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Developing a new small-area measure of deprivation using 2001 and 2011 census data from Scotland [☆]

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ABSTRACT

Material deprivation contributes to inequalities in health; areas of high deprivation have higher rates of ill-health. How deprivation is measured has a great impact on its explanatory power with respect to health. We compare previous deprivation measures used in Scotland and propose a new deprivation measure using the 2001 and 2011 Scottish census data. We calculate the relative index of inequality (RII) for self-reported health and mortality. While across all age groups different deprivation measures provide similar results, the assessment of health inequalities among those aged 20–29 differs markedly according to the deprivation measure. In 2011 the RII for long-term health problem for men aged 20–24 was only 0.71 (95% CI 0.60–0.83) using the Carstairs score, but 1.10 (0.99–1.21) for the new score and 1.13 (1.03–1.24) for the income domain of Scottish Index of Multiple Deprivation (SIMD). The RII for mortality in that age group was 1.25 (0.89–1.58) for the Carstairs score, 1.69 (1.35–2.02) for the new measure and 1.76 (1.43–2.08) for SIMD. The results suggest that researchers and policy makers should consider the suitability of deprivation measures for different social groups.

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1. Introduction

Area-level measures of material deprivation are important for understanding and describing health inequalities (Adhikari, 2006; Barnett et al., 2001; Krieger et al., 2003) and are sometimes used by governments in an attempt to focus funding on the most disadvantaged communities (Welsh Government, 2011). These measures are also used when individual level variables of socio-economic position are not available or when researchers wish to show that the deprivation of a place has an independent effect on a person's health beyond that of the individual socioeconomic circumstances (Ellaway et al., 2012; Meijer et al., 2012; Pickett and Pearl, 2001; Diez-Roux et al., 1997; Diez-Roux, 2004). The effectiveness of a deprivation measure in achieving these goals depends on how well it reflects the construct one wishes to measure (Diez-Roux, 1998) and on its validity for any particular social group or geographic area (Braveman et al., 2005; Martin et al., 2000).

For a long time the Carstairs deprivation score was one of the most frequently used measures of deprivation in Scotland and a basis for similar scores for the rest of UK. It is the only score in

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Scotland that has been provided over a 30-year span (1981–2011) (Brown et al., 2014). The availability of the Carstairs score for such a long time-span is a great strength, but has also made it vulnerable to social change. This has caused some debate about whether the index is still able to measure deprivation as well as it did in the past (Tunstall et al., 2011; Reid, 2009; Hanlon et al., 2005).

While new measures, such as the Scottish Index of Multiple Deprivation (SIMD), have been developed, there is still need for census-based measures of deprivation such as the Carstairs score. Measures using census data allow for a better comparison across countries and over time. Indices using policy take-up rates are less useful for comparative work as policies differ across countries and are changed by government. For example, welfare reform and the subsequent changes to benefits systems will mean that the income and employment domains of the SIMD have to be substantially revised. While census questions also change, they remain relatively constant over time and across different areas both within the UK and internationally, such that a reasonable comparison across decades or countries is possible. For this reason larger comparative studies prefer census based measures of deprivation (Exeter et al., 2011; Norman et al., 2011; Marí-Dell'Olmo et al., 2015). Constancy of questions also means that older census results can be used to derive new deprivation measures without loss of continuity across time. In addition, census data are provided for multiple different geographies (e.g. output areas, datazones and postcode sectors in Scotland) and as such census based measures

can be easily replicated for different levels of analysis.

In this article we propose an alternative measure of deprivation using data from the 2001 and 2011 Scottish censuses. We show that in some circumstances the Carstairs score is unable to distinguish between deprived and less deprived areas and to detect potential health inequalities among young adults. In developing the new measure we draw on previous research on small-area deprivation measures and focus on wider applicability across different social groups and geographic areas. Finally, we compare the association of the new measure, the Carstairs score and the SIMD income domain to self-reported measures of health and mortality.

2. Measures of material deprivation

In the UK area level measures of deprivation have been used for decades to explain variation in health outcomes. The earlier measures included the Carstairs score (Carstairs and Morris, 1991), the Townsend (Townsend et al., 1988) and Jarman indices (Jarman, 1983). Since 2000 the Scottish, Welsh and Northern Irish governments have developed official measures of deprivation using administrative data – the SIMD (The Scottish Government, 2012), the Welsh Index of Multiple Deprivation (WIMD) (Welsh Government, 2011) and the Northern Ireland Multiple Deprivation Measure (NIMDM) (Northern Ireland Statistics and Research Agency, 2010) respectively. The Social Disadvantage Research Centre at the University of Oxford has produced the Indices of Deprivation (ID) for England since 2000 (McLennan et al., 2011). Similar measures of deprivation have also been developed in Australia (Pink, 2013), USA (Butler et al., 2013), New Zealand (Salmond and Crampton, 2012), Canada (Pampalon et al., 2009) and other countries (Havard et al., 2008; Panczak et al., 2012; Maier et al., 2012).

The national indices vary in some details depending on definitions, and how the various items are weighted and combined into a single index. In some countries the index may also include social deprivation (e.g. in Australia and Canada), which can refer to family relations or household type (e.g. single parent families, lone person households) and demographic or ethnic characteristics of the community (e.g. level of English). While social characteristics can have a strong association with health, they are clearly distinct from material deprivation – socially deprived people or areas are not necessarily materially deprived and vice versa. We have focused on material deprivation as it may be more amenable to policy interventions compared to social deprivation.

Despite some differences in these measures, there is widespread consensus on the main areas of material deprivation that should be included. These common items are (un-)employment, material wealth such as car ownership or income, indicators of socioeconomic position, particularly education and occupation, and housing conditions, such as overcrowding, home ownership or renting from a public authority. The Carstairs score combines four of these variables – no car ownership, male unemployment, overcrowding and low social class (Carstairs and Morris, 1991; McLoone, 1994, 2004; Brown et al., 2014).

There are strong theoretical reasons for including each of these common indicators in a measure of material deprivation (see for example Galobardes et al. (2006a, 2006b)). Material resources or wealth affects access to a number of factors that directly influence health (food, housing, various services, etc.). Wealth can be measured by income, but this is not an option when the census does not ask this question, as in Scotland. In such cases researchers often use proxies, like car ownership (Carstairs and Morris, 1991; Townsend et al., 1988). While frequently used as an indicator of wealth its validity is criticized by researchers interested in rural areas, where owning a car is not an indicator of material wealth, but rather a necessity (Farmer et al., 2001; Martin et al., 2000), the

cost of which may further impoverish poor families (Barnett et al., 2001). Car ownership is not necessarily a better measure in urban areas, where not having a car might be a life style choice, even when affordable (Johnson et al., 2010). Ultimately, the ownership of any durable goods is a problematic indicator of wealth as it depends on preferences (McKay, 2004).

Occupation can affect health directly through the work environment (e.g. toxins) or the physical demands in places on employees, and indirectly, e.g. through material resources or social connections. Occupation based measures are easily available and frequently used, but vary over time due to changes in the occupational structures. The “low social class” used in the Carstairs score was based on Registrar General's social class classification (Carstairs and Morris, 1991). Due to the increases in service jobs and in women's labour force participation this classification became conceptually outmoded and was replaced in 2000 with the National Statistics Socio-economic Classification (NS-SeC) which is based on employment relations and conditions (Rose and Pevalin, 2005). For the Carstairs scores this means that retaining the old definition of low social class has become technically more difficult as well as theoretically less suitable. Another drawback of occupational measures is that they are sometimes not assigned to those currently not employed (as was the case in Scotland in 2001). Excluding the non-employed (e.g. temporarily unemployed, retired, those looking after a family, sick or disabled) from a deprivation measure may bias the results since mortality rates and mortality differentials among the inactive can be different from the economically active (Martikainen and Valkonen, 1999). In 2011 rules were used to estimate a category of NS-SeC for any person who did not have current occupation details and in most cases these people were classified according to their last main job (Scotland's Census, 2015b).

Exclusion from the labour market is also related to health through a variety of mechanisms, such as lack of resources, social isolation, stress and loss of self-esteem. A frequently used measure of exclusion from the labour market is unemployment. As a measure unemployment has some limitations, particularly in weak labour market conditions where it may undercount the true extent of labour market exclusion due to “hidden unemployment” – the diversion of people with health problems from recorded unemployment to recorded sickness (Beatty et al., 2000). Regardless the measure is still frequently used due to its association with health and its availability. While most deprivation measures use both male and female unemployment (e.g. SIMD or in Australia and New Zealand) the Carstairs score uses only male unemployment.

The effect of educational qualifications on material deprivation is nuanced. Education is associated with deprivation as the skills people obtain in school affect their employment, occupation and income. In addition education is unique in that it can capture the opportunities and constraints of childhood socio-economic conditions, which can have a strong impact on health outcomes later in life (Davey Smith et al., 1998; Lynch and Kaplan, 2000; Galobardes et al., 2007). Thus, not only does education correlate with other aspects of material deprivation, but it can differentiate between childhood opportunities for those who have the same deprivation level with respect to other indicators (e.g. employment) in adulthood. This is very important as current health is very much a product of life-long circumstances. Of the different areas of material deprivation widely included in measures, educational qualifications is the only one absent from the Carstairs score.

The lack of adequate housing also reflects material deprivation. Housing can be inadequate due to overcrowding (as in Carstairs score, SIMD and WIMD) or a lack of certain amenities such as central heating (as in WIMD and SIMD). Some people may be unable to afford housing at all and thus indicators of housing

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