Exploring frequency of public transport use among older adults: A study in Adelaide, Australia

Long Tien Truong [a,*], Sekhar V.C. Somenahalli [b]

[a] Institute of Transport Studies, Department of Civil Engineering, Building 60, Monash University, Clayton, Victoria 3800, Australia
[b] School of Natural and Built Environments, University of South Australia, Mawson Lakes, South Australia 5095, Australia

ABSTRACT

Population ageing presents formidable challenges to transport systems in developed countries and many developing countries. While public transport is particularly important for older adults in terms of modal shift and social exclusion, there has been limited understanding of factors affecting the frequency of their public transport use. This paper presents results of an empirical study that explores factors influencing the frequency of public transport use among older adults in Adelaide, Australia. Multinomial logistic regression is used to model the frequency of public transport use while multiple correspondence analysis is used to capture non-linear relationships among the frequency of public transport use and influencing factors. Results show that more frequent use of public transport is closely associated with very high perceived importance of public transport to residential locations and easy access to public transport in neighbourhoods (perceived walking time to stops of five minutes or less and stop density of at least four stops within 400 metres of residential locations). Results also suggest public transport might be preferred to driving by older adults for travel during high-pressure driving periods such as peak hours. In addition, mobile phone possession is found to increase the likelihood to use public transport.

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1. Introduction

Many countries around the world are experiencing rapid growth in the older population (Kinsella and He, 2009). This dramatic demographic change can pose substantial challenges, such as maintaining mobility for the increasing number of older people to the transport system. Furthermore, the older population is recognised as a heterogeneous population as mobility and travel characteristics vary among subgroups (Alsnih and Hensher, 2003; Hildebrand, 2003), which strongly influences the use and design of the transport system (Haustein, 2012). The mobility of this growing group of older people is the focus of much research (Schwanen and Páez, 2010) as mobility is closely associated with quality of life and health in old age (Banister and Bowling, 2004; Spinney et al., 2009; Nordbakke and Schwanen, 2013). Increasing car dependence among the older population may result in environmental and congestion issues (Rosenbloom, 2001), road safety issues (Oxley et al., 2010), and issues related to driving cessation (Charlton et al., 2006; Golob and Hensher, 2007). While public transport can offer a viable alternative for older people with

regards to low cost, low emission, and enhanced social benefits for disadvantaged people most at risk of social exclusion, the ridership among this cohort remains low (Rosenbloom, 2001; Burkhardt, 2003; Currie and Delbosc, 2010; Engels and Liu, 2011; Buys et al., 2012). Therefore, it is important to understand the use of public transport among older people so that greater use can be encouraged both for the purpose of modal shift and for reducing the impacts of social exclusion.

Several studies have focused on the mode choice behaviour of older adults. Stern (1993) examined mode choice of older and disabled people in rural Virginia and found that walking problems have a negative effect on the use of buses. In a study of travel mode choice for leisure activities of older adults in the Netherlands, Schwanen et al. (2001) found that single older people and older women are more likely to use public transport. Kim and Ulfarsson (2004) investigated travel mode choice of older people in Washington state and suggested that public transport use tends to decrease with higher income and increasing auto ownership. The likelihood of using public transport increased with shorter distances to bus stops and longer travel distances. In a study of shopping trips among older and disabled London residents, Schmöcker et al. (2008) found that public transport use is negatively affected by disabilities while it is positively associated with living within inner London and higher bus stop density in residential locations.

* Corresponding author. Tel.: +61 3 9905 1851; fax: +61 3 9905 4944.
E-mail addresses: long.truong@monash.edu (L.T. Truong), sekhar.somenahalli@unisa.edu.au (S.V.C. Somenahalli).

Using the same data set, Su et al. (2009) analysed their mode choice before and after shopping and indicated that the likelihood to use public transport increases if they are females or under the age of 75. Results also emphasised the significant influence of bus stop density on their public transport use. Mercado and Newbold (2009) investigated car driving and public transport use among older Canadians and found that the probability of using public transport increases with higher education levels and not being close to family members. Moniruzzaman et al. (2013) studied mode use and trip length of older adults in Montreal and suggested that the likelihood of using public transport decreases with increasing age and driver's licence possession while it increases with higher street density and building area ratio.

While the link between perceptions towards public transport and the use of public transport is well established for the general population (Beirão and Sarsfield Cabral, 2007; Habib et al., 2011), only a few studies have reported the effect of perceptual factors on travel mode choice of older people (Haustein, 2012). For example, Cao et al. (2010) found that older people who perceive good public transport service in their neighbourhood are more likely to use it and that the impact of improved accessibility tends to be much larger for older people than for younger groups. However, as these studies investigated the general population, understanding of perceptual factors affecting public transport use among older people has therefore been limited. In addition, although the relationship between telecommunications and travel demand has been suggested in the literature (Choo and Mokhtarian, 2007) and mobile phone possession is found to be associated with increased tour complexity among older London residents (Schmöcker et al., 2010), the potential link between mobile phone possession and public transport use among older people remains unclear.

This paper reports the findings from a survey of older people's travel in Adelaide, Australia. The purpose of this research is to understand factors influencing the frequency of public transport use among older Adelaide residents. Multinomial logistic regression is used to model the frequency of public transport use and multiple correspondence analysis is then used to capture non-linear relationships among the frequency of public transport use, perceived importance of proximity to public transport, mobile phone possession, and local service characteristics including perceived walking time to the nearest stop and stop density.

The rest of the paper is organised as follows. The next section describes the study area, data and analytical methodology, followed by a review and discussion of findings associated with factors influencing the frequency of public transport use. Fundamental relationships among the frequency of public transport use, perceived importance of proximity to public transport, and local service characteristics are then graphically presented and discussed. The paper concludes with a summary of key findings and directions for future research.

2. Data and methods

2.1. Study area

Australia's population, similar to other developed countries, is ageing. In 2007, people aged 65 and above represented 13% of Australia's population (ABS, 2008). This proportion will be almost doubled, to 25%, in 2056. Adelaide, the capital city of the state of South Australia, had a population of 1.17 million in 2008 and a population density of 641 people per square kilometre (ABS, 2010). About 15% of Adelaide residents were 65 and above.

Adelaide is a car-dominated city with a total public transport share of travel to work of 9.9% (Mees et al., 2008). In South Australia, older drivers aged 70 and above have to provide evidence of their fitness to drive every year, in the form of a medical report from a doctor. However, many older women never learned to drive and have thus relied on their partners and friends (Hugo et al., 2009). In Adelaide, almost all trains and trams are accessible to people in wheelchairs while 80% of buses are accessible. Older people are entitled to concession fares and the Senior Free Travel scheme, introduced in Adelaide in July 2009 with free public transport for senior card holders between 9 am and 3 pm weekdays and all day on weekends and public holidays (Hugo et al., 2009). Additional assistance is available to people with permanent and severe disabilities, as part of the Plus One Free Companion card, which entitles holders to a free ticket for a companion to assist them with public transport. Access taxis, subsidised under the South Australian Transport Subsidy Scheme, are available to older people who are unable to use buses, trams and trains.

2.2. Data

This study uses data from a survey of older people travel conducted by the authors in Adelaide in 2010. The aim of the survey was to collect one-day travel information, socio-economic characteristics, public transport use and opinions about the importance of facilities/services to residential location and transport issues of older Adelaide residents.

The survey took the form of self-administered questionnaires. Questionnaires were distributed to older people (aged 65 and above) who attended 10 seminars about road safety awareness for senior drivers in different suburbs from July to September 2010. These seminars were part of the Years Ahead program provided by Royal Automobile Association to organised groups of older people in Adelaide. Groups involved in these presentations include local retirement clubs, senior groups, senior education associations, and religious senior groups. Since the majority of older people who attended these presentations were able to drive, the sample might be biased against non-drivers and disabled older people. It is likely that older people involved in these groups have more active lifestyles than those who did not participate in such groups. The sample was stratified equally into days of week. The valid response rate was 31% and the number of valid respondents was 117. The spatial distribution of respondents is illustrated in Fig. 1. It can be seen that the sample was biased against outer suburbs as respondents' locations were concentrated on coastal, inner and middle suburbs. The research also used secondary data including census data, the South Australian Digital Cadastral Database as well as road and public transport network databases.

2.3. Analysis approach

As the frequency of using public transport is ordinal in nature and differences between categories are not equal, ordinal regression models should be used to explore the determinants of public transport use of older people. One of the assumptions underlying ordinal regression is that the effect of the independent variables is the same for each category of the dependent variable, which implies that the results will be a set of parallel lines for each category of the outcome variable (O'Connell, 2006). However, tests of parallel lines suggested that this assumption was violated in the ordinal regression model. Therefore, the multinomial logistic regression (Menard, 2002; Hosmer et al., 2013) is used to explore factors affecting the frequency of public transport use among older people. The multinomial logistic regression approach uses the following equations.

$$\text{Ln}\left(\frac{\text{Probability(use public transport 1 to 2 days per month)}}{\text{Probability(do not use public transport)}}\right)$$

$$= B_{1,0} + \sum_{i=1}^{k} B_{1,i} \cdot X_i \tag{1}$$