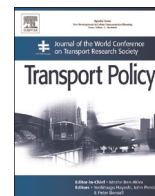




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Children's travel to school—the interaction of individual, neighbourhood and school factors



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ABSTRACT

The increase in average distance from home to secondary school over recent decades has been accompanied by a significant growth in the proportion of pupils travelling to school by motorized means as opposed to walking or cycling. More recently this switch in travel mode has received considerable attention as declining levels of physical activity, growing car dependence and the childhood obesity “crisis” have pushed concerns about the health of future generations up the public health agenda, particularly in the U.S., but also in the UK and Europe. This has led to a proliferation of international studies researching a variety of individual, school and spatial characteristics associated with children's *active travel to school* which has been targeted by some governments as a potential silver bullet to reverse the trend. However, to date national pupil census data, which comprises annual data on all English pupils, including a *mode of travel to school* variable, has been under-utilised in the analysis of how pupils commute to school. Furthermore, methodologically, the grouped nature of the data with pupils clustered within both schools and residential neighbourhoods has often been ignored - an omission which can have considerable consequences for the statistical estimation of the model. The research presented here seeks to address both of these points by analysing pupil census data on all 26,709 secondary pupils (aged 11–16) who attended schools in Sheffield, UK during the 2009–10 school year. Individual pupil data is grouped within school, and neighbourhood, within a cross-classified multilevel model of *active* versus *motorised* modes of commuting to school. The results support the findings of other research that distance to school is key, but suggest that sociospatial clustering within neighbourhoods and schools is also critical. A further finding is that distance to school varies significantly by ethnicity, with white British pupils travelling the shortest distance of all ethnic groups. The implications of these findings for education and transport policy are discussed.

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1. Introduction

In the mid-1980s the mean distance travelled to school by 11–16 year olds in the UK was just over 2 miles; by 2013 this had almost doubled, increasing to 3.7 miles (Department for Transport, 2013). This lengthening of the high school commute has been influenced by some of the urban-structural processes which have occurred over the past 50 years. Firstly a marked increase in the size of high schools, which began in the post-war decades (Rigby, 1979) has resulted in secondary schools drawing their pupil intakes from wider catchment areas on average. Second, the suburbanisation and decentralisation which has occurred in many cities has dispersed some school-aged children to family housing in low density new-build housing estates on the outskirts (Hoare,

1975), which involves both longer travel distances and an urban form that favours car use (Dieleman et al., 2002, Newman and Kenworthy, 2006). A third factor that has also influenced the length of children's journey to school is legislation promoting parental choice, which has encouraged the selection of out-of-area schools (see for example Parsons et al., 2000, Hoare, 1975). In recent studies it has been estimated that less than half of all school-age children in England now attend their nearest school (Allen, 2007, Ferrari and Green, 2013).

These changes in the spatial configuration of schools and urban space have been accompanied by significant social change such as the rise of the dual-working family and growing private car ownership, a corollary of increased household affluence. These have occurred over a period that has seen the cost of car travel decrease in real terms compared to other forms of transport (especially following deregulation and privatisation of public transport which occurred in the 1980s (Fairhurst and Edwards,

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1996)). The rise in volume of road traffic associated with increased private car use has also led to rising concerns about road safety, which has in turn contributed to decreasing child independence and increased parental surveillance. Parental strategies to cope with this dual challenge often most conveniently involve driving children to school *en route* to work.

All of these factors have combined to produce a highly complex pattern of travel from home to school characterised by, and enabled by, growth in the use of motorised forms of transport. According to 1975/6 National Transport Survey data for Great Britain, 55% of all secondary school pupils walked to school, and 7% travelled by car (Rigby, 1979). By 2012 only 38% of pupils aged 11–16 years walked to school and 26% travelled by car (Department for Transport, 2013). In 1975–6, walking was the selected mode of travel for 93.6% of all “education” trips under 1.6 km (approximately 1 mile), exemplifying the key underlying constraint on modal choice: distance.

Notwithstanding the effect of distance, the choices that children (and their parents) make with regards to school commuting may depend crucially on the interaction of several factors operating at a number of levels. Neighbourhood-level factors, which include characteristics of the urban form and structure, may have a range of direct and indirect effects on travel behaviour. School-level factors, most notably variations in the ‘performance’ of schools and the socioeconomic composition of their pupil intake, may influence school and residential location choices, thereby potentially circumscribing travel options and average travel distances to school. Individual-level characteristics, such as age, have a relationship to the extent to which children will countenance or be empowered to choose active forms of travel. The relationship between factors at these different levels is likely to be very complex: individual pupils are simultaneously ‘members’ of their neighbourhood and the school they attend, and models of travel behaviour may be underpinned by both fixed (e.g., age, gender) and random effects (e.g., distance to school).

The aim of this paper is to specifically consider the interaction of these effects in explaining the travel mode of choice for secondary school children in Sheffield, UK. A typical UK city characterised by a high degree of self-containment, significant social variation between schools and neighbourhoods, and a highly heterogeneous set of pupils within the context of a ‘loosened’, non-hierarchical spatial relationship between home and school locations. The findings are important for policy makers aiming to maximise the use of active forms of transport (e.g. for public health reasons) or to minimise car use (e.g. for environmental or congestion reasons) and suggest that policy efficacy is likely to be highly contingent on contextual factors, not only of individuals but of the schools they attend and the neighbourhoods they live in.

1.1. Structure of the paper

The paper is organized as follows: Section 2 highlights some of the shortcomings of the literature in this area to date. Data and Methods, are described in Section 3, and the Results of the multilevel models are presented and discussed in Section 4. The concluding remarks and policy implications are outlined in Section 5.

2. Active commuting: definition and correlates

The majority of the literature on commuting to school focuses on walking and cycling, which are generally referred to as “active” modes of transport. This term is often used in an oppositional, dichotomous sense which either explicitly states (see for example Lee et al., 2008), or implies that modes of transport such as

travelling by car, bus, or train are totally “passive” or “non-active” (see for example Sirard and Slater, 2008, Voss and Sandercock, 2010). However, this is not necessarily the case, particularly with regards to public transport where users walk to and from bus or tram stops or train stations (Rissel et al., 2012). Yet, whilst it is acknowledged that the degree of activity involved in different modes of transport can be conceptualised as a continuum, which itself has significant policy implications, data considerations in the present study mean that we generally classify journeys into those that are predominantly “active” or “motorised”.

There is now a burgeoning international literature on active commuting to school, particularly from the US, in the wake of a childhood obesity ‘epidemic’, which has shone a spotlight on school commuting as a potential ameliorative agent that could provide children with a regular daily dose of physical exercise (Banerjee et al., 2014). Although there are considerable differences between the case of the US and Europe in terms of local geography, school-siting, the level of car dependency and the proportions of children walking and cycling to school, the dramatic decrease in active commuting witnessed across North America in recent decades is one possible future scenario in the UK.

A wide range of factors have been found to be associated with active school commuting. Stewart’s (2011) review of 42 studies found 480 correlates including: distance to school, family income (access to private transport), concern about traffic and crime *en route*, parental views on walking, cycle use and family timetables. Urban form has both a direct effect on mode of travel choice and, by influencing parental opinion, an indirect effect. The urban form factors Stewart (2011) identified from other studies include:

- Active transport *infrastructure*—pavements, safe crossings, cycle paths;
- *Barriers* such as *major road or railway crossings* encountered en route;
- Network *connectivity*—local streets, route choice, cul-de-sacs;
- *Land use* mix—residential (populated) versus industrial, parks, derelict land;
- Residential *density* – increased numbers of people, “eyes on the street”;
- “*Walkability*”—aesthetic environment (greenery, trees, etc).

The evidence of the impact of urban form is broadly mixed and is likely to be highly context specific. Kemperman and Timmermans (2014) found that Dutch primary school children were more likely to walk (though not necessarily cycle) in more urbanised neighbourhoods, although the relationship between factors is complex and the impact of environmental characteristics may be indirect (in that distance, for example, is a function of density). Schlossberg et al. (2006) found that the density of road junctions and cul-de-sacs in a neighbourhood, as proxies of ‘walkability’, were significant predictors of walking rates among middle school pupils in Oregon. Urban form explanations can only be partial, however. Stead (2001) found that individual and household-level socioeconomic factors were more important than urban form in explaining travel patterns, although no attempt was made to predict travel mode.

The literature is further complicated by the impact of age on the results. It is widely understood that age is a significant correlate of active commuting (see for example Aarts et al., 2013, Johansson et al., 2012). However, previous studies comprise a wide range of subject age-groups, which preclude systematic comparison. There has tended to be a focus on younger children, who often have less independence (Mammen et al., 2012) and who live closer to school on average. English primary school children aged 5–10 live 1.6 miles from school on average, compared to 3.7 miles for 11–16 year olds (Department for Transport, 2013). In order to

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