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Movers and stayers: The geography of residential mobility and CVD hospitalisations in Auckland, New Zealand

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ABSTRACT

The association between area-level disadvantage and health and social outcomes is unequivocal. However, less is known about the health impact of residential mobility, particularly at intra-urban scales.

We used an encrypted National Health Index (eNHI) number to link individual-level data recorded in routine national health databases to construct a cohort of 641,532 participants aged 30+ years to investigate the association between moving and CVD hospitalisations in Auckland, New Zealand. Residential mobility was measured for participants according to changes in the census Meshblock of usual residence, obtained from the Primary Health Organisation (PHO) database for every calendar quarter between 1/1/2006 and 31/12/2012. The NZDep2006 area deprivation score at the start and end of a participant's inclusion in the study was used to measure deprivation mobility.

We investigated the relative risk of movers being hospitalised for CVD relative to stayers using multivariable binomial regression models, controlling for age, gender, deprivation and ethnicity. Considered together, movers were 1.22 (1.19–1.26) times more likely than stayers to be hospitalised for CVD. Using the 5×5 deprivation origin-destination matrix to model a patient's risk of CVD based on upward, downward or sideways deprivation mobility, movers within the least deprived (NZDep2006 Quintile 1) areas were 10% less likely than stayers to be hospitalised for CVD, while movers within the most deprived (NZDep2006 Q5) areas were 45% more likely than stayers to have had their first CVD hospitalisation in 2006–2012 (RR: 1.45 [1.35–1.55]). Participants who moved upward also had higher relative risks of having a CVD event, although their risk was less than those observed for participants experiencing downward deprivation mobility.

This research suggests that residential mobility is an important determinant of CVD in Auckland. Further investigation is required to determine the impact moving has on the risk of CVD by ethnicity.

1. Introduction

The association between area-level disadvantage and health and social outcomes is unequivocal. Numerous studies from New Zealand and abroad, focussing on mortality (Boyle et al., 2005; Robson and Purdie, 2007; Salti, 2010) morbidity (Abas et al., 2006; Barnett and Lauer, 2003; Robson et al., 2007) and risk factors (Hippisley-Cox et al., 2010; Utter et al., 2010) demonstrate a clear social gradient in which the most disadvantaged populations experience significantly worse outcomes than their peers living in the least disadvantaged communities. For example, research using data on 4020 participants aged 35–74 years from the Diabetes, Heart and Health survey conducted in 2001–3 in Auckland, New Zealand (Metcalf et al., 2008) investigated the association between many CVD and diabetes risk factors, including smoking status, waist-to-hip ratio and 5-year CVD risk. Using the NZDep2001 Index of deprivation (Salmond and Crampton, 2002) and adjusting for age gender and ethnicity, the authors reported higher diastolic blood pressure, fasting and 2-h glucose concentrations, and 5-year CVD risk among the 1202 participants in the most deprived neighbourhoods (NZDep2001 9and10) compared to the participants in the least deprived areas (NZDep2001 1 and 2). A more recent study of participants presenting at Auckland City Hospital with a cardiac or vascular related-illness found that participants living in the most

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deprived neighbourhoods in the Auckland District Health Board (ADHB) region were on average 10 years younger than participants living in least deprived neighbourhoods (Ellis et al., 2012). Furthermore, at a median 2.4 years following discharge for CVD-related outcomes and after adjusting for age and gender, participants from the most deprived areas had 50% greater odds (OR 1.5 [95% CI 1.3–1.7]) of dying than participants from least deprived neighbourhoods. A Swedish study of 2.6 million adults aged 40–64 found a significant association between increasing levels of neighbourhood deprivation and incidence rates of coronary heart disease for both women and men. Males in the most deprived areas had a 42% higher risk of developing coronary heart disease than males in the least deprived neighbourhoods, while females in the most deprived neighbourhoods were 87% more likely to develop coronary heart disease than their peers living in the least deprived neighbourhoods (Sundquist et al., 2004).

Relatively less is known about the health impact of residential mobility, particularly at intra-urban scales, although the theoretical arguments have long been made (Bentham, 1988). Both psychosocial stressors and life-threatening events have been linked to migration (Brimblecombe et al., 2000; Tunstall et al., 2012). Tunstall et al., using the British Millennium Cohort Study, found that residentially mobile families had lower infant birth weight, higher rates of accidents, poorer maternal self-rated health, limiting long-term illness and mental health. Much less is known however about the association between migration and CVD events.

There is considerable evidence that health inequalities between the least and most deprived have widened over time (Blakely et al., 2002a,b,c; Boyle et al., 2002, 2004a; 2004b, 2005; McLoone, 1996). One potential explanation for the widening gap is the influence of health-selective migration. Under the health-selective migration hypothesis, those in lower-socioeconomic groups who have good health, or have individual characteristics favourable to good health, are more likely to move up the social scale, thus driving the widening gap between the most deprived and least deprived areas further (Boyle, 2004). Recently, a number of studies set in England, Wales and Scotland have investigated the influence that 'deprivation mobility' has on health inequalities (Boyle et al., 2004b; 2009; Exeter et al., 2011; Norman et al., 2005; 2011). In these studies, deprivation mobility is a form of social selective migration, that is, a change in area-level deprivation circumstances as a result of a change in residence at the smallest census output level. For individuals, deprivation mobility is the deprivation trajectory created as they move from one neighbourhood to another. For example (Norman et al., 2005) used the Office for National Statistics Longitudinal Survey (ONS-LS) data from England and Wales to investigate the association between selective migration from 1971 to 1991 and its association with self-reported limiting long term illness and mortality. They used the Carstairs index of deprivation (Carstairs and Morris, 1991) for the ward of residence in 1971 and 1991, all-cause mortality events between the 1991 and the 1999 census, and a binary indicator of moving between 1971 and 1991 to distinguish between migrants and non-migrants over time. They found that migrants who moved from more to less deprived neighbourhoods had lower age-standardised illness rates than those who moved out of less deprived into more deprived neighbourhoods. Migrants in the most deprived areas had worse health than non-migrants while the converse was true in least deprived neighbourhoods. Note that deprivation mobility analyses do not necessarily include the change in deprivation circumstances that might occur if a neighbourhood either declines or becomes gentrified as a result of social processes.

The aim of our study was to determine the association between residential migration and the risk of a patient being hospitalised for CVD. Using a cohort of participants obtained by linking routine health databases, this research had three key research questions. First, we tested whether movers were more likely to have CVD than stayers. Next, we investigated the risk of movers being hospitalised for CVD, controlling for their deprivation circumstances at the start of the study. Finally, we investigated whether the risk of being hospitalised for CVD is influenced by the trajectory of a participant's move with respect to area-level deprivation. In other words, to what extent does moving up, down or across the area-level deprivation spectrum affect the likelihood of a participant being hospitalised for CVD?

2. Data and methods

Every New Zealand resident has a unique health identifier, the National Health Index (NHI) number, which enables anonymous and secure linkage of data from patient electronic medical records within the health and disability support sectors (Ministry of Health, 2011).

In this study, encrypted National Health Index (eNHI) numbers were used to anonymously link four nationally held datasets that record a patient's interaction with New Zealand's universal health care system: enrolment with a Primary Health Organisation (PHO), pharmaceutical dispensing claims from community pharmacies, hospital discharges and mortality. PHOs receive government funding to provide primary health services to an enrolled population and the enrolment database is updated quarterly. Since 2007, over 97% of the NZ population has been enrolled in a PHO (Ministry of Health, 2012a). Participants using private hospitals, which account for 6.0% of total discharges from hospitals, were excluded from this study because data from private hospitals held by the Ministry of Health is incomplete (Ministry of Health, 2014a).

Participants were eligible for inclusion in this analysis if they were enrolled in an Auckland region PHO during at least one of 28 calendar quarters between 1 January 2006 and 31 December 2012, were aged at least 30 years on 1 January 2006, and had complete demographic information (age, gender, ethnicity, area-level deprivation and Census Meshblock [MB] as a residential location identifier). Participants with a history of CVD before 1 January 2006 were identified from national datasets so that they could be excluded.

2.1. Denominator population sources

For each eNHI identified in at least one of these 28 calendar quarters, we obtained the patient's age, gender, ethnicity, area of residence, area-level deprivation, history of CVD at 31 December 2005 and hospitalisation for any CVD event or procedure. Age was categorised into 6 groups (<45, 45–54, 55–64, 65–74, 75–84 and 85+ years), enabling the investigation of the increasing likelihood of CVD events among older ages. A patient's self-identified ethnicity (in which individuals may report up to 3 ethnic groups) was included in the PHO enrolment database and was prioritised to ensure each individual was assigned to one ethnic group, using national ethnicity coding protocols. This study reports results by ethnicity for Maori, Pacific, Indian, Other Asian and New Zealand European and All Other Ethnic groups combined (NZEO). We distinguished between Indian and other Asian ethnic groups as Indian participants are known to have a higher risk of CVD than participants of other Asian ethnic groups (Ministry of Health, 2012b).

2.2. Defining cardiovascular disease (CVD)

Using the International Classification of Diseases, version 10 (ICD-10) codes, we included those participants admitted to a public