Unravelling the extent of inequalities in health across urban and rural areas: Evidence from a national sample in England[☆]

Mylene Riva^{a,*}, Sarah Curtis^a, Lise Gauvin^b, and James Fagg^c

^aInstitute of Hazard and Risk Research, Department of Geography, and the Wolfson Research Institute, Durham University, Durham, United Kingdom

^bDépartement de Médecine sociale et préventive and Groupe de Recherche interdisciplinaire en santé (GRIS) at Université de Montréal, Centre de Recherche du Centre Hospitalier de l'Université de Montréal (CRCHUM) and Centre de Recherche Léa-Roback sur les inégalités sociales de santé de Montréal, Montreal, Canada

^cDepartment of Geography, Queen Mary, University of London, London, United Kingdom

Abstract

Studies of inequalities in health between rural and urban settings have produced mixed and sometimes conflicting results, depending on the national setting of the study, the level of geographic detail used to define rural areas and the health indicators studied. By focusing on morbidity data from a national sample of individuals, this study aims to examine the extent of inequalities in health between urban and rural areas, as well as inequalities in health across rural areas of England. Multilevel analyses for poor self-rated health, overweight and obesity, and common mental disorders are reported for a sample of 30,776 individuals aged 18 years and older (obtained from the Health Survey for England years 2000–2003 combined) and distributed across 3645 small areas classed in four categories: two groups of urban areas (Greater London area or 'other cities') and two types of rural settings (semi-rural areas or villages). Results show that rural dwellers were significantly less likely than residents of urban areas to report their health as being fair or poor and to report common mental disorders, independent of their socio-demographic characteristics. However, as for urban settlements, there were significant variations in health across semi-rural areas and across villages, indicating the presence of health inequalities within rural settings in England. These inequalities were not fully explained by the individual composition of the areas or by the available measures of area socioeconomic conditions, indicating that in rural

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*Corresponding author. mylene.riva@durham.ac.uk (M. Riva).

contexts more specific factors may have significance for health. Different policies and services for health promotion and care may need to be targeted to different types of rural areas.

Keywords

Rural health; Small area analysis; United Kingdom; Multilevel modelling; Health inequalities

Introduction

Geographic inequalities in health have been shown to vary between areas with contrasting socioeconomic conditions (Curtis, 2004; Ellen, Mijanovich, & Dillman, 2001; Pickett & Pearl, 2001; Riva, Gauvin, & Barnett, 2007). Many of the studies reviewed by these authors concentrated within urban areas. However, health may also vary between urban and rural areas, but few studies have examined how health status varies geographically across different rural settlements (Kobetz, Daniel, & Earp, 2003; Levin, 2003). By focusing on morbidity data from a national sample of individuals in England, this study aims to examine the extent of inequalities in health between urban and rural areas and inequalities in health across rural areas.

There is considerable research suggesting that urban and rural areas differ in terms of population health. Studies set in Canada, Australia, and the USA, for example, have indicated higher overall mortality rates among rural populations (Australian Institute of Health and Welfare, 2007; Eberhardt & Pamuk, 2004; Pampalon, Martinez, & Hamel, 2006). Studies of cause specific mortality also reveal rural disadvantage with respect to mortality from suicide (Eberhardt & Pamuk, 2004; Leenaars et al., 1998; Page, Morrell, Taylor, Dudley, & Carter, 2007; Pearce, Barnett, & Jones, 2007; Singh & Siahpush, 2002) and from motor vehicle accidents (Kmet, Brasher, & Macarthur, 2003; Stella, Sprivulis, & Cooke, 2001). Mortality from ischemic heart disease is higher among rural Australians (Australian Institute of Health and Welfare, 2007) and among American rural men, but lower among rural American women (Eberhardt & Pamuk, 2004) and among the rural population in one Canadian province (Pampalon et al., 2006). Cancer mortality is also more prevalent in rural areas in the USA (Eberhardt & Pamuk, 2004). In Canada, rural areas show higher rates of mortality from lung and stomach cancer, but lower rates of mortality from breast cancer (Pampalon et al., 2006). Rural residents in Canada and the USA are more likely to report fair or poor health and activity limitations than their urban counterparts (Eberhardt & Pamuk, 2004; Pampalon, Martinez, & Hamel, 2006), but no such difference was found in Australia (Brown, Young, & Byles, 1999). Indicators of mental health (other than suicide) have not shown consistent urban–rural patterns in the USA (Eberhardt & Pamuk, 2004), Canada (Wang, 2004), or Scandinavia (Lehtinen, Michalak, Wilkinson, Dowrick, Ayuso-Mateos, Dalgard, et al., 2003), whereas in Australia, women living in more rural and remote areas expressed lower stress compared to urban women (Brown et al., 1999). Smoking, physical inactivity in leisure time, and obesity have also been reported to occur more frequently among rural populations (Eberhardt & Pamuk, 2004; Mitura & Bollman, 2003; Pampalon et al., 2006; Wilcox, Castro, King, Housemann, & Brownson, 2000).

Overall findings from these countries suggest a certain health disadvantage of rural areas in relation to selected health indicators and for some groups of the population. But they also highlight that living in rural areas is not systematically associated with ill-health. This is further evidenced when the North American literature is compared with studies for the UK and other European countries (Verheij, van de Mheen, de Bakker, Groenewegen, & Mackenbach, 1998). Indeed, several studies show that, in England as in other parts of the UK, mortality and illnesses are less prevalent in rural areas than in urban areas (Connolly, O'Reilly, & Rosato, 2007; Haynes & Gale, 1999; Levin, 2003). Rural dwellers are not more likely than urban dwellers to rate their health as fair or poor (Kelleher, Friel, Gabhainn, & Tay, 2003), and better mental health is experienced by those living in rural areas (Paykel, Abbott, Jenkins, Brugha, & Meltzer, 2000; Weich, Twigg, & Lewis, 2006). However, for other health outcomes such as mortality from suicide (Levin & Leyland, 2005; Middleton, Sterne, & Gunnell, 2006) and from unintentional injury (Boland, Staines, Fitzpatrick, & Scallan, 2005), the prevalence is relatively higher in rural areas as well as in certain inner city areas. Widening health inequalities in overall mortality have also been observed in rural areas of Scotland (Levin & Leyland, 2006b).

Focusing solely on comparing health status between urban and rural areas may mask important variation in health *across* rural settings. Indeed studies have shown that limiting long term illnesses (LLTI) are more prevalent in more remote rural areas in the South West (Barnett, Roderick, Martin, & Diamond, 2001) and the East of England (Haynes & Gale, 2000) than in rural areas located on the urban fringe. Similar within-rural variations regions were also observed for overall mortality (Bentham, 1984) and for the risk of ischemic heart disease mortality in the hospital or within 28 days of discharge (Levin & Leyland, 2006a). Other studies have reported variation in LLTI (Levin, 2003) and mental health (Weich et al., 2006) across rural areas but this variation was generally smaller than that observed across urban areas.

Studies of inequalities in health between rural and urban settings in England have therefore produced mixed and sometimes conflicting results depending on the level of geographic detail in defining the rural and on the health indicator studied. Most studies have investigated influence of rurality on limiting long term illnesses and mortality. Less is known about inequalities in health between urban and rural areas in relation to other health indicators and about inequalities in health across rural settings. Investigating variations in health across categories of rural areas, and for a range of indicators that distinguish between physical and psychosocial dimensions of health is likely to contribute to the understanding of variation in health across and within-rural areas (Higgs, 1999; Pampalon et al., 2006).

Study objectives

In this paper, we examine the extent and nature of inequalities in health, first between urban and rural areas, and then across rural areas. More specifically, the objectives are to (1) examine the influence on health of living in different types of rural settlements in comparison to living in urban settings; and (2) compare the extent of geographic variation (inequality) in health across independent samples of rural settlements and of urban areas.

Our conceptual and empirical approach to study inequalities in health is based on a broad model of health that incorporates lay, social, and clinical constructs of health and includes mental and physical dimensions of health and well-being. From the dataset available to us, the *Health Survey for England*, we identified three health indicators tapping into these different dimensions, namely self-rated health, presence of common mental disorders (anxiety and depression), and excess body weight.

Self-rated health is a measure of global health that is predictive of morbidity and mortality (Idler & Benyamini, 1997). Anxiety and depression represent the most common forms of psychological health problems, and overweight and obesity are associated with a number of diseases, including cardiovascular diseases, glucose regulation, and cancers which are among the leading causes of mortality in developed countries.

Data and methods

Individual sample and data

Individual data are from the *Health Survey for England* (HSE), an annual representative cross-sectional survey of the English population, that collects data on a wide range of health indicators and socio-demographic conditions (Prior, Deverill, Malbut, & Primatesta, 2003). Data for the years 2000–2003 were pooled. Exclusion of non-adults (<18 years old), pregnant women, those living in care homes, and those having invalid data on length of residence in their local area, produced an overall study sample of 36,254 respondents.

Responses to the self-rated health question were dichotomised by assigning 1 to those reporting their health as being fair, bad or very bad, and 0 to those reporting very good or good health. Common mental disorders were assessed using the 12-item General Health Questionnaire (GHQ) which has been widely validated against standardized clinical interviews; GHQ scores were dichotomised by assigning 1 to those having a score of 3 or more, i.e. to those presenting signs of anxiety and/or depression (Goldberg & Williams, 1988; Weich et al., 2006) and 0 otherwise. Anthropometric measurements allowed for the estimation of body mass index (BMI); overweight and obesity were defined by a BMI ≥ 25 kg/m². Individual socio-demographic characteristics considered were sex, age, self-reported ethnic group, and occupational social class which are known to predict health variation among individuals. We also modelled access to a car as an indicator of disposable wealth and mobility especially in rural areas, and length of residence in the local area to try to control for effects of migration and length of exposure to local conditions. Dummy variables were created to represent each category of these characteristics. Table 1 presents descriptive information for individuals and MSOAs.

Area sample and data

Areas were defined using *Middle Layer Super Output Areas* (MSOAs) which are aggregates of Output Areas, the smallest units for which census data are published (Office of National Statistics, 2006). Compared to electoral wards, MSOAs are more consistent in geographical extent and population (between 5000 and 7200 people); they are designed to maximise social homogeneity in terms of housing tenure and dwelling type, to be delimited by obvious

boundaries such as major roads, and to have relatively stable boundaries over time (Office of National Statistics, 2006).

Our use of the HSE data was reviewed and approved by the National Centre for Social Research (NatCen) and in accordance with their standard restrictions on data release. The NatCen linked the area data we had prepared to provide information on nesting of individuals within MSOAs and supplied the research team with pseudo-codes for the MSOAs. Individuals from our sample resided in 3645 MSOAs (53.8% of the total 6780 MSOAs in England). Urban and rural areas were defined using the Department for Environment, Food, and Rural Affairs 2001 classification (Bibby & Shepherd, 2001). Urban areas were classified either as located within the Greater London area ($n = 554$) or in 'other cities' ($n = 2468$). This distinction between types of urban areas was made because London differs from 'other cities' in England in the socioeconomic and ethnic composition of its population, and also in its economy. London's economy is driven by global financial services and has become stronger in recent decades in comparison to other large cities in England where the economy is less dominated by global financial service industries. Rural areas were classified according to their settlement type that depicts dwelling density profiles at selected geographical scales. They were defined as *small town and fringe settlements* (hereafter 'semi-rural areas'; $n = 271$) or as *villages, hamlets, and isolated dwellings* (hereafter 'villages'; $n = 352$). A sparse/less sparse classification, referring to the broader settings in which rural settlements are located, was not considered because of small sample size (sparse semi-rural areas $n = 15$; sparse villages $n = 30$).

MSOA-level deprivation was measured using the 2004 Index of Multiple Deprivation (IMD) (Noble et al., 2004). To protect confidentiality of the HSE respondents to whom the data would be linked, MSAO data on deprivation were classified into deciles of deprivation, with lower values corresponding to low deprivation and higher values to greater levels of deprivation. Distribution of deprivation for the whole sample and per settlement type is shown in Fig. 1 (this distribution is similar to that of the national sample; data not shown).

Because the MSAO data were classified in deciles of deprivation based on the total number of MSOAs in England, and not as continuous data, the deciles categories capture the range of variability in socioeconomic circumstances across the whole country and urban areas, but not necessarily across rural areas. The distribution of deciles of deprivation per settlement types is illustrated in Fig. 1. Rural areas, and especially villages, were most often characterised by lower deciles of deprivation with a limited range, so our available deprivation measure for areas did not discriminate well the varying levels of deprivation in rural areas. Ideally, we would have needed differently constructed area deprivation measures to analyse within-rural socioeconomic conditions. MSOAs were categorised as being in the lower deciles (1–3), mid deciles (4–7) and higher deciles of deprivation (8–10) to account for small numbers of MSOAs in some of the deciles. Areas in the mid and higher deciles of deprivation were contrasted to those in the lower deciles.

MSOAs were further classified by broader administrative regions (see Table 1).

Statistical analyses

Data were analysed using multilevel modelling procedures, to measure variation in health across small areas while controlling for individuals' characteristics (HLM 6.04) (Raudenbush, Bryk, & Congdon, 2005). Multilevel models are particularly useful because they account for the clustering of similar individuals within areas (non-independence of observations within groups), the variation in health outcomes is attributed to differences between individuals and to differences between areas, and they allow for the assessment of the relative contribution of both individual-level and area-level characteristics on these two sources of variation (Diez-Roux, 2000).

Two sets of multilevel logistic analyses were conducted following a 'built-up approach' (Raudenbush et al., 2005). First, to examine the extent of health inequalities between urban and rural areas of England (using the full sample of people in urban and rural areas), we measured how the health status of respondents living in the Greater London area, in semi-rural areas, and in villages compared to the health of those living in 'other cities'. These associations were further adjusted for individual-level socio-demographic characteristics and for area-level deprivation.

Second, to examine the extent of inequalities in health, variation of health indicators across independent samples of categories of rural and urban settlements was assessed from unconditional multilevel models (no predictor variables). The emphasis in these analyses was on comparing the extent of variation in health occurring across categories of rural settlements to that occurring across urban settlements. These second stage analyses were then adjusted for individual-level characteristics, and for area-level deprivation. To further unravel inequalities in health, we examine whether or not standard administrative region of residence was associated with health, as this might provide additional contextual explanations for urban/rural variations.

Results

The final sample is composed of 30,776 individuals aged 18 years and older having complete data on the selected health indicators and individual characteristics and residing in one of 3645 MSOAs. The HSE sample design resulted in a sample of individuals which was not stratified within MSOAs. For this reason, there is variation in numbers of individuals within each MSOA, ranging from 1 to 51 individuals (mean = 8; median = 7). For some MSOAs, estimates might have been less reliable due to small numbers of individuals. To test the sensitivity of results to this issue, we repeated analyses using only data where a minimum of 5 individuals were nested within MSOAs. This reduced the number of MSOAs in the sample by about 30% and the individual sample size by less than 10%. Results of analyses did not differ from the results given here for the full sample.

Examining inequalities in health between urban and rural areas

The focus of the first set of analyses is on comparing the health status of respondents living in the Greater London area, in semi-rural areas, and in villages to the health of those living in 'other cities'. Results are presented in Table 2.

Rural dwellers were significantly less likely than residents in ‘other cities’ to report their health as being fair or poor and to report common mental disorders, independent of their socio-demographic characteristics. However, residents of semi-rural areas were more likely to be overweight or obese, though this was significant in unadjusted models only.

Residents of the Greater London area were less likely to report poorer health status and to be overweight or obese than their urban counterparts living in ‘other cities’, but they did not differ in their probability of reporting common mental health problems. These associations remained statistically significant when individual characteristics were accounted for.

Higher deprivation in the area of residence was significantly associated with poorer self-reported health, presence of mental disorders and overweight and obesity. Although area deprivation was more strongly associated with poorer health indicators, there remained an independent, although weak, effect of settlement type. Adjusting the models for area-level deprivation did not explain the differences in health between residents of Greater London compared with ‘other cities’. However, the health advantage of populations of villages in terms of self-rated health and common mental disorders, and the increased likelihood of being overweight or obese in semi-rural areas was no longer statistically significant under the conventional $p < 0.05$ (effects of settlement types were significant at $p < 0.10$).

Examining inequalities in health across rural settings

To further investigate geographic inequalities in health, we then examined and compared variation in health indicators across independent samples of semi-rural settlements ($n = 271$) and villages ($n = 352$) and across urban areas located within the Greater London area ($n = 554$) and in ‘other cities’ ($n = 2468$). The aim of these analyses is to compare inequalities in health occurring across categories of rural settlements to inequalities occurring across urban settlements. Overall predicted probabilities and plausible value ranges for health indicators from unadjusted multilevel models are reported in Fig. 2. The overall predicted probability provides an estimate of the average probability of observing a specific health indicator across all area units whereas the plausible value range describes the probable range within which the predicted probability varies across areas (Raudenbush et al., 2005).

There was significant variation in health indicators within categories of urban and of rural settlements, thus revealing the presence of inequalities in health within small rural areas and urban settings alike. Across villages the average probability of health being rated as fair or poor was 19.0%. Although lower than that observed in urban areas (24.4% in ‘other cities’ and 21.6% in Greater London area), this probability varied between 8.3% in some villages to 37.7% in others ($\chi^2(df:351) = 454.82$; $p < 0.001$). There was also significant variation in the probability of reporting poor health across semi-rural areas, which ranged between 12.0% and 34.0%. Common mental disorders also varied significantly for populations of villages but not for those of semi-rural areas. Although the average probability is smaller for villages (14.6%) than for urban settings in ‘other cities’ (18.4%), again results underline important local differences where the probability of common mental disorders varies between 8.5% and 23.8% across villages ($\chi^2(351) = 414.71$; $p < 0.05$). Significant variation in overweight and obesity was also observed across all categories of areas.

These analyses were extended to adjust for individual socio-demographic characteristics. Results are reported, for each health indicator, in Table 3(a–c). Significant individual social inequalities in health *within* rural and *within* urban were observed. In all areas, women were more likely than men to report common mental disorders but were less likely to be overweight or obese. A strong effect of age was observed, whereby older adults were more likely to report poorer health and present excess weight. In comparison to younger adults (aged between 18 and 24 years), being between 35 and 54 years of age was associated with poorer mental health in semi-rural areas only. Lower social class was strongly associated with poorer self-rated health, with elevated odds ratios in all urban and rural categories. The effect of one's social class on overweight and obesity was irregular across areas with significant negative associations being observed mainly in 'other cities' and in semi-rural areas. Social class was not significantly associated with common mental disorders. Having access to a car was associated with lower likelihood of poor health and common mental disorders in urban and rural areas, but associated with higher likelihood of overweight and obesity in 'other cities' only.

For all health indicators, controlling for variation between individuals did not fully explain the observed variation in health between rural areas. In urban settings, significant variation in all health indicators remained between small areas of 'other cities', but not between areas located within Greater London. These results indicate that, as in urban areas, the context of rural areas relates to health independent of the composition of the population.

Table 4 presents results of models examining potential contextual explanations for observed variation in health across 'other cities', semi-rural areas, and villages. Overall, higher area-level deprivation was associated with worse health indicators in both urban and rural environments, independent of individuals' circumstances. Residents of semi-rural areas and of 'other cities' characterised by highest levels of deprivation were almost twice as likely as residents of similar, but more affluent, settlements to report poorer health and moderately more likely to be overweight or obese. Area deprivation was associated with mental health only in 'other cities' where residents of areas in the higher deciles of deprivation reported significantly more common mental disorders (OR: 1.38; 95% CI: 1.24–1.53; results not reported in Table 4) than city dwellers of more affluent areas. Estimates of associations between area-level deprivation in villages and health indicators were unstable (probably as a consequence of the small number of MSOAs falling with this category) as indicated by the wide confidence intervals, and should be interpreted with caution. Area levels of deprivation did not fully explain the observed variation in health indicators across urban and rural areas, except for variation in poor self-rated health across semi-rural areas, which became marginally non-significant ($p < 0.10$).

In the final models information on administrative region of residence was introduced to examine regional variation in health. The results are presented in Table 4. Regions were modelled as separate dummy variables and compared to a reference category of health indicators in the South East region. Moderate to strong regional effects on health indicators were observed independent of individuals' socio-demographic characteristics and area-level deprivation. Residents of semi-rural areas in the West Midlands and the North West and of 'other cities' in the North East were significantly more likely to report poorer health than

residents of similar settlements located in the South East. For individuals living in villages, those in the East Midlands, Yorkshire and the Humber, and the North West were more likely to report poorer health than residents of villages located in the South East. Regional variations were also observed for overweight and obesity among residents living in rural settlements and 'other cities', but there was no clear pattern. In comparison to residents of similar settlements in the South East, overweight and obesity was significantly more likely among residents of cities located in the Midlands and East of England, of semi-rural areas in the North, and of villages in all regions apart from the North East (where elevated odds ratios were not statistically different from the South East).

There was no significant regional variation in the likelihood of reporting common mental disorders (results not shown in Table 4).

Discussion

Guided by a broad model of health that encompassed physical and psychosocial dimensions, this paper aimed to unravel the extent of inequalities in health in England both between urban and rural areas, and within-rural areas. The focus was on indicators of self-rated health, common mental disorders and excess weight. From our analyses, several observations can be made.

First, health in rural areas is not systematically better, or worse, than in urban areas. Self-rated health was more positive in rural settings. Common mental disorders were also less prevalent, as reported in other studies relying on UK panel (Weich et al., 2006) and cross-sectional data (Paykel et al., 2000) and by international studies (Brown et al., 1999). This result may seem to run counter to other research showing that indicators of serious psychiatric morbidity (especially mortality from suicide) were more prevalent in remote rural than in suburban areas (Levin & Leyland, 2005; Middleton et al., 2006). Our indicator of mental health relates to more common disorders, i.e. anxiety and depression, as opposed to suicide for which the factors determining inequalities could be rather different. Potential explanations for more favourable psychosocial outcomes in the rural in comparison to urban areas could relate to the absence of urban environmental risk factors (Haynes & Gale, 1999) including more stressful life circumstances, e.g. adverse social environments. But as we discuss in greater details below, significant variation between rural areas in poorer self-rated health and mental health outcomes (independent of the individuals' characteristics) suggests the existence of health inequalities in rural areas.

As observed in rural areas in North American countries (Belanger-Ducharme & Tremblay, 2005; Eberhardt & Pamuk, 2004; Mitura & Bollman, 2003; Pampalon et al., 2006), in our sample overweight and obesity were marginally more prevalent in semi-rural areas. One explanation for this could be a lack of opportunities in semi-rural areas for leading active lifestyles, i.e. where physical activity is integrated in leisure time but also in daily activities. Indeed, results from American studies indicate lower physical activity levels among rural dwellers (Parks, Housemann, & Brownson, 2003; Wilcox et al., 2000). Although one might imagine that rural lifestyles would be more physically active, this may not be the case if

semi-rural residents have long distances to commute to work and do not have access to built leisure amenities.

The greatest proportions of poor self-rated health and common mental disorders were observed in cities other than London. This may be a consequence of geographically varying impacts of sustained social and economic structural change in England's 'other cities', often characterised by higher levels of deprivation. Our results suggest that after controlling for area deprivation, urban–rural disparities were attenuated. The positive effect of rural areas on psychosocial health outcomes and negative effect in relation to excess weight were no longer apparent when area-level deprivation was considered. This suggests that health differences between large cities and more rural areas may be largely accounted for by differences in socioeconomic conditions between poor urban localities and more affluent rural places.

However, this impression should be qualified by results from our second set of analyses, examining local patterns of variation, which revealed significant inequalities in health among small areas that are all classified as rural. Across villages the proportion of persons reporting poorer health and common mental disorders varied respectively between 8.3% and 37.7%, and between 8.5% and 23.8%. There was also significant variability in overweight and obesity across England where the highest prevalence of excess weight were found in some small rural areas. These inequalities in health were apparent after controlling for individual characteristics. Considerable discrepancies in observed probabilities of less favourable health indicators suggest that processes afforded by material and social opportunities structures may vary across rural areas. We consider further below why this may be so.

Second, social inequalities in health between individuals living in rural areas were also apparent. Although it may not be valid to compare coefficients across separate models, the results in Table 3, for example, suggest that the health advantage of individuals in the professional social class compared with all other social categories is especially marked in semi-rural areas. We had expected an especially strong independent influence of car ownership on overweight and obesity in rural areas, but this is not apparent in results. Interestingly, having access to a car was associated with better psychosocial health indicators. Although it may be an indicator of individual or household wealth, having access to a car could be especially significant in rural areas as it influences the possibility of reaching otherwise hard to access services, resources, and social networks. These individual social inequalities in health illustrate that rural environments may have differential effects on particular subgroups of the population. Although these inequalities were not emphasised in this paper, they should be the focus of future investigations.

Third, inequalities in rural health associated with local socioeconomic conditions may be best explained when contrasting rural areas amongst themselves, rather than comparing them to urban areas. Higher levels of deprivation in the area were strongly associated with poorer health indicators in 'other cities' and in semi-rural areas independent of individuals' characteristics. However, estimates for villages were unreliable because the indicator of

socioeconomic conditions calibrated to national conditions was not sufficiently discriminating for villages.

Furthermore, the observed regional pattern of health variation across small rural areas suggests that rural health inequalities significantly relate to broader differences in regional settings, over and above individual and area levels of deprivation. Indeed, analysis by region revealed additional information about the complexities in the patterning of health in rural areas. As observed by others (Doran, Drever, & Whitehead, 2004), a northern health disadvantage was observed for self-rated health and body weight whereby residents of rural areas in northern regions were significantly more likely to report poorer health and to be overweight or obese. Residents of 'other cities' located in northern regions were also more likely to report poorer health than urban dwellers of the South East. These findings add to those of other studies showing variation in health between southern and northern regions in England (Dorling, 1997; Law & Morris, 1998; Lawlor, Bedford, Taylor, & Ebrahim, 2003; Raudenbush et al., 2005; Woods et al., 2005).

We conclude that inequalities in health in rural settings were not fully explained by the individual composition of the areas, suggesting that specific rural contexts, i.e. the social, economic and regional/cultural circumstances as reported in our study, have significance for health.

Methodological considerations

A strength of this study rests on contrasting different categories of urban and rural areas which allowed us to examine patterns of variation in health across types of settlements, rather than relying on an urban/rural dichotomy. Also, the operational definition of areas, Middle Layer Super Output Areas (MSOAs), offered differentiation of local conditions with sufficient population numbers for estimates to be statistically stable. However, our interpretations of the results are subject to some limitations of the analyses. The cross-sectional design of the study prevents analysis of processes of causation linking rural and urban contexts to health. Other limitations probably result from varying individual and area sample sizes between urban and rural areas.

In our study, the nature of urban–rural and of rural health inequalities differed with respect to the health indicators investigated. Our study offers only one point of view on rural health disparities that of the *Health Survey for England*, and based on data relating to self-rated health, common mental disorders, and overweight and obesity. Future studies should explore rural inequalities in health in relation to other health outcomes and health-related behaviours, e.g. smoking and alcohol consumption.

As argued by others (Barnett et al., 2001; Haynes & Gale, 2000; Levin, 2003), our findings show that unravelling inequalities in health between urban and rural areas, and across and within rural settings probably depend on the definition of rurality and more sensitive measurement of rural conditions. Indeed, studies focusing on a simple urban/rural dichotomy may mask significant variation in health associated with specific rural contexts, or at least that urban/rural difference may be dependent on where the line is drawn between what is urban and what is rural. Rural areas should be subdivided into rural types in order to

better account for the heterogeneity in their composition and context. Future studies should examine how specific rural areas compare to other rural areas which differ in terms of their characteristics and regional location, e.g. comparing health status of rural areas located in northern regions of England to rural areas located in the South. This could contribute towards a better understanding of the complex process linking place to health in rural settings.

Some social and economic conditions may be more specific to the context of rural areas (Barnett et al., 2001; Curtis, 2004; Haynes & Gale, 2000), such as lower employment opportunities, lack of affordable housing, and declining availability of public transport, stigma and social exclusion (Parr, Philo, & Burns, 2004; Watkins & Jacoby, 2007), and the lack of accessibility of services and facilities (Niggebrugge, Haynes, Jones, Lovett, & Harvey, 2005; Page et al., 2007). Some of these indicators may not be routinely collected or be captured by readily available composite indices of deprivation, such as the 'Townsend' (Townsend, Phillimore, & Beattie, 1988), the 'Carstairs' (Carstairs & Morris, 1991) and the Index of Multiple Deprivation 2004 (Noble et al., 2004) which may be more relevant for measuring the socioeconomic context of urban environments. Indeed, Fig. 1 clearly illustrates that distribution of deprivation across urban and across rural MSOAs follows different patterns, with more deprived areas located in urban environments and more affluent areas in rural environments. Hence, the effect on health of the measure of deprivation (Index of Multiple Deprivation) used in this study should be interpreted with caution. Deciles of deprivation were defined based on the ranking of the whole sample of MSOAs in England ($n = 6780$). Ranking of deprivation per settlement types, e.g. ranking rural MSOAs against rural MSOAs, might have yielded a distribution of deprivation more in line with the 'actual' distribution of deprivation in rural areas. More work is needed to develop appropriate methodologies and valid measures of area-level characteristics to better understand the social and environmental determinants of health of rural populations. There is scope to extend the research reported here to try to identify factors that may better explain health variation within-rural areas.

Conclusion

Population health status in rural areas has tended to receive less attention than health problems in inner cities (Hartley, 2004). One reason for this is one of numbers: a greater concentration of the population lives in large urban centres and considerable differences in health expectancy have been observed between deprived and affluent areas within the same city (Hartley, 2004). Yet, results of our study revealed significant inequalities in health within the small rural areas, which were not fully explained by individual characteristics of local populations or by local area socioeconomic context and broader regional setting. Especially in the case of obesity, some small areas show particularly poor outcomes, as bad or worse than in cities. These discrepancies in health in rural areas require further investigation, and we have identified potentially useful avenues to explore. These inequalities may also be important for informing actions in public health and public policy; different health promoting policies, programs and services may need to be targeted to different types of rural areas (Hartley, 2004). Given limited resources for health promotion

and provision of care, this could help in identifying local target areas for interventions aiming to reduce inequalities in health.

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Fig. 1.
Distribution of deciles of deprivation across a sample of 3645 MSOAs categorised by settlement type.

Fig. 2. Overall predicted probability and plausible value range for self-rated health, common mental disorders and overweight and obesity in unadjusted models across independent sample of urban and rural areas.

Table 1

Distribution of individual ($n = 30,776$) and area (MSOAs; $n = 3645$) characteristics.

	Proportions	N
Individual characteristics		
Self-rated health		
Good or excellent	76.6	23,567
Fair, poor, or bad	23.4	7209
Overweight/obese		
BMI < 25	38.6	11,865
BMI ≥ 25	61.4	18,911
Common mental disorders		
GHQ score < 3	82.1	25,270
GHQ score ≥ 3	17.9	5506
Gender		
Women	53.8	16,549
Men	46.2	14,227
Age		
18–24	12.3	3799
25–34	16.2	4972
35–44	20.5	6320
45–54	16.9	5216
55–64	15.5	4780
65 years and older	18.5	5689
Occupational social class		
I – Professional	4.8	1482
II – Managerial technical	29.1	8970
IIIN – Skilled non-manual	25.2	7759
IIIM – Skilled manual	18.6	5712
IV – Semi-skilled manual	17.0	5241
V – Unskilled manual	5.2	1612
Self-reported ethnic group		
British, Scottish, Irish or Welsh	91.4	28,134
Other	8.6	2642
Access to a car		
Yes	82.8	25,475
No	17.2	5301
Length of residence in local area		
5 years or less	21.0	6454
More than 5 years	79.0	24,322
Area characteristics (MSOAs %/n)		
Settlement types		
Greater London (15.2/554)	10.8	3320

	Proportions	N
Other cities (67.7/2468)	69.0	21,234
Semi-rural areas (7.4/271)	10.3	3166
Villages (9.7/352)	9.9	3056
Administrative regions		
South East (15.7/574)	15.4	4729
South West (9.6/351)	10.6	3251
East of England (10.0/364)	12.3	3786
East Midlands (9.2/337)	9.6	2952
West Midlands (10.9/396)	10.5	3218
Yorkshire and the Humber (9.7/353)	10.5	3224
North West (14.0/509)	13.8	4247
North East (5.7/207)	6.7	2049

Table 2

Variation in health indicators across the full sample of urban and rural areas.

	Unadjusted model	Model adjusted for individual characteristics	Model adjusted for individual characteristics and area-level deprivation
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Self-rated health			
Settlement type			
Other cities	1.00	1.00	1.00
London	0.85 (0.77–0.94)	0.83 (0.75–0.92)	0.80 (0.72–0.89)
Semi-rural areas	0.82 (0.73–0.92)	0.85 (0.76–0.95)	0.97 (0.88–1.09)
Villages	0.73 (0.65–0.81)	0.77 (0.70–0.86)	0.89 (0.80–1.00)
Deprivation			
Lower deciles			1.00
Mid deciles			1.32 (1.23–1.43)
Higher deciles			1.78 (1.63–1.94)
Common mental disorders			
Settlement type			
Other cities	1.00	1.00	1.00
London	1.09 (0.98–1.20)	1.02 (0.92–1.13)	1.00 (0.90–1.11)
Semi-rural areas	0.87 (0.77–0.97)	0.92 (0.82–1.03)	0.98 (0.88–1.10)
Villages	0.76 (0.69–0.85)	0.83 (0.74–0.93)	0.89 (0.79–1.00)
Deprivation			
Lower deciles			1.00
Mid deciles			1.14 (1.06–1.24)
Higher deciles			1.32 (1.21–1.45)
Overweight and obesity			
Settlement type			
Other cities	1.00	1.00	1.00
London	0.81 (0.75–0.88)	0.88 (0.81–0.96)	0.87 (0.80–0.95)
Semi-rural areas	1.12 (1.02–1.22)	1.04 (0.95–1.14)	1.09 (1.00–1.20)
Villages	1.08 (0.99–1.18)	0.94 (0.86–1.03)	0.99 (0.90–1.09)
Area-level deprivation			
Lower deciles			1.00
Mid deciles			1.17 (1.10–1.25)
Higher deciles			1.23 (1.14–1.32)

Table 3

Variations in health indicators across settlement types in models adjusted for individuals' characteristics.

Individual characteristics	London OR (95% CI)	Other cities OR (95% CI)	Semi-rural areas OR (95% CI)	Villages OR (95% CI)
a. Self-rated health				
Sex				
Men	1.00	1.00	1.00	1.00
Women	0.84 (0.69–1.01)	0.97 (0.90–1.04)	0.92 (0.75–1.12)	1.00 (0.81–1.23)
Age				
18–24	1.00	1.00	1.00	1.00
25–34	1.19 (0.81–1.75)	1.04 (0.91–1.20)	0.81 (0.51–1.30)	1.31 (0.77–2.24)
35–44	1.97 (1.38–2.81)	1.38 (1.21–1.58)	1.29 (0.85–1.95)	1.74 (1.10–2.74)
45–54	2.93 (2.02–4.27)	2.10 (1.83–2.40)	2.15 (1.43–3.21)	1.76 (1.12–2.79)
55–64	4.07 (2.78–5.95)	2.88 (2.52–3.29)	3.39 (2.28–5.02)	2.56 (1.65–3.99)
65 and older	5.08 (3.51–7.36)	3.61 (3.17–4.10)	3.77 (2.56–5.55)	3.82 (2.47–5.92)
Self-reported ethnic group				
British, Scottish, Irish, Welsh	1.00	1.00	1.00	1.00
Other	0.64 (0.53–0.78)	0.72 (0.63–0.83)	1.47 (0.72–3.02)	0.70 (0.39–1.25)
Occupational social class				
Professional	1.00	1.00	1.00	1.00
Managerial technical	1.19 (0.76–1.87)	1.33 (1.09–1.62)	2.28 (1.24–4.19)	1.01 (0.65–1.57)
Skilled non-manual	1.95 (1.23–3.09)	1.60 (1.30–1.96)	2.28 (1.22–4.26)	1.35 (0.85–2.16)
Skilled manual	2.56 (1.61–4.08)	2.15 (1.76–2.63)	3.71 (2.01–6.85)	1.78 (1.12–2.83)
Semi-skilled manual	2.35 (1.46–3.80)	2.26 (1.95–2.94)	2.92 (1.55–5.48)	1.87 (1.17–3.00)
Unskilled manual	4.31 (2.26–7.53)	2.45 (1.95–3.09)	4.59 (2.30–9.15)	2.09 (1.16–3.77)
Access to a car				
No	1.00	1.00	1.00	1.00
Yes	0.66 (0.53–0.80)	0.49 (0.45–0.53)	0.41 (0.31–0.53)	0.49 (0.35–0.69)
Years of residence in local area				
<5 years	1.00	1.00	1.00	1.00
>5 years	1.25 (0.98–1.60)	0.91 (0.83–1.00)	0.81 (0.63–1.04)	1.10 (0.84–1.43)
Between-area variation				
Variance component	0.137	0.137***	0.073*	0.164***
Change in variance (%)	–15.7	–33.0	–36.8	–33.2
b. Common mental disorders				
Sex				
Men	1.00	1.00	1.00	1.00
Women	1.56 (1.30–1.88)	1.39 (1.29–1.50)	1.24 (1.00–1.53)	1.35 (1.08–1.69)
Age				
18–24	1.00	1.00	1.00	1.00
25–34	0.77 (0.57–1.05)	0.84 (0.74–0.96)	1.38 (0.90–2.10)	0.96 (0.61–1.52)
35–44	0.92 (0.69–1.24)	0.98 (0.86–1.11)	1.53 (1.02–2.28)	1.03 (0.69–1.53)

Individual characteristics	London	Other cities	Semi-rural areas	Villages
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
45–54	1.06 (0.77–1.47)	0.94 (0.83–1.07)	1.70 (1.14–2.55)	0.76 (0.50–1.15)
55–64	0.83 (0.58–1.18)	0.88 (0.77–1.01)	1.48 (0.98–2.24)	0.75 (0.50–1.13)
65 and older	0.70 (0.49–1.00)	0.68 (0.59–0.77)	1.25 (0.83–1.89)	0.74 (0.49–1.12)
Self-reported ethnic group				
British, Scottish, Irish, Welsh	1.00	1.00	1.00	1.00
Other	0.91 (0.76–1.10)	0.94 (0.81–1.08)	0.99 (0.56–1.77)	1.04 (0.53–2.01)
Occupational social class				
Professional	1.00	1.00	1.00	1.00
Managerial technical	1.05 (0.72–1.55)	1.05 (0.86–1.27)	1.70 (0.93–3.10)	1.16 (0.71–1.88)
Skilled non-manual	0.96 (0.64–1.43)	1.05 (0.86–1.28)	1.64 (0.88–3.04)	1.19 (0.72–1.98)
Skilled manual	1.10 (0.72–1.69)	1.10 (0.90–1.35)	1.81 (0.98–3.35)	1.22 (0.73–2.06)
Semi-skilled manual	1.15 (0.75–1.76)	1.34 (1.10–1.64)	1.69 (0.90–3.17)	1.36 (0.81–2.29)
Unskilled manual	1.42 (0.83–2.43)	1.11 (0.87–1.40)	1.66 (0.81–3.40)	1.24 (0.63–2.45)
Access to a car				
No	1.00	1.00	1.00	1.00
Yes	0.74 (0.60–0.90)	0.64 (0.59–0.70)	0.47 (0.36–0.63)	0.54 (0.36–0.79)
Years of residence in local area				
<5 years	1.00	1.00	1.00	1.00
>5 years	0.87 (0.70–1.09)	0.80 (0.73–0.88)	0.67 (0.53–0.86)	0.82 (0.63–1.07)
Between-area variation				
Variance component	0.038	0.106***	0.009	0.093**
Change in variance (%)	–25.3	–20.7	–20.0	–5.5
c. Overweight and obesity				
Sex				
Men	1.00	1.00	1.00	1.00
Women	0.63 (0.54–0.73)	0.62 (0.59–0.67)	0.57 (0.48–0.67)	0.45 (0.38–0.54)
Age				
18–24	1.00	1.00	1.00	1.00
25–34	2.52 (1.93–3.29)	2.03 (1.83–2.26)	2.18 (1.61–2.94)	3.06 (2.14–4.39)
35–44	3.86 (2.97–5.02)	2.83 (2.56–3.14)	2.44 (1.84–3.24)	4.30 (3.12–5.93)
45–54	4.85 (3.63–6.48)	3.89 (3.49–4.35)	2.98 (2.22–3.98)	4.26 (3.09–5.87)
55–64	5.48 (4.02–7.47)	4.70 (4.19–5.27)	3.79 (2.81–5.12)	6.03 (4.36–8.34)
65 and older	5.56 (4.11–7.53)	4.50 (4.03–5.02)	4.29 (3.18–5.79)	5.36 (3.87–7.42)
Self-reported ethnic group				
British, Scottish, Irish, Welsh	1.00	1.00	1.00	1.00
Other	0.95 (0.81–1.11)	1.08 (0.97–1.23)	1.05 (0.66–1.66)	1.60 (0.98–2.62)
Occupational social class				
Professional				
Managerial technical	1.17 (0.86–1.59)	1.09 (0.94–1.26)	1.71 (1.17–2.51)	1.04 (0.74–1.47)
Skilled non-manual	1.32 (0.95–1.82)	1.12 (0.96–1.31)	1.43 (0.96–2.13)	0.96 (0.67–1.38)
Skilled manual	1.37 (0.97–1.93)	1.21 (1.04–1.42)	1.86 (1.25–2.77)	1.03 (0.71–1.50)

Individual characteristics	London	Other cities	Semi-rural areas	Villages
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Semi-skilled manual	1.50 (1.06–2.14)	1.26 (1.07–1.47)	2.10 (1.39–3.17)	1.28 (0.87–1.88)
Unskilled manual	1.27 (0.80–2.01)	1.22 (1.01–1.48)	1.78 (1.08–2.94)	1.47 (0.86–2.50)
Access to a car				
No	1.00	1.00	1.00	1.00
Yes	1.18 (0.99–1.41)	1.19 (1.10–1.29)	1.24 (0.96–1.60)	1.04 (0.74–1.48)
Years of residence in local area				
<5 years	1.00	1.00	1.00	1.00
>5 years	1.13 (0.94–1.36)	1.02 (0.95–1.10)	0.99 (0.81–1.21)	1.08 (0.88–1.33)
Between-area variation				
Variance component	0.088 [†]	0.074 ^{***}	0.090 [*]	0.095 [*]
Change in variance (%)	–16.2	–3.7	–0.1	+0.3

[†]
 $p < 0.10$;

^{*}
 $p < 0.05$;

^{**}
 $p < 0.01$;

^{***}
 $p < 0.001$.

Table 4

Variations in self-rated health and overweight and obesity across settlement types, adjusted for individuals' characteristics, in relation to area-level deprivation and to administrative region of location.

	Poor self-rated health			Overweight and obesity		
	Other cities	Semi-rural areas	Villages	Other cities	Semi-rural areas	Villages
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Area-level deprivation^a						
Lower deciles	1.00	1.00	1.00	1.00	1.00	1.00
Mid deciles	1.36 (1.23–1.49)	1.22 (1.00–1.50)	1.45 (1.18–1.79)	1.19 (1.11–1.29)	1.28 (1.06–1.54)	1.08 (0.90–1.29)
Higher deciles	1.86 (1.68–2.06)	1.80 (1.29–2.50)	3.21 (1.03–9.98)	1.25 (1.15–1.37)	1.45 (1.05–2.02)	0.62 (0.21–1.87)
Between-area variation						
Variance component	0.090 ***	0.039 †	0.129 **	0.068 ***	0.078 *	0.095 **
Change in variance (%)	–0.3	–0.5	–0.2	–0.1	–0.1	0.0
Administrative regions^b						
South East	1.00	1.00	1.00	1.00	1.00	1.00
South West	0.90 (0.78–1.04)	0.94 (0.62–1.41)	1.32 (0.89–1.95)	0.91 (0.81–1.03)	1.21 (0.86–1.71)	1.41 (1.05–1.90)
East of England	1.00 (0.87–1.16)	1.27 (0.88–1.82)	1.42 (0.98–2.08)	1.14 (1.02–1.28)	0.93 (0.69–1.25)	1.67 (1.25–2.22)
East Midlands	1.13 (0.98–1.31)	1.34 (0.92–1.96)	1.60 (1.05–2.45)	1.15 (1.01–1.30)	1.04 (0.75–1.43)	1.61 (1.15–2.25)
West Midlands	1.06 (0.92–1.22)	1.64 (1.05–2.55)	1.14 (0.74–1.75)	1.34 (1.19–1.51)	1.05 (0.71–1.54)	1.40 (1.01–1.94)
Yorkshire & Humber	1.06 (0.93–1.23)	1.38 (0.94–2.03)	1.60 (1.00–2.57)	0.97 (0.86–1.10)	1.28 (0.92–1.79)	1.59 (1.09–2.32)
North West	0.98 (0.86–1.12)	1.61 (1.08–2.40)	1.80 (1.10–2.94)	1.04 (0.93–1.16)	1.47 (1.04–2.10)	1.73 (1.16–2.59)
North East	1.20 (1.03–1.41)	1.51 (0.98–2.31)	1.29 (0.63–2.66)	1.00 (0.87–1.16)	1.55 (1.04–2.30)	1.78 (0.99–3.19)
Between-area variation						
Variance component	0.088 ***	0.030 †	0.140 **	0.057 ***	0.068 *	0.086 *
Change in variance (%)	–0.02	–0.2	+0.1	–0.2	–0.1	–0.1

† $p < 0.10$;

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$.

β_p Models are adjusted for individuals' characteristics.
 β_q Models are adjusted for individuals' characteristics and for area-level deprivation.