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From 'car-dependency' to 'desirable walking'–15 years trend in policy relevant public health indicators derived from Household Travel Surveys

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ABSTRACT

Reducing car dependency in favour of health-enhancing active travel can address the issues of prolonged sitting and physical inactivity. This study utilises transportation-sector population surveys to develop interdisciplinary policy relevant indicators for benchmarking and progress tracking. The continuous Sydney Greater Metropolitan Household Travel Survey (2000-June 2015) was analysed in 2017. The prevalence of adults (≥15 years old) who i) travelled by car for distances amenable for health-enhancing walks (≤ 1.5 km, ≤2.0kms); ii) only drove a car and did not walk, including no walks that link to other modes (i.e, CD: 'car-dependency'); and iii) walked ≥30 min, or ≥3 kms, or > 3 walking trips (i.e., DW: 'desirable walking') in the past 24 hours were examined including prevalence ratios for CD/DW by population sub-groups (e.g., age, gender, employment status, income and household structure) and by statistical districts located within short (< 13kms), medium (13-30kms) and long (> 30kms) driving distance from Sydney Central District.

The adjusted yearly decline in the prevalence of CD was small (0.3%) but significant, from 40.3% (95% CI: 39.6 − 41.1) in 2000/3 to 39.3% (38.1–40.1) in 2012/14. DW remained unchanged, from 20.6% (95% CI: 20.0; 21.2) to 21.2% (95%CI: 20.6–21.9). The CD/DW prevalence ratio varied greatly by distance from Sydney city, with medians ratios 0.86, 1.86 and 3.25 in short, medium and long distance categories, respectively, and by demographic sub-group (range from 0.64 to 2.67). The yearly prevalence ratios of CD/DW presented a declining trend from 1.42 to 1.13, after adjustment for population demographic characteristics. Across all periods 21% travelled by car for ≤1.5kms, of those travellers 44% were car dependent. These indicators can serve both transportation and health sectors wherever transport surveys exist, for benchmarking, monitoring and setting area- specific goals that are aligned with public health and transport policies.

1. Background

Physical inactivity, defined as not meeting the minimal movement requirement for general health (150 min per week) (World Health Organization, 2017a), is a major public health issue and economic burden; in 2008 physical inactivity was responsible for 9%

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of premature deaths globally (Lee et al., 2012), and in 2013 physical inactivity was estimated to cost the health care systems nearly $54 billion globally (Ding et al., 2016). Active travel is a practical way to integrate physical activity into daily routines and hence can assist inactive individuals in achieving the minimal recommendation (Berrigan and Troiano, 2002; Besser and Dannenberg, 2005). Evidence for the health benefits of active travel based on longitudinal studies has grown considerably in the past decade. A meta-analysis of six cohorts estimated an 8% reduction in the risk of all- cause mortality solely through active commuting of 150 min per week and a 15% reduction, if this amount is doubled (Samitz et al., 2011). Recently, a study based on a large UK cohort estimated that active commuting was associated with substantial reductions in the incidence of cardiovascular disease and cancer (Celis-Morales et al., 2017).

Meanwhile, research has shown that long hours spent driving is a lifestyle risk factor that requires public health attention. Not only is driving associated with various unhealthy behaviours and outcomes (Ding et al., 2014), prospective investigations have also shown that sitting more than 10 hours a week in a car increases cardiovascular mortality by 50% (Warren et al., 2010) and incidence of depression by 28% among those not achieving the minimal physical activity recommendation (Sui et al., 2015). Therefore, replacing driving in favour of active travel has the potential to reduce the harms of prolonged sitting and of insufficient levels of physical activity.

Transportation policies and systems that prioritise walking, cycling and public transport represent one of the seven investments that work to increase physical activity participation (Global Advocacy for Physical Activity the Advocacy Council of the International Society for Physical And Health, 2012) and are strongly represented in the WHO global action plan for physical activity 2018 – 2030 (World Health Organization, 2017b), and have long been the focus of transportation and urban planners to ensure sustainable transportation (World Health Organization, 1999). Although car use is still the dominant travel mode in high-income countries, there seems to be some attenuation since 2000 (Goodwin and Dender van, 2013). In European cities like Vienna, Zurich, Berlin and Munich the implementation of programs that discouraged car use has resulted in declines in the modal share of car trips even from a baseline level that was among the lowest in the world. (Buehler et al., 2017, 2016).

Household Travel Surveys (HTS) are traditionally used by transportation researchers to monitor changes at the aggregate level, but they have also been used to monitor active travel at the disaggregated levels, informing population trends that are relevant to public health (Buehler et al., 2011; Merom et al., 2010; Pucher et al., 2011). HTS can also be used to estimate the prevalence of car dependency and the potential of engaging car-dependent adults in active travel. Car dependency is often used by transport researchers to indicate high share of trips made by car from all trips (Buehler et al., 2016). However, 'car dependency', from a public health behavioural perspective, refers to consistent reliance on cars as a single mode of travel with no active travel trips. Since a person can use the car and walk/cycle on the same day, a reduction in the share of car trips does not necessarily equal a reduction in the proportion of car –dependent adults. Further, to shift from driving to active travel we should focus on the proportion of car travellers for distances amenable to walking or cycling. Replacing a car trip of 2.0km would require no more than 22 min of walking at 5 km per hour or 7 min of cycling at 16 km per hour (Shephard, 2008).

1.1. Objectives

The overall aim of this paper was to propose policy relevant indicators using the HTS of Sydney Greater Metropolitan area. Specifically, we aimed to i) examine the prevalence of 'car-dependency' against 'desirable walking' and the trend in the prevalence ratio of the two indicators from 2000 to 2015; ii) monitor changes in short car trips amenable for walking; and iii) identify population groups and geographical areas presenting higher ratios of 'car-dependency' to 'desirable walking' as population benchmarks.

2. Materials and methods

2.1. Survey methodology and sample

The HTS is a continuous survey, where 5000 households are randomly selected and approached in each Australian financial year (1st July to 30th of June) to form a representative sample of the Sydney Greater Metropolitan. The sampling process is designed so that data from each additional financial year (wave of data) are pooled to minimise the relative standard error and to increase the statistical reliability at the smaller geographical area. Here, pooled data of three years are reliable for region-wide or Sydney Statistical District levels, allowing for accurate estimates for four periods (2000–2002; 2004–2006; 2007–2010; 2011–2014). The annual contacted response rates for all five periods ranged from 63% to 69% (New South Wales Bureau of Transport Statistics, 2013).

The HTS collects detailed information on all trips undertaken for a nominated 24-hour period (travel day) for every member of the selected household during a face-to-face interview. The travel day is allocated to each household in a manner where the sample represents all days of the week and year including holidays. For each trip the interviewer recorded the trip origin and destination (addresses), mode of travel, trip purpose, and time of departure and arrival.

Household information also included residential location, household structure, and detailed sociodemographic information: age, gender, employment status, and income adjusted to 2006 dollars for all periods.

2.2. Main indicators

The HTS data are released de-identified for public use at no cost but at the aggregated trip level. We obtained customised de-identified HTS dataset which contained specific indicators at the person level (i.e., number of walking trips, car trips) as explained