



Socioeconomic and geographic inequalities in adolescent smoking: A multilevel cross-sectional study of 15 year olds in Scotland



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ABSTRACT

The objective of the study was to present socioeconomic and geographic inequalities in adolescent smoking in Scotland. The international literature suggests there is no obvious pattern in the geography of adolescent smoking, with rural areas having a higher prevalence than urban areas in some countries, and a lower prevalence in others. These differences are most likely due to substantive differences in rurality between countries in terms of their social, built and cultural geography. Previous studies in the UK have shown an association between lower socioeconomic status and smoking. The Scottish Health Behaviour in School-aged Children study surveyed 15 year olds in schools across Scotland between March and June of 2010. We ran multilevel logistic regressions using Markov chain Monte Carlo method and adjusting for age, school type, family affluence, area level deprivation and rurality. We imputed missing rurality and deprivation data using multivariate imputation by chained equations, and re-analysed the data ($N = 3577$), comparing findings. Among boys, smoking was associated only with area-level deprivation. This relationship appeared to have a quadratic S-shape, with those living in the second most deprived quintile having highest odds of smoking. Among girls, however, odds of smoking increased with deprivation at individual and area-level, with an approximate dose–response relationship for both. Odds of smoking were higher for girls living in remote and rural parts of Scotland than for those living in urban areas. Schools in rural areas were no more or less homogenous than schools in urban areas in terms of smoking prevalence. We discuss possible social and cultural explanations for the high prevalence of boys' and girls' smoking in low SES neighbourhoods and of girls' smoking in rural areas. We consider possible differences in the impact of recent tobacco policy changes, primary socialization, access and availability, retail outlet density and the home environment.

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1. Introduction

Smoking is a major risk factor for lung cancer, high blood pressure, ischaemic heart disease, stroke, emphysema, and asthma. Smoking during adolescence is of particular interest because it is associated with other health damaging behaviours such as alcohol and cannabis use, fighting and unprotected sex (CDC, 1994). This is a life stage where many health behaviours are initiated, often tracking into adulthood (Jarvis, 2004). In the US, for example, 80% of adult smokers begin smoking before the age of 18 (Campaign for

Tobacco-Free Kids, 2013). Furthermore, substance use during adolescence has a greater negative impact on the brain than in adulthood, increasing the risk of addiction, and negatively affecting memory, concentration and judgement (Chambers et al., 2003; Crews et al., 2007). The negative effects of smoking to the individual smoker are further compounded by the fact that young people who smoke are more likely to be exposed to secondhand smoke through their peers and parents, as smokers are more likely to have friends who smoke (West and Michell, 1999) and are more likely to have one or more parents who smoke (Gilman et al., 2009). Moreover, exposure to secondhand smoke, after controlling for adolescents' own smoking, is linked to asthma, respiratory problems and arterial thickening (Kallio et al., 2010; Vork et al., 2007). Reducing smoking in adolescence is therefore not only beneficial for individuals but also for the overall population.

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Although smoking rates in Scotland have reduced, socio-economic inequalities in smoking prevalence rates must be tackled if Scotland is to achieve its ambition of becoming smoke-free by 2036 (Scottish Government, 2013). The 2011 Scottish Household Survey illustrates that while smoking prevalence among Scottish adults has fallen from 31% in 1999 to 23.3% in 2011, rates remain disproportionately high among those living in areas of high deprivation (i.e. 40% in the most deprived compared to 11% in the least deprived communities) (Scottish Government, 2012a). Among 15 year olds, inequalities in smoking are dependent on the measure used; while 23% of non-smokers live in the least deprived quintile compared with 14% in most deprived quintile, 22% of occasional smokers live in the least deprived quintile compared with 10% in the most deprived, and 17% of regular smokers live in the least deprived and 17% in the most deprived quintiles (Black et al., 2011).

Studies of socioeconomic and geographic inequalities are important, firstly, because as health improves, as it has done over recent decades in Scotland, greater improvements are often observed among some members of the population than others (Wagstaff, 1991). This was also seen in an evaluation of health publicity, which showed no decrease in smoking among British adults of lowest social class (Townsend et al., 1994). Ignoring inequalities may lead us to the incorrect conclusion that the population as a whole is improving. Secondly, by identifying subgroups within the population whose health is particularly poor or particularly good, we may progress to identify associated modifiable risk factors, a first step in putting interventions in place for those at the greatest risk.

Internationally, a larger number of country-specific studies have considered urban–rural differences in adolescent smoking. However, the findings are at odds. A review of psychosocial correlates with adolescent smoking concluded that the relationship with rural residence was ‘undecided’, with a higher prevalence found in rural tobacco-producing areas of the US and in urban Sri Lanka and Finland. A further two studies, in Iceland and New Zealand, which were included in the review, showed no relationship at all (Tyas and Pederson, 1998). Subsequent studies in China, Slovakia, Germany, Greece, Peru and the Sudan have shown a higher prevalence of smoking among urban adolescents (Ho et al., 2010; Hujova and Lesniakova, 2011; Idris et al., 1998; Robinson et al., 2011; Spyrtos et al., 2012; Volzke et al., 2006), although in Argentina, Taiwan, and Korea smoking was more prevalent among rural adolescents (Mulassi et al., 2010; Chang et al., 2011; Park, 2010). Furthermore, a study in Lithuania found the relationship to be dependent on gender; while boys living in rural areas smoked more frequently, girls living in urban areas did so (Zaborskis et al., 2009). Studies carried out in the US appear to contradict one another (Evers et al., 2001; Lutfiyya et al., 2008; Mistry et al., 2011).

Differences in association by country may be due to differences in comparability of studies caused by the indicators of rurality used (Brady and Weitzman, 2007), or indeed smoking eg occasional versus regular (Black et al., 2011), or may be due to substantive differences in rurality between countries; rural lifestyles in a highly urbanised country such as Taiwan (population density of 645 per Km²) is likely differ from that of a country such as Peru (population density of 23 per Km²). In particular there are cultural and socioeconomic differences in rural areas of low, middle and high income countries and those which have experienced a recent transition from one classification to another. Country-specific results are therefore primarily relevant to those countries with a similar social, built and cultural geography.

Scotland has a population of approximately 5,250,000 with a landmass of 78,772 km². However, most of the population of Scotland resides in the central belt which includes the two largest cities, Glasgow and Edinburgh, and several other large towns. The Highlands and Islands, home to 7% of the Scottish population, makes up over 60% of Scottish landmass, with a resulting sparse

Table 1
Definition of the urban–rural classification used.

| Rural classification | Description ^a | % of study sample | % of Scottish population ^a |
|----------------------|---|-------------------|---------------------------------------|
| 4 cities | Settlements with population over 125,000 (i.e. Aberdeen, Dundee, Glasgow, and Edinburgh) | 24.1 | 38.9 |
| Other urban | Other settlements with population over 10,000 | 23.7 | 30.3 |
| Accessible towns | Settlements with population between 3 and 10,000 and within a 30 min drivetime of a settlement of 10,000 or more | 10.5 | 8.6 |
| Remote towns | Settlements with population between 3 and 10,000 and more than 30 min drivetime of a settlement of 10,000 or more | 9.4 | 4.1 |
| Accessible rural | Settlements with population less than 3000 and within a 30 min drivetime of a settlement of 10,000 or more | 14.6 | 11.2 |
| Remote rural | Settlements with population less than 3000 and more than 30 min drivetime from a settlement of 10,000 or more | 17.7 | 7.0 |

^a Source: Scottish Government, 2008.

population density of 8 people per square kilometre. These large differences in geography make the study of urban–rural differences in Scotland particularly interesting. Previous research of adult health has shown less favourable outcomes in remote rural Scotland; higher rates of suicide (Levin and Leyland, 2005) and ischaemic heart disease following discharge from hospital (Levin and Leyland, 2006a), more severe injuries due to road traffic accidents (Weiss et al., 2001) and more advanced stages of cancer at diagnosis (Campbell et al., 2001), after adjustment for socioeconomic status.

Adjustment for SES is particularly important in the study of urban–rural health inequalities because of sociodemographic differences in Scotland’s geographies (Bishop et al., 2004; Levin and Leyland, 2006b). Rural areas, and particularly rural areas located within a 30 min drivetime from urban centres, also known as ‘accessible rural’ areas, have lower rates of deprivation. Unadjusted geographic analyses may therefore be confounded by deprivation. Conversely, adjustment for rurality is therefore relevant in the study of socioeconomic inequalities. Although various socioeconomic and geographic measures and proxy measures have been analysed at individual and higher levels in association with adolescent smoking in Scotland (Black et al., 2011; Corbett et al., 2005), no previous study has analysed these simultaneously.

The aim of the current study is to describe adolescent smoking behaviour across the urban–rural spectrum, and by socioeconomic status. The objectives are to 1. examine urban–rural differences in adolescent smoking for a number of different smoking measures, 2. quantify socioeconomic inequalities, by measuring the independent effect of individuals’ affluence, school type and area-level deprivation, 3. investigate whether socioeconomic inequalities differ by rurality.

2. Methods

2.1. Study design

This paper examines Scottish data from the 2010 Health Behaviour in School-aged Children (HBSC) survey, a WHO collaborative cross-national study conducted in 43 countries in Europe

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