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Prospective trends in body mass index by main transport mode, 2007–2013

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ABSTRACT

Background: Cohort studies have examined whether change in transport mode is associated with change in bodyweight among commuters. We complement this research by examining trends in body mass index (BMI) for men and women who used the same transport mode between 2007 and 2013, and where transport was used for any activity of daily life.

Methods: Data are from the HABITAT study, a longitudinal investigation of health among 11,035 persons aged 40–65 residing in 200 neighbourhoods in Brisbane, Australia. Transport mode was measured as private motor vehicle (PMV), public transport, walking, and cycling. Analyses were conducted using random effects models before and after adjustment for time-varying and time-invariant confounders. Interactions between transport mode and time were modelled to assess whether the rate of change in BMI differed by mode.

Results: Averaged over the four time-points, the BMI of men who consistently walked or cycled was -3.20 kg/m^2 (95%CI -4.28, -2.12) and -2.15 kg/m^2 (95%CI -3.22, -1.08) lower respectively than PMV users: the corresponding difference for women who walked or cycled was -2.42 kg/m^2 (95%CI -3.66, -1.18) and -2.44 kg/m^2 (95%CI -5.98, 1.11). For men, there were no BMI differences between PMV and public transport users; among women, those who mainly used public transport had higher BMI (1.06 kg/m^2 95%CI 0.51, 1.62) than PMV users. For men, no significant interactions were found between transport mode and time; for women, those who mainly walked for transport experienced a significant decline in BMI compared with PMV users.

Conclusion: Those who consistently walked or cycled sustained a lower BMI over time relative to those who consistently used a PMV. Transport and land use policies and behavioural interventions that successfully shift mode-share from PMV to active travel might help stem the global increase in obesity related chronic disease.

1. Introduction

During the last two decades Australia experienced rapidly rising rates of overweight and obesity amongst its adult population

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(Australian National Preventive Health Agency, 2014). In 2013, the prevalence of obesity among Australians aged 20 years and older was 29%, placing it 25th out of 188 countries surveyed for the Global Burden of Disease Study; and since 1980, the obesity prevalence in Australia increased by 81%, compared with 66% in the UK and 65% in the US (Ng et al., 2014). International health authorities have attempted to stem the rising tide of overweight and obesity and address the related increases in chronic disease by calling for a shift in transport mode-share from private motor vehicle (PMV) use to active transport (public transport, walking and cycling) as a way of incorporating physical activity into everyday life (World Health Organisation, 2013; British Medical Association, 2012; National Heart Foundation of Australia, 2014). The use of active transport translates into higher levels of physical activity (Besser and Dannenberg, 2005; Sallis et al., 2004) and the physiological benefits and increased energy expenditure that accrue from this probably partly accounts for the lower rates of mortality (Andersen et al., 2000), type 2 diabetes (Hu et al., 2003), and cardiovascular disease (Hamer and Chida, 2008) among regular users of active travel.

Research examining relationships between transport and bodyweight is mostly cross-sectional. This work shows that, compared with PMV users, users of public transport, and those who walk or cycle, have significantly lower body mass index (BMI) (Wanner et al., 2012; Flint et al., 2014; Flint and Cummins, 2016), a lower odds of overweight and obesity (Lindstrom, 2008; Wen and Rissel, 2008; Laverty et al., 2013; Millett et al., 2013), and a lower percentage body fat (Flint et al., 2014; Flint and Cummins, 2016). There are few longitudinal studies of transport mode and bodyweight; however, the limited findings to date lend credence to a causal interpretation of the relationship. Prospective ecologic research shows that population-level reductions in active travel (Bassett et al., 2008; Pucher et al., 2010) and increases in travel by PMV (Jacobson et al., 2011; Behzad et al., 2013) are correlated with later increases in average BMI and prevalence of obesity. Natural experiment studies of public transport interventions show that older adults who commenced using free travel on local busses in England had a lower odds of becoming obese (Webb et al., 2012), and residents of Charlotte (North Carolina) who used light rail after its introduction experienced a reduction in BMI (MacDonald et al., 2010). Cohort studies show that changing from PMV to active travel over two time-points within a 5 year period was associated with significant reductions in BMI (Martin et al., 2015; Flint et al., 2016) and the consistent use of an active mode over one year was associated with a sustained lower average BMI (Mytton et al., 2016).

The aim of this paper is to examine prospective trends in BMI for men and women who consistently used the same mode of transport at four time-points between 2007 and 2013. Whilst we know that BMI gradually increases over time as we age, we don't know if the rate of increase differs depending on transport mode. By tracking trends in transport mode and BMI over a seven year period we examine a question that is central to the advocacy efforts of health authorities who are calling for policies that promote active travel: Does the consistent use of active travel help mitigate the increases in overweight and obesity that have been observed in Australia and elsewhere during the last few decades?

In addition, a notable feature of previous cross-sectional and longitudinal research is its almost exclusive focus on commuting (i.e. travel to work), consequently it has focused on a relatively narrow and circumscribed cross-section of the population, namely, working-aged people in paid employment. This has necessarily excluded sizeable population sub-groups outside the labour market such as the unemployed, the retired, or those doing home duties. Put differently, earlier research may have focused primarily on healthier higher status respondents (i.e. the 'healthy worker' effect). As a complement to this work, we examine the relationship between transport mode and BMI in a population-representative sample of mid-to older-aged men and women who reported on their main mode of travel irrespective of purpose (e.g. commuting, shopping, socialising, errands); and using a sample that included employed and non-employed groups.

2. Materials and methods

2.1. Data

This investigation used data from the HABITAT (**H**ow **A**reas in **B**risbane **I**nfluence Heal**Th** and **AcT**ivity) study. HABITAT is a multilevel longitudinal study of mid-aged adults living in the Brisbane Local Government Area, Australia (Turrell et al., 2010). The primary aim of HABITAT is to examine patterns of change in health and well-being over the period 2007–2016 and to assess the relative contributions of environmental, social, psychological and socio-demographic factors to these changes. In this paper, we used data from Waves 1–4 of the study which were collected in May-July 2007, 2009, 2011 and 2013.

2.2. Ethics approval

The HABITAT study received ethical clearance from the Queensland University of Technology Human Research Ethics Committee (Ref. Nos. 3967H & 1300000161).

2.3. Sample design

Details about HABITAT's sampling design have been published elsewhere (Burton et al., 2009). Briefly, a multi-stage probability sampling design was used to select a stratified random sample (n = 200) of Census Collector's Districts (CCD), and from within each CCD, a random sample of people aged 40–65 years (on average 85 people per CCD).