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Exploring public transport equity between separate disadvantaged cohorts: a case study in Perth, Australia

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ABSTRACT

This paper explores the equity distribution of public transport for three separate disadvantaged cohorts including elderly residents, low-income households and no-car households for Perth, Western Australia. It also undertakes a city-wide equity analysis of Perth and compares this with a published analysis for Melbourne. Overall the public transport distribution of the three socially disadvantaged groups was identified to be less equitable when compared to the population as a whole. The elderly had the most inequitable distribution of population relative to other cohorts. Perth's population exhibits a 0.52 Gini coefficient suggesting a relatively unequal spatial distribution of services to the population. However, this is much better than Melbourne (at 0.68). Results imply that 70% of Perth's population have only 33% of services supplied, whilst in Melbourne this figure was 19%. Policy implications and areas for future research in this field were identified.

1. Introduction

An uneven distribution of transport supply across a population can create adverse effects for social groups already facing disadvantage for economic or social reasons such as older, disabled, or low income people (Lucas and Jones, 2012; Sanchez et al., 2004). A common feature of the distribution of Public Transport (PT) in Australian contexts is the lack of services in fringe suburban areas, those places where economically and socially disadvantaged groups typically can afford to live (Currie, 2010; Litman, 2014). Western Australian government has attempted to develop equitable PT policies to favour these vulnerable groups by providing concessional fares, but many live in regions lacking transport services and so do not benefit from the compensation (Transperth, 2014). In other words, they may suffer transport disadvantage. Therefore, an opportunity exists to use spatial analysis tools to demonstrate the distribution of PT among vulnerable populations. Over the last decade, new methods have been developed to quantify the relative supply of services and to associate these with the spatial distribution of social needs at a very disaggregate spatial scale (Currie, 2010). More recently these methods have been integrated into a Lorenz curve analysis framework to better understand the aggregate distribution of equity for urban populations as a whole (Delbosc and Currie, 2011). However to date these approaches have only been applied in one city—Melbourne, Australia—and have only been used to assess equity for the population as a whole and to employment access. To date no equity analysis using the Lorenz curve framework has explored the equity distribution of PT for separate social groups within a population.

This paper explores the equity distribution of PT for three separate disadvantaged cohorts—the elderly, low-income households, and no-car households—in Perth, Western Australia. These three groups have traditionally been considered as transport disadvantaged (Currie and Delbosc, 2011; Morris, 1981), that is they potentially won't be able to easily travel to opportunities such as employment, education and social activities. Currie and Delbosc (2011) stated that no-car groups rated their social exclusion levels 1.9 dimensions higher than the high-car groups. However, they also mentioned that individual dimensions such as income and unemployment show the strongest variance between these two groups. Therefore, car ownership, income and unemployment are dimensions that reinforce each other and contribute to transport disadvantage. Numerous studies have investigated transport related social exclusion of seniors (Currie, 2004; Engels and Liu, 2011; Páez et al., 2009). For example, Páez et al. (2009) identified that seniors located out of the central part of the city tend to have low accessibility to health care services. This paper aims to compare equity of transit supply between different cities and between these three different vulnerable groups and develop a measure to

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identify spatial gaps in transit services based on the needs of vulnerable groups.

The paper is structured as follows: the next section presents a research context including a review of the relevant research literature associated with equity in PT supply and a short description of the case study context. The research methodology is then described and results presented. The paper concludes with a discussion of key findings.

2. Research context

2.1. Literature review

Crucial to assessing the inequity of a PT network is to properly define inequity (Welch, 2013; Welch and Mishra, 2013). Litman (2002) explores this concept in detail, and determines that there are three types: *Horizontal, Vertical with Regards to Income and Social Class* and *Vertical with Regards to Mobility Need and Ability* (Bullard et al., 2004; Litman, 2014).

(a) *Horizontal:* Suggests that for transport policies to be seen as equal and fair, commuters need to essentially get out what they put in, which is also called fairness and egalitarianism (Litman, 2014) It emphasises equal distribution of an attribute, such as income, among equal individuals or groups of a population (Welch, 2013). Those who contribute more to the system (for example, financially through taxes) would receive superior service (Kakwani, 1984). Subsidy or special services provided to disadvantaged groups needs to be properly justified based on the principle of economic efficiency (marginal cost) and horizontal equity (average cost) (Litman, 2014).

(b) *Vertical with regards to income and social class:* Advocates that to be equitable, the distribution of the transport supply between groups or individuals differs in income and social class (Litman, 2014; Rawls, 1971). This means that transport policies must favour those who are of lower income and social class by providing discounts and special services to them.

(c) *Vertical with regards to mobility need and ability:* The third measure focuses on the equal distribution facilities and services between individuals and groups who have different mobility needs and abilities. This means favouring the needs of those who are restricted in the use of private transport and attempts to utilise a universal design, which accommodates not only all users but also for people with special mobility needs (Bocarejo S and Oviedo H, 2012; Farber et al., 2014).

In this paper, we investigated the horizontal equity of transit service across a total population and compared it with the pattern in Melbourne. We also targeted on the vertical equity of transit service provision to disadvantaged populations such as the older, no-car households, and low-income people (Currie et al., 2010; Meadows et al., 1988; Shaw et al., 1999).

Various studies have examined transport-related social exclusion. One of the key arguments of these studies is that the social exclusion is caused by lack of transport supply or by lack of access to transport provision (Preston and Rajé, 2007). Studies, such as Kenyon et al. (2002), Manaugh and El-Geneidy (2012), Sanchez et al. (2004), Wee and Geurs (2011) highlighted the accessibility and mobility perspectives of the links between transport disadvantage and social exclusions and suggested that lack of accessibility to opportunities is both the cause and consequence of social exclusion. Preston and Rajé (2007) examined whether accessibility was a good measure of social exclusion by reviewing the work of the UK Department for Transport in accessibility planning. They suggested that spatially and socially disaggregated accessibility measures could be a more appropriate approach to support policy responses to social exclusions. Fan et al. (2012) also proved that improved transport infrastructure, such a light rail, can significantly increase accessibility to low-wage jobs. Kaplan et al. (2014) developed an equity measure in transit provision based on connectivity-based accessibility assessment methods and the Gini coefficient. They found that lower equitable transit services were associated with connectivity in the finger areas. Spatial cluster analysis tools have also been used by Dodson et al. (2011) to analyse the geographic distribution and travel activity of disadvantaged populations and to quantify the overall accessibility to goods and services for these populations.

Instead of measuring equity in transport provision using accessibility measures, some studies have focused on measures of equity by understanding the relationship between transport supply and demand, especially from a spatial perspective. For example, Currie (2010) identified significant spatial gaps between transport services supplied and social needs using spatial disaggregated techniques. The methods were found to be relatively easy to develop and powerful in terms of generating meaningful results. Another spatial distribution equity analysis tool, the Gini index, was used to measure equity in a number of studies (Delbosc and Currie, 2011; Kaplan et al., 2014; Karlström and Franklin, 2009; Welch, 2013; Welch and Mishra, 2013). The overall coefficient of the Gini index calculated by Delbosc and Currie (2011) was 0.68, which means around 70% of population shares only 19% of transit service in Melbourne, Australia. While for Baltimore City, it has a slightly lower equity of transit services with a Gini index of 0.7083. Rodier et al. (2009) investigated how one such spatial economic model was applied to evaluate the equity effects of land use and transport policies intended to reduce greenhouse gas emissions.

One of the pioneer works by Church et al. (2000) proposed a conceptual framework to explicitly link two evaluated indicators, which can be used to guide policy-making for exclusion reduction. The Social Exclusion Unit (2003) played an important role in formalising the foundation of studies on inter-relationships between transport disadvantage and social exclusion. Key areas of social policy concerns were identified and numerous studies followed; better conceptual and theoretical frameworks were developed; innovative techniques for measuring transport-based social exclusion were established; and transport policy agendas were realised in local, practical projects (Lucas, 2012). Preston (2009) reviewed the development of the concept of social exclusion, especially its relationship with transport policy, identified issues: "difficulties in defining the concept and, more importantly, difficulties in operationalising the concept" and suggested a research agenda based on understanding the social component of sustainability for reducing social exclusion.

In Australia, the topic of inequity in PT has received some significant attention. Previous studies have been conducted in Melbourne, where researchers used GIS to identify areas of socio-economic disadvantage which received poor levels of PT (Currie, 2010). A clear mismatch between PT supply and social needs in Australian cities stated by Currie (2010). Stanley and Vella-Brodrick (2009) argued that social inclusion should be incorporated as a goal when designing transport networks with considerable research being conducted in Melbourne to prove the links between mobility, income and social inclusion. Their results indicated a positive correlation between these three, even suggesting that the average number of trips undertaken per day by an adult drops from 3.8 to 2.8 when various social exclusion factors (such as household income, employment status, political activity,