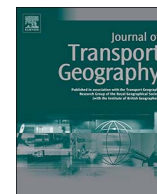




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Creating inequality in accessibility: The relationships between public transport and social housing policy in deprived areas of Santiago de Chile

Cristhian Figueroa Martínez*, Frances Hodgson, Caroline Mullen, Paul Timms

ITS Institute for Transport Studies, University of Leeds, LS2 9JT, United Kingdom

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ABSTRACT

This paper identifies the very limited connectivity provided by the current public transport system to the most deprived groups of Santiago de Chile, and explores the territorial aspects of transport and social housing policies that have contributed to the creation of unequal public transport schemes. To achieve those aims, we present a review of public policies in Chile and the results of an original quantitative analysis that measures the travel times required to access the opportunities and activities located in the city. The results show that housing policies put people at a disadvantage by increasing the distance between them and the opportunities of the city. Three decades after the implementation of housing policies, transport still fails to mitigate these distances and instead of alleviating the patterns of segregation, it may have reinforced them. The travel times required increase towards the periphery (even though densities do not decrease) and are higher than the averages of the city in social housing estates.

1. Introduction

Inequalities in the ability to access available material and social resources can produce further inequalities, affecting living standards and personal expectations and can cause (or worsen) conditions of deprivation (Kaufmann et al., 2004; Ascher, 2007; Sheller and Urry, 2003). At city-level, the availability of public transport is often identified as a measure that can reduce those disparities. It can improve the access to the opportunities offered by a specific territory and, therefore, it can diminish the disadvantages of the most fragile segments of the society (Preston, 2009).

In Latin America, and led by the pioneer experiences in Curitiba in Brazil or Bogota in Colombia, public transport became a central subject of the discussion due to several plans that intended to modernise the obsolete systems of the main urban areas of the region. Santiago de Chile followed the same path with the modernisation of the public transport system in 2007 (Transantiago); however, a complex implementation triggered a profound urban crisis that questioned the role of public transport in a highly unequal city (Forray et al., 2013).

Further, Santiago is commonly portrayed as a segregated territory because different socio-economic groups are highly isolated from each other (Sabatini et al., 2001). Although the reasons behind the phenomenon are diverse, numerous studies argue that one of the key factors was the aggressive social housing policies that displaced the most deprived groups of the society to marginal locations of the city (Ducci,

1997; Rodríguez and Sugranyes, 2005).

While housing policy and public transport have both been implicated in reducing accessibility and inclusion for those in deprived areas, studies to date have treated housing policy and transport separately and there has not been investigation of the impacts of relations between housing policy and transport in Santiago de Chile. This article examines those by (i) measuring the travel time costs of the connectivity offered by the current public transport system to the groups displaced by housing policies, and (ii) recognising the territorial aspects of transport and housing policies that may have contributed to the creation of unequal schemes.

To this end we present a review of public policies in Chile and the results of a quantitative analysis that measures the times required to access the activities located in the city. Excluding this introduction, the article is structured in six sections: (i) a review of the relationship between transport and deprivation, (ii) the methodology and the materials used, (iii) a review of transport and housing policies in Chile, (iv) the results of the quantitative analysis, (v) the discussion, and (vi) the main conclusions.

2. Transport and inequalities

A vast body of literature covers the effects of having (or not) access to transport and mobility. According to Stanley and Vella-Brodrick (2009) and Delbosc and Currie (2011), transport affects aspects of

* Corresponding author.

E-mail address: tscaf@leeds.ac.uk (C.F. Martínez).

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psychological wellbeing (i.e. the sense of feeling competent, autonomous and connected) by enabling people to choose among options and master resources. To Preston (2009) transport can alter the quality of life, by this means, the level of satisfaction with one's life in accordance with local culture and personal experiences, goals, expectations, standards and concerns (Van Kamp et al., 2003; Skevington et al., 2004).

Transport disadvantages can be also translated into social exclusion, which refers to a lack/denial of resources that affects ability to participate in the normal activities of the society. The resources exist yet they are not available to all (Atkinson, 1998; Church et al., 2000; SEU, 2003; Kenyon et al., 2002; Cass et al., 2005; Levitas et al., 2007). Social exclusion is an extensively studied topic often defined as **dynamic**, varying over time and space, **relative**, people can be excluded from the society or just aspects of it, and with **agency**, being provoked directly or indirectly by external factors (Richardson and Le Grand, 2002; Preston, 2009; Lucas et al., 2016).

By conceptualising the effects of transport on people, Lucas et al. (2016) define transport poverty as a multi-criteria condition suffered by anyone affected by at least one of the following four issues: transport affordability (economic costs), mobility poverty (lack of options to perform trips), accessibility poverty (access to the opportunities in acceptable times) and exposure to externalities such as the indirect effects of pollution on people. However, transport needs vary person to person, and this complexity prevents the development of canons to measure transport poverty. In a similar approach, other scholars highlight the complexity to draw causalities; transport can be either the cause or an issue that can strengthen inadequate living conditions (Preston, 2009; Jones and Lucas, 2012).

From the perspective of the instruments and policies, and under a principle of equal concern, Mullen et al. (2014) argue that the distribution of benefits and risks of transport among people should secure equal opportunities to sustain adequate lives. This means that any instrument should recognise the advantages, or disadvantages, enjoyed, or suffered, by the groups of the society and act differentially according to them.

The measurement of the disadvantages is often addressed with quantitative approaches (Hernández and Witter, 2011). In the case of public transport, previous studies have focused mostly on the potential use of the available network by contrasting the features of the public transport services (frequencies, bus stops and capacities) with demographic parameters (Currie, 2004, 2010; Jaramillo et al., 2012). Studies that compare public transport with the distribution of activities across the cities are less common and have been applied to optimise the usage of public transport or to identify income-related inequalities in aggregated levels (Ceder et al., 2009; Kaplan et al., 2014).

Finally, by linking transport features with demographics, several studies have demonstrated an unequal transport supply in Latin American cities that tends to favour the most affluent groups of the societies (Jaramillo et al., 2012; Farbiarz, 2013; Capelli, 2015; Figueroa and Guzmán, 2016). The discussion is situated under the understanding that many cities of the region are well-covered by public transport, with healthy model shares (low usage of private transport), but fragmented due to social, economic and ethnic issues (Cebollada, 2006; Gutiérrez and Rearte, 2006; Avellaneda, 2009; Ramírez, 2009; Dangond et al., 2011; Blanco et al., 2014).

3. Methodology

The method is composed of two parts. The first part is a literature and documentary review of Chilean transport policies with an emphasis in those developed since 1980 as they delineated the approaches of current programs. The transport policy review is complemented with a secondary review of housing policies and maps that highlight the territorial features of the housing estates built from 1982 onwards. As there is not an updated database that compiles all social housing estates, the maps were created with several figures present in Ducci and

Gonzalez (2006) and MINVU (2014) and later corroborated with orthophotographs (SECTRA, 2012b).

The second part is a quantitative analysis in two sections: a general description of the city (residential density, concentration of activities and distance from the city centre) and the potential opportunities to reach activities available in the city in a certain period of time (connectivity). The opportunities to reach activities are measured through a composite index that calculates the percentage of the total supply of each activity accessible by public transport from a specific point of the city by a unit of time.

The index is divided into four aspects (employment, education, shopping, health) seeking to understand the opportunities to access the different available resources. As the city does not have a reliable database of activities (or land use), attracted trips by area are considered a 'proxy' of the activities. Therefore, the public transport connectivity index $PT - Con_{ick}$ in the area i is the sum of all the trips (T) by activity (c) attracted by all the areas j connected with the area i in equal or less than k minutes, weighted by the total number of trips by purpose produced by the city (T_c). Then,

$$PT - Con_{ick} = \frac{1}{T_c} \sum_{j=1}^n T_{jck} \cdot \delta_{ijk}$$

$$\delta_{ijk} \begin{cases} 1 & \text{if } t_{ijh} < k \\ 0 & \text{any other case} \end{cases}$$

With n equal to the number of areas in the city, and δ_{ijk} equal to 1 if the time of the public transport route h (t_{ijh}) between areas i and j is equal or less than k minutes. The time t_{ijh} was obtained as,

$$t_{ijh} = \min_H \left(\sum_{r=1}^R \alpha_{rh} + \beta_{rh} \right)$$

where variable h represent the fastest public transport route (selected by GIS, in its Network Analysis component) of buses and subway lines that connect areas i and j of all the possible H routes. The variable R represents the whole public transport services needed to use the route h , while variable β_{rh} is the travel time of that service, and α_{rh} is the average waiting time of the public transport service r needed to use the route h , obtained as half of the waiting time for all the services as,

$$\alpha_{rh} = \frac{1}{2} \cdot \frac{1}{\sum_{l=1}^L f_l}$$

With f_l equal to the frequency of the public transport service (bus and subway lines) l that serves route h . To calculate the index, the distribution of the activities and the densities, this paper uses the information of the latest origin-destination survey of Santiago (2012) and considers 737 origin-destination areas (which are mostly urban and part of the greater Santiago), 551 bus services that operate regularly in working days and the five subway lines (108 stations) that currently operates in the city (SECTRA, 2012a; DTPM, 2014).¹

From the 737 origin-destination areas, 27 are part of the historical centre and its financial expansion, 40 were classified as 'mostly covered by housing states' as they contain 80% of the housing estates built from 1982 and grouped in 12 clusters (Fig. 1). To facilitate the lecture of the data, the clusters were identified with numbers and an abbreviation of their geographical location as Fig. 1 displays (N north, S south, SE southeast, etc.). All the information was processed in Geographical Information System (GIS).

4. Transport and housing in Santiago de Chile

With 6.5 million people, Santiago de Chile is currently covered by

¹ Nos-Express, an urban train service, was not included in the analysis as it was still under construction by 2012.

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