The association between the density of retail tobacco outlets, individual smoking status, neighbourhood socioeconomic status and school locations in New South Wales, Australia

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ABSTRACT

Aim: We explored the association between the density of tobacco outlets and neighbourhood socioeconomic status, and between neighbourhood tobacco outlet density and individual smoking status. We also investigated the density of tobacco outlets around primary and secondary schools in New South Wales (NSW).

Methods: We calculated the mean density of retail tobacco outlets registered in NSW between 2009 and 2011, using kernel density estimation with an adaptive bandwidth. We used generalised ordered logistic regression model to explore the association between socioeconomic status and density of tobacco outlets. The association between neighbourhood tobacco outlet density and individuals' current smoking status was investigated using random-intercept generalised linear mixed models. We also calculated the median tobacco outlet density around NSW schools.

Results: More disadvantaged Census Collection Districts (CDs) were significantly more likely to have higher tobacco outlet densities. After adjusting for neighbourhood socioeconomic status and participants' age, sex, country of birth and Aboriginal status, neighbourhood mean tobacco outlet density was significantly and positively associated with individuals' smoking status. The median of tobacco outlet density around schools was significantly higher than the state median.

Conclusion: Policymakers could consider exploring a range of strategies that target tobacco outlets in proximity to schools, in more disadvantaged neighbourhoods and in areas of existing high tobacco outlet density.

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1. Introduction

Smoking remains the leading cause of preventable disease and death in Australia and the state of New South Wales (NSW) Begg et al.,2003; Collins and Lapsley, 2010. Since 1997, NSW has experienced success in significantly reducing the proportion of adults who are current smokers from 24.0% to 14.7% in 2011 (Centre for Epidemiology and Evidence, 2012). Substantial progress also been made in reducing the uptake of smoking in children, with a reduction in the proportion of children aged 12–17 reporting they had ever smoked from 56.3% in 1996 to 25.3% in 2008 (Department of Health, 2008). However smoking rates remain high in certain groups, especially among Aboriginal people and those from low socioeconomic, disadvantaged and other specific groups, such as people in correctional facilities, people with a mental illness and some culturally and linguistically diverse groups (NSW Ministry of Health, 2012).

Australian governments are investing heavily in initiatives to reduce the demand for and restrict the supply of tobacco, and to reduce exposure to second-hand smoke (National Preventative Health Taskforce, 2008). The NSW Tobacco Strategy 2012–2017 has a focus on groups with higher rates of smoking than the general population, and also children and young adults in order to reduce the numbers who take up smoking (NSW Ministry of Health, 2012).

Recently, Australian policy makers have turned their attention to possible relationships between smoking and the retail availability of tobacco products. This has raised the possibility of new initiatives to restrict the availability of tobacco by regulating the density, location and type of tobacco outlets, and/or to target community education and compliance and enforcement activities. The Australian Preventative Health Taskforce Report for example included tobacco licensing schemes and limiting the number and type of retail outlets in its future options for Australian tobacco control, as part of a comprehensive suite of interventions to address the prevalence and take-up of tobacco (National Preventative Health Taskforce, 2008).

In NSW, a tobacco retailer notification scheme is operated by the State health authorities. The information on the location of tobacco outlets presents an opportunity for designing new tobacco control policy initiatives, at a time when additional effective and innovative strategies are needed to target harder-to-reach and more vulnerable groups (National Preventative Health Taskforce, 2008). Research is required in relation to the particular Australian and NSW circumstances as socio-environmental contexts can be location-specific. Understanding how environmental determinants influence the availability, accessibility and attractiveness of tobacco products is needed in order to recommend the most effective interventions to reduce smoking amongst target populations. This study applied geographic analysis techniques to tobacco retail outlet location and density in relation to socio-economic status and the location of primary and secondary schools in NSW.

We aimed to investigate whether the density of tobacco outlets is greater in more disadvantaged areas and to assess the association between neighbourhood tobacco outlet density and smoking. We also aimed to describe the density of tobacco outlets near primary and secondary schools in NSW.

2. Methods

2.1. Density of retail tobacco outlets

Since the *Public Health (Tobacco) Act 2008* came into force all tobacco retailers have been required to notify the NSW Ministry of Health of their tobacco retailing activities through a free online registration system. This includes not only tobacconists but also those businesses which sell tobacco and other goods and services, such as supermarkets, newsagents, petrol stations, convenience stores and liquor licensed premises. We used the 2009–2011 tobacco outlet registration data to locate all registered tobacco retail outlets in NSW. A density surface of tobacco outlets was created using kernel density estimation with an adaptive bandwidth of 1000 people (Carlos et al., 2010; Rodriguez et al., 2012). Tobacco outlets with no exact address match were assigned to the centroids. We used a geocoded dataset of all residential properties in NSW and the 2006 Australian Census estimated residential population data for estimating the underlying population density (Australian Bureau of Statistics, 2010). Each property was given a weight based on the estimated number of people living in each household in each Census collection district (CD). Census collection districts average about 220 dwellings in urban areas, and less in rural areas. The bandwidth was expanded until 1000 people were included in the study area. This method accounted for the inhomogeneous background population by limiting the influence of tobacco outlets located in regions with higher population density to smaller spatial areas than those in regions with lower population density (Carlos et al., 2010; Rodriguez et al., 2012). In sparsely populated areas, we restricted the bandwidth to a 25 km radius, in order to prevent expansion to a spatially unreliable distance (Carlos et al., 2010; Rodriguez et al., 2012; Berke et al., 2010; Shi, 2010). Mean tobacco outlet density per 1000 population, within each CD and each postal area was then calculated using the created density surface.

2.2. Neighbourhood socioeconomic disadvantage and retail tobacco outlet density

Each CD in NSW was assigned a population-weighted socioeconomic disadvantage quintile (where the first quintile indicates least disadvantage, and the fifth quintile most disadvantage), based on the index of relative socioeconomic disadvantage (IRSD) calculated for the NSW 2006 Census population (Australian Bureau of Statistics, 2006). This index uses 20 disadvantage indicator variables including income, education, employment and the proportion of Aboriginal people to assign a relative socioeconomic status to geographic areas. The outcome of interest was the mean tobacco outlet density per 1000 population, categorised into four approximately equal-sized ordered categories indicating zero, low, medium and high tobacco outlet