transportation, the three indicators presented above were integrated in such a manner that their contributions are properly reflected. This has been achieved by multiplying the product of the service access SAi and the senior non-driver concentration si by the reciprocal of the bus access ai as follows:

The larger the index value the more disadvantaged the CD is, whereas the smaller the index value the less disadvantaged the CD becomes. Map 4 shows the spatial pattern of overall location disadvantage over the study area.



Map 4. The spatial pattern of overall location disadvantage over the study area, showing three categories based on natural breaks

4. DISCUSSIONS AND CONCLUSIONS

This study has sought to examine the likelihood that locality based social exclusion can be asserted to exist amongst non-car driving seniors who live within a middle distant region of metropolitan Melbourne, and to alert public policy makers and transport researchers to the prospect of more social exclusion emerging within our cities, over the coming decades. The study has also sought to understand location disadvantage

in terms of where non-driving seniors live, how difficult it might be for non-driving seniors to reach their nearest bus stop, and where seniors might need to travel to within the designated case study area by the public bus service. This included a range of locality specific services and facilities including doctor surgery, dentist, chemist, hospital, grocery stores, post office, park, church, community centre and social club. Some of these services and facilities were spatially concentrated and at a considerable distance from the homes of some seniors including those who do not have access to a car.

The study has made use of the subjective preferences of usage patterns of the services/facilities by surveyed seniors who participated in this study, thereby giving voice to the people who actually need to travel outside of their home. The collection of survey data made it possible to derive empirical statistical weights for the selected types of service/facilities. The study has also made extensive use of spatial datasets and GIS-based spatial analytical procedures, e.g. the derivation of bus access and the calculation of network distances between population centres and sites of service provision, to generate visualizations of spatial patterns of bus access, service access and concentration of non-driving seniors over the Monash municipality.

While research and data collected in this study has confirmed that seniors will continue to drive their cars for a much longer period than ever before, there does come a time when driving becomes hazardous to personal and community safety. Like a kind of demographic time bomb, many middle distant residential areas of Melbourne which have large ageing populations, shall be faced by sizeable increases in the number of non-driving seniors who will need public transport in order for them to continue to positively age in their homes. The initial signs of this problem are already evident in Monash municipality where a small number of non-driving seniors who do not use the internet and are already disadvantaged by where they live relative to basic services / facilities and bus network. Unless there is an upgrading of the existing public transport system to cater for the growing demand that shall arise in the coming decades then the prospect of greater levels of transport based social exclusion will be inevitable amongst our senior population that continues to live in the post-war suburbs that the car had made possible. It is however worth noting that many of these bus routes are located on major arterial roads and certain parts of the municipality are not within the recommended 400 m walking threshold.

ACKNOWLEDGEMENTS

The authors wish to acknowledge funding support from the Office of Seniors Victoria, data support from ABS and Victorian DSE, and Ms. Francis Stiglec who has assisted with the collection and collation of senior survey data for this project.