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Urban–rural differences in suicide trends in young adults: England and Wales, 1981–1998

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Abstract

Suicide rates amongst young people, particularly males, have increased in many industrialised countries since the 1960s. There is evidence from some countries that the steepest rises have occurred in rural areas. We have investigated whether similar geographical differences in trends in suicide exist in England and Wales by examining patterns of suicide between 1981 and 1998 in relation to rurality. We used two complementary population-based indices of rurality: (1) population density and (2) population potential (a measure of geographic remoteness from large concentrations of population). We used the electoral ward ($n = 9264$, median population aged 15–44: 1829) as the unit of analysis. To assess whether social and economic factors underlie rural–urban differences in trends we used negative binomial regression models to investigate changes in suicide rates between the years for which detailed national census data were available (1981 and 1991). Over the years studied, the most unfavourable trends in suicide in 15–44-year olds generally occurred in areas remote from the main centres of population; this effect was most marked in 15–24-year-old females. Observed patterns were not explained by changes in age- and sex-specific unemployment, socio-economic deprivation or social fragmentation. The mental health of young adults or other factors influencing suicide risk may have deteriorated more in rural than urban areas in recent years. Explanations for these trends require further investigation.

Keywords: Suicide; Mental health; Social fragmentation; Urban–rural differences; England and Wales

Introduction

Youth suicide, especially young male suicide, has increased in many industrialised countries in the last 40 years (Charlton, Kelly, Dunnell, Evans, & Jenkins, 1993; Cantor, 2000). In England and Wales, suicide rates have declined in females and older (>45 years) males since the 1960s (Charlton et al., 1993). In contrast, young male suicide rates have doubled and in 1999 25–34-year-old males had the highest rate of all age and sex groups including the elderly (Gunnell, Middleton, Whitley, Frankel, & Dorling, 2002; Middleton & Gunnell, 2000).

Research in Australia (Dudley et al., 1997, 1998b; Dudley, Kelk, Florio, Howard, & Waters, 1998a) and Norway (Mehlum, Hutten, & Gjersten, 1999) shows that the steepest rises in suicide in young adults since the 1960s/1970s have occurred in rural areas. It is speculated that the increases in Australia may be due to declines in the rural economy and subsequent break-up of family units and/or the migration of healthier individuals away from rural areas leaving behind a greater concentration of more susceptible individuals (Dudley et al., 1997).

In England and Wales, cross-sectional studies show that while suicide rates tend to be high in urban areas in both sexes, high rates are also found amongst males living in rural and resort areas (Kelly, Charlton, & Jenkins, 1995; Saunderson & Langford, 1996). No previous study has investigated rural–urban differences

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in recent suicide trends in England and Wales. Our aims were (a) to examine trends since 1981 using two different measures of rurality—population potential and population density—and (b) to use 1981 and 1991 census data to assess the extent to which any trends were associated with the changing social and economic characteristics of rural and urban areas.

Methods

Data sources

All suicide and undetermined deaths (ICD9 codes E950-959 and E980-989, excluding E988.8) for England and Wales were obtained from the Office for National Statistics (ONS) for 1981–1998 by postcode of usual residence at the time of death. We included undetermined deaths (those given open verdicts by coroners) in accordance with previous analyses of national suicide data for England and Wales (Charlton et al., 1992; Kelly & Bunting, 1998). All violent or unnatural deaths are investigated by coroners in England and Wales; based on their enquiries a verdict of homicide, suicide, accident or open verdict is given. Where there is uncertainty about whether the deceased intended to kill themselves an open or accidental verdict may be given. Research indicates that most deaths given an open verdict are suicides (Linsley, Schapira, & Kelly, 2001). Deaths coded E988.8 were excluded from the analysis because this code is used to accelerate death registration and is mostly used in cases of homicide.

Postcodes were linked to electoral wards (based on 1981 geographic boundaries). Wards were used as the unit of analysis as they are generally small enough to cover areas with similar characteristics (rurality and socio-ecomonic conditions) but large enough to ensure a reasonable proportion of wards include some deaths. Wards are aggregates of smaller spatial units (enumeration districts) designed to capture similar numbers of population for census purposes. As a result of the population-based method of designing the ward boundaries, their areas inevitably vary with smaller wards in densely populated areas and larger wards in rural, sparsely populated areas.

Population figures from the 1981 and 1991 censuses were used as denominators for the periods 1981–83 and 1991–93, respectively. For intervening year periods, we used extrapolations and interpolations of these figures.

Rurality indices

Because there is no clear definition of rurality (Martin, Brigham, Roderick, Barnett, & Diamond, 2000), we used two different indices—population density and population potential. Population density is the population of the index ward divided by the ward's area. Population potential is an index of the geographic remoteness from the rest of the population of Britain and is most commonly used in demography (Craig, 1972; Clarke, 1987; Dorling & Atkins, 1995). It is calculated for the index ward as the sum of populations of all the other wards in the country, each weighted by its distance from the centre of the index ward (see Appendix A). A low population potential indicates remoteness from highly populated areas (even if that ward itself is highly populated). Wards with the lowest population potential tend to be found in the West of England and Wales (see Fig. 1). Some wards with low population potential may score highly for population density if they are located in cities/large towns in remote parts of the country. We therefore note that the term rurality in the context of this paper means either low population density or remoteness.

The rurality indices were calculated using 1991 populations and were used to categorise wards on a rural–urban scale for the whole period of the analysis. The indices of rurality reflect relatively fixed characteristics of each ward—the correlation between a ward's population density in 1981 and 1991 was 0.99 ($p<0.001$).

Socio-economic variables

Previous research indicates that a number of area characteristics are associated with geographic patterns of suicide. These characteristics include unemployment, social fragmentation and socioeconomic deprivation (Ashford & Lawrence, 1976; Charlton, 1995; Congdon, 1996; Whitley, Gunnell, Dorling, & Davey Smith, 1999; Crawford & Prince, 1999). To control for the possible effect of changes in these area characteristics on changes in suicide rates, we used two census-based aggregate measures calculated from the 1981 and 1991 censuses for each ward: the Townsend socio-economic deprivation index (Townsend, Phillimore, & Beattie, 1988) and a social fragmentation index (Congdon, 1996). The Townsend deprivation index is calculated by summing the z-scores (the number of standard deviations above or below the population mean value) for each ward's levels of (a) unemployed economically active population, (b) households with no access to a car, (c) households not owner occupied and (d) overcrowded households. Similarly, social fragmentation score is calculated by adding the z-scores for ward levels of (a) unmarried adults, (b) single-person households, (c) households privately renting and (d) people who changed address in the year before the census. Standardised levels of each of the components in 1991 were calculated using their 1981 mean and standard deviation so that the difference between 1981 and 1991 levels gives a measure of the absolute change in a ward's characteristics.

Data analyses

We used graphical displays to examine secular trends in suicide for the period 1981–1998 in the most rural 25% of wards (containing around 10% of the total population) and the most urban 25% of wards (40% of the population) as indexed by population potential and population density. Our main analyses, however, were based on changes between 1981–1983 and 1991–1993 as these years are centred close to the 1981 and 1991 censuses. We were therefore able to assess the extent to which changes in the social and economic characteristics of rural and urban areas over this period explained changes in their suicide rates.

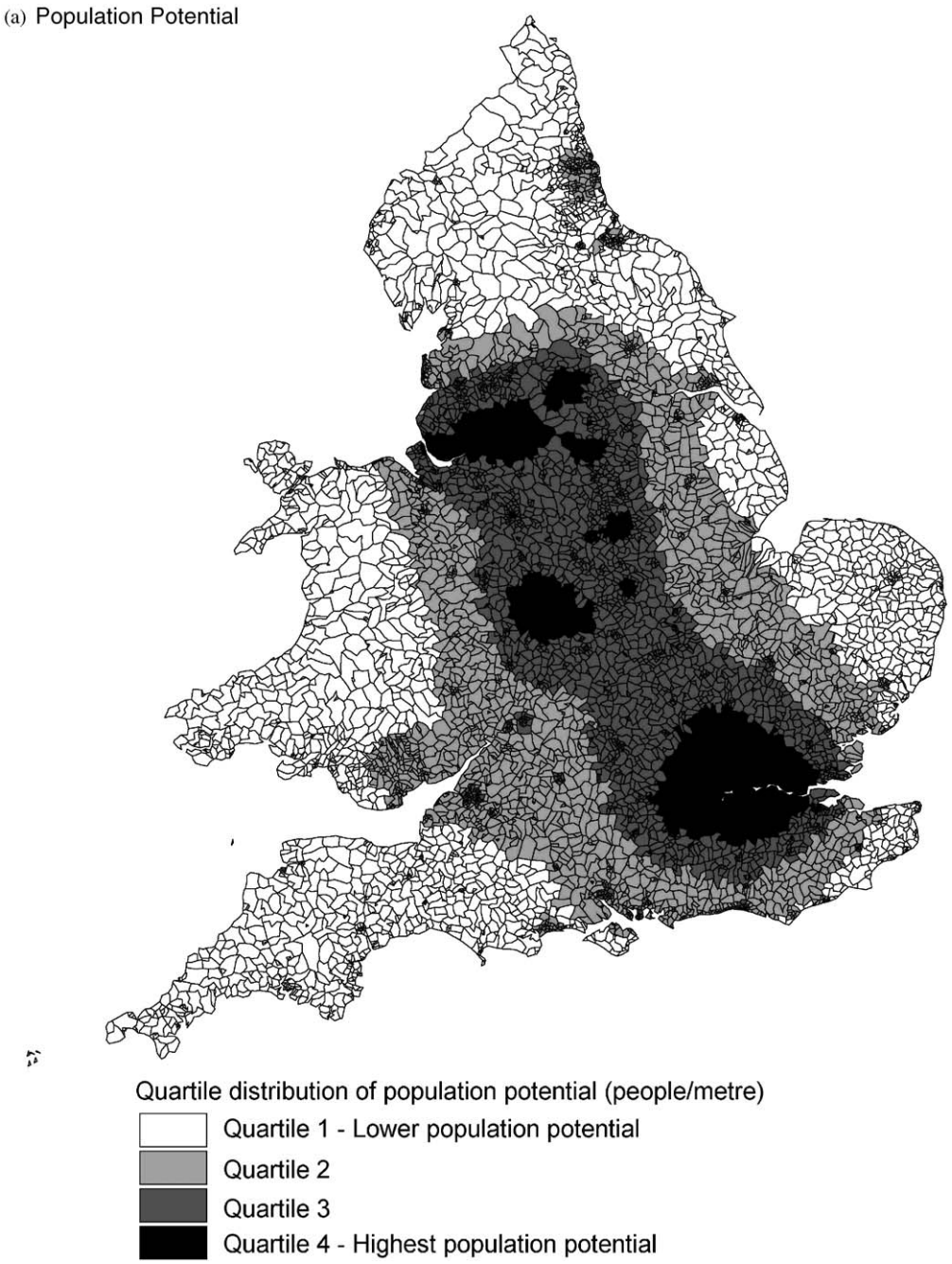

Fig. 1. Maps or rurality as indexed by (a) population potential and (b) population density at ward level (1981 ward boundaries) England and Wales (1991).

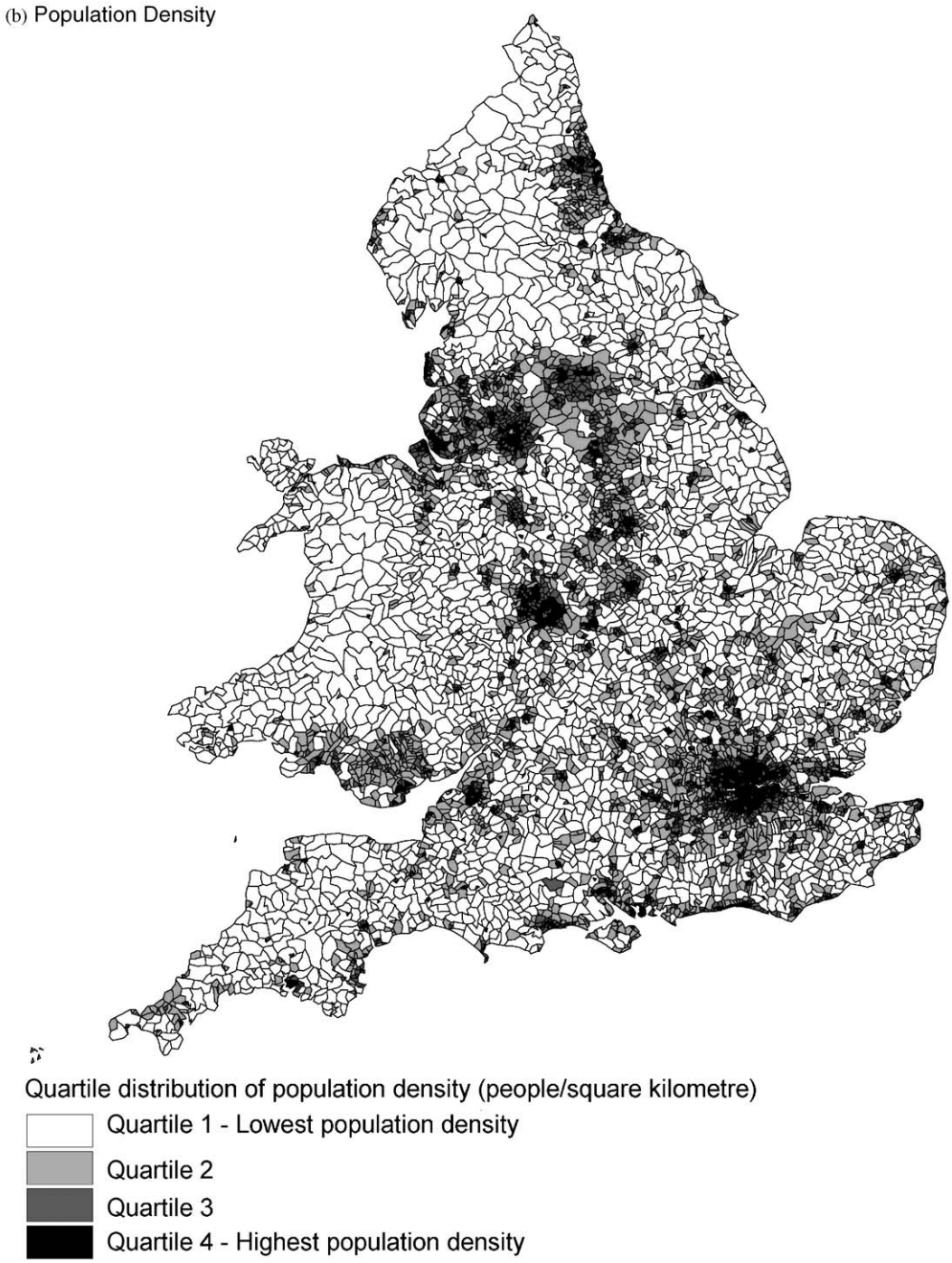

Fig. 1 (*continued*).

Analyses were based on a total of 9264 wards (median population aged 15–44 in 1991: 1829, inter-quartile range: 869–3252). We excluded the wards from the "City of London" constituency ($n = 25$)—these wards occupy only a small area in the business centre of London and include few residential areas. Eighteen of these 25 wards had no resident population in 1991 and the number of 15–44-year olds living in the area was only 2018; one suicide occurred in this area between 1981 and 1983 and three in 1991–1993.

Negative binomial regression models were used to investigate changes in age- and sex-specific suicide and undetermined mortality across wards between 1981–1983 and 1991–1993. We used this approach rather than Poisson regression as there was some evidence of over-dispersion (extra-Poisson variation). We looked at males and females aged 15–24 and 25–44 separately as these age groups have exhibited different trends in recent years (Charlton et al, 1992). Moreover, suicide rates are quite different in these two age groups—suicide rates in 15–24-year olds are half those in people aged 25–44. All models included terms for period (1981–1983 or 1991–1993) and rurality index (population potential or population density) as quartiles or continuous terms (standard deviation scores). We fitted a period × rurality interaction term to assess whether the changes in suicide rates between 1981–1983 and 1991–1993 varied in different locations (i.e. rural or urban). To increase precision of our effect estimates, the most urban wards were used as the baseline in the analysis as they had the largest population and the highest number of suicides.

To compare the strength of association of our two measures of rurality with suicide trends, we also estimated the relative risk of change in suicide rates between 1981–1983 and 1991–1993 per standard deviation decrease in population density and population potential (i.e. increasing rurality). A logarithmic transformation was used to normalise the distributions of population potential and population density as these were both highly positively skewed. The effects of adjusting for changes in age- and sex-specific unemployment, socio-economic deprivation and social fragmentation were assessed in these models, using ward specific data for these measures.

Previous analyses have shown that suicide trends may at least partly be explained by temporal changes in the lethality of some commonly used methods, namely psychotropic drugs and car exhaust gases (Gunnell, Wehner, & Frankel, 1999; Gunnell, Middleton, & Frankel, 2000). Therefore, we assessed the effect on observed associations of excluding poisoning and gas (mainly car exhaust) suicides from the overall figures. We also assessed the effect of excluding undetermined deaths from the overall figures to examine whether any observed trends could be explained by changes in coronial verdicts.

Results

Rurality indices

Population potential ranged from 123 people/m in St Agnes in the Scilly Isles (a group of islands off the South West coast of England) to 1152 people/m in Bayswater in Central London (median: 448 people/m). Population density ranged from 2 people/km^2 in Upper North Tyne, Hexham (in the North of England) to 21646 people/km^2 in Brunswick in Central London (median: 920 people/km^2). The correlation between population density and population potential was 0.62 ($p<0.001$). Fig. 1 shows maps of the spatial quartile distributions of both measures. Areas with the highest values of population potential are to be found around the largest centres of population in the country, i.e. Greater London, Birmingham, Manchester and Liverpool; in contrast, areas with low values are found in the areas most distant from these centres. Levels of population density are not smoothly distributed across the country, high scoring areas are found in most city centres where the wards are usually the smallest in size.

Changes in suicide in the most rural and urban areas

Fig. 2 shows secular trends in suicide rates (3-year moving averages) between 1981 and 1998 in the most rural and most urban quartiles of wards as indexed by population potential and population density. Figures for males and females and for those aged 15–24 and 25–44 are shown separately. Rates in rural areas are based on lower numbers because of the smaller populations in these areas.

In the early 1980s, suicide rates were generally higher in urban areas. However, by the 1990s the differences had generally narrowed, and in some instances rates in rural areas exceeded those in urban locations. The most marked trends were seen in relation to population potential—all four age–sex—groups living in the most rural areas, as indexed by this measure, had less favourable trends than those living in urban areas. These effects are particularly apparent in 15–24-year-old females in whom rates doubled in rural areas but remained fairly stable in urban locations. In the most remote areas (as indexed by population potential), suicide rates in 15–24-year-old females increased by 0.04 [95% CI (0.02,0.07)] per 100,000 per year between 1981 and 1998 while in the most urban areas there was a decrease of 0.01 [95%CI (–0.02,0.0)] per 100,000 per year (P (difference in trends) <0.001).

Trends in rural and urban areas, as indexed by population density, were less consistent across time. The most striking adverse trends in rural areas occurred in 15–24-year-old females. In this age group, suicide rates increased by 0.03 [95%CI (−0.00,0.07)] per 100,000 per year in the most sparsely populated areas while in the most densely populated areas they decreased by 0.01[95%CI (−0.02,0.01)] per 100,000 per year (P (difference in trends) = 0.02).

In 25–44-year-old males, increases in rural suicide in the early 1980s led to a narrowing of the rural–urban differences and in the case of population potential, rural rates exceeded urban rates from the mid-1980s. From

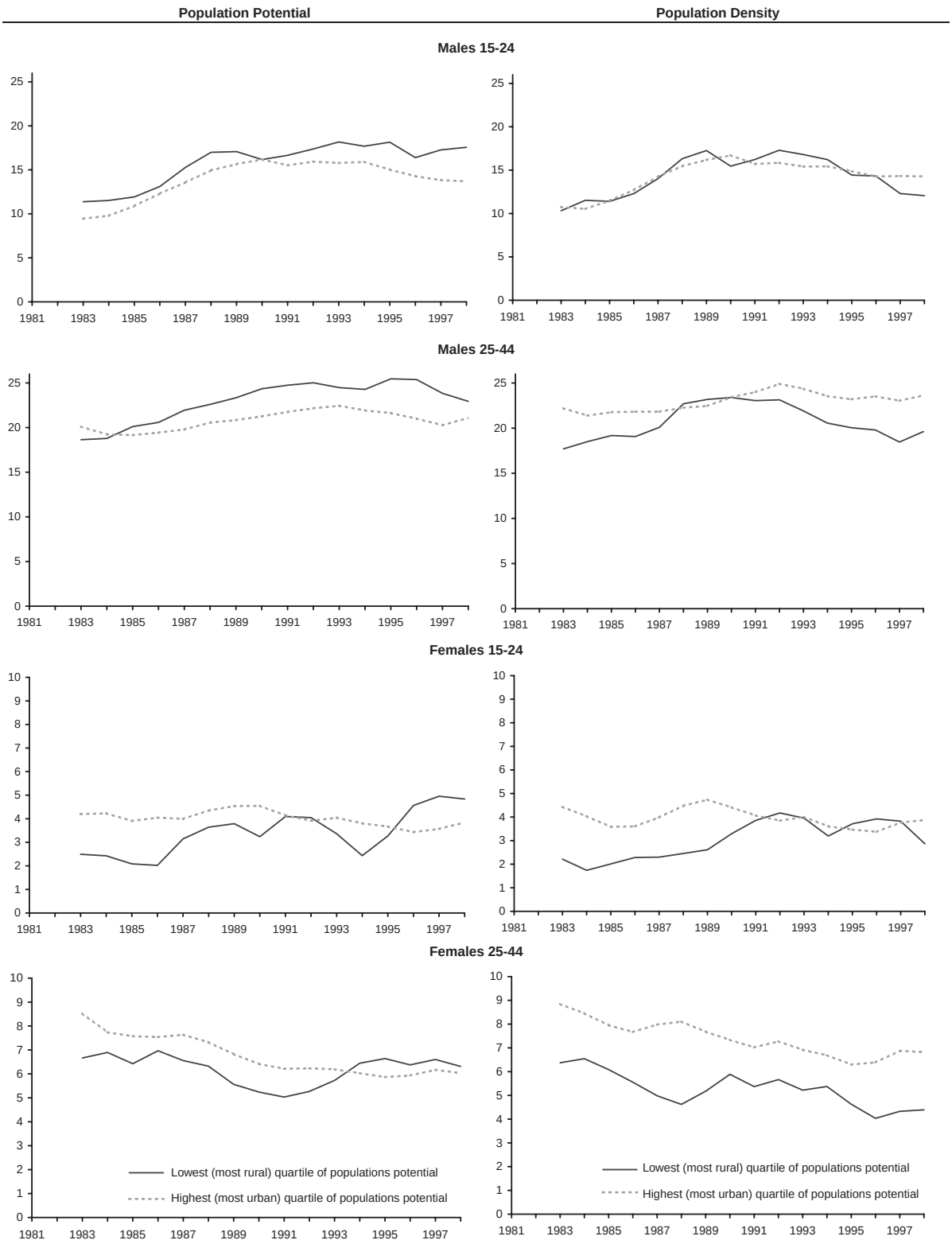

Fig. 2. Age- and sex-specific suicide and undetermined mortality rates per 100,000 in males and females 15–44 in the lowest (most rural) quartile and highest (most urban) quartile of wards in E&W 1981–1998 as indexed by population potential and population density (3-year moving averages).

the early 1990s, however, rates in rural areas appear to have remained stable (in areas of low population potential) or declined (in areas of low population density).

We repeated this graphical analysis excluding undetermined deaths (figures not shown), the observed trends in rates were the same as those based on suicide and undetermined deaths.

Quantitative analysis of urban–rural differences in suicide trends between 1981–1983 and 1991–1993

Our quantitative analysis of urban-rural trends in suicide is based on changes between 1981–1983 and 1991–1993, as these are the years closest in time to Britain's decennial census. This enables us to investigate the extent to which trends may be explained by changes in the socioeconomic characteristics of rural and urban areas. These years also correspond to the period between 1981 and 1998 in which rural suicide rates increased the most relative to urban rates (see Fig. 2).

Table 1 presents changes (95% confidence intervals) in suicide rates per 100,000 person-years between 1981–1983 and 1991–1993 in each quartile of population potential and population density, together with the overall change in that age–sex-groups suicide rate over the 10-year period. In 15–24-year-old males, overall suicide rates increased by 5.4 per 100,000 over this period but there was no clear trend in relation to population potential—the most rural areas experienced an increase in suicide rates of 6.4 per 100,000, whereas the most urban areas experienced an increase of 6.0 per 100,000. In relation to population density, the smallest increase occurred in urban areas. In 25–44-year-old males, in relation to both measures of rurality, the smallest rises in suicide occurred in the most urban areas, whereas the greatest rise (5.6 per 100,000) occurred in the most rural wards as measured by population potential.

In females aged 15–24, there was a very modest increase in overall suicide rates (0.2 per 100,000) (Table 1). However, there were more marked increases in suicide in the most rural wards (0.8 per 100,000 in relation to population potential and 1.7 per 100,000 in relation to population density), whereas there were decreases in the most urban wards. In 25–44-year-old females, there was an overall decrease in suicide rates, the smallest falls occurring in the most rural wards. Whilst there was not always a smooth trend in the changes in rates of suicide across quartiles of rurality, the data in Table 1 generally suggest that changes in suicide between 1981–1983 and 1991–1993 were increasingly unfavourable at each level of greater rurality.

It is unlikely that changes in socio-economic factors account for the observed patterns of suicide since the greatest increases in unemployment, deprivation and social fragmentation in the same period tended to occur in urban areas (Dorling & Woodward, 1996). For example, the Spearman's correlation between population density and change in the Townsend deprivation

Table 1
Change (95% CI) in suicide rates per 100,000 person years between 1981–1983 and 1991–1993 by quartiles of population potential and population density

		Quartile 1 Most urban	Quartile 2	Quartile 3	Quartile 4 Most rural	Overall change in suicide rate within age/sex group
Quartiles of population potential						
Males	15–24	6.0	5.3	3.6	6.4	5.4
		(4.6, 7.4)	(3.5, 7.2)	(1.6, 5.6)	(3.7, 9.1)	(4.4, 6.3)
	25–44	2.2	3.9	3.8	5.6	3.2
		(0.8, 3.6)	(2.2, 5.6)	(1.9, 5.8)	(3.2, 8.0)	(2.4, 4.1)
Females	15–24	−0.2	0.5	0.5	0.8	0.2
		(−1.0, 0.6)	(−0.4, 1.4)	(−0.6, 1.5)	(−0.4, 2.1)	(−0.3, 0.7)
	25–44	−2.3	−1.1	−1.8	−1.0	−1.8
		(−3.1, −1.5)	(−2.0, −0.1)	(−2.9, −0.7)	(−2.3, 0.3)	(−2.3, −1.3)
Quartiles of population density						
Males	15–24	4.3	5.8	6.9	6.3	5.4
		(2.9, 5.8)	(4.2, 7.4)	(4.8, 9.0)	(2.9, 9.7)	(4.4, 6.3)
	25–44	2.0	4.6	3.7	4.0	3.2
		(0.6, 3.5)	(3.1, 6.1)	(1.9, 5.5)	(1.0, 6.9)	(2.4 , 4.1)
Females	15−24	−0.5	0.8	0.3	1.7	0.2
		(−1.3, 0.3)	(−0.0, 1.6)	(−0.7, 1.2)	(−0.0, 3.4)	(−0.3, 0.7)
	25–44	−2.0	−1.7	−1.5	−1.2	−1.8
		(−2.8 , −1.1)	(−2.6, −0.9)	(−2.5, −0.5)	(−2.9, 0.4)	(−2.3, −1.3)

Table 2

(a) Relative risks (95% CI) of an increase in suicide between 1981–1983 and 1991–1993 in relation to population potential

		Quartiles of population potential				Relative risk associated with 1 SD decrease in log population potential (i.e. increasing rurality)	
		Quartile 1 Most urban	Quartile 2	Quartile 3	Quartile 4 Most rural	Unadjusted	Adjusted[a]
Males	15–24	1.00	0.95 (0.78,1.16)	0.84 (0.68,1.04)	0.95 (0.76,1.20)	1.06 (0.99,1.16)	1.08 (1.00,1.16)
	25–44	1.00	1.11 (0.99,1.24)	1.09 (0.97,1.23)	1.17 (1.02,1.34)	1.11** (1.06,1.16)	1.14** (1.08,1.18)
Females	15–24	1.00	1.25 (0.86,1.82)	1.24 (0.83,1.85)	1.41 (0.88,2.28)	1.19* (1.03,1.39)	1.22** (1.04,1.41)
	25–44	1.00	1.15 (0.94,1.40)	1.03 (0.84,1.28)	1.17 (0.92,1.49)	1.08 (1.00,1.16)	1.12** (1.03,1.20)

(b) Relative risks (95% CI) of an increase in suicide between 1981–1983 and 1991–1993 in relation to population density

		Quartiles of population density				Relative risk associated with 1 SD decrease in log population potential (i.e. increasing rurality)	
		Quartile 1 Most urban	Quartile 2	Quartile 3	Quartile 4 Most rural	Unadjusted	Adjusted[a]
Males	15–24	1.00	1.6 (0.97,1.39)	1.30 (1.04,1.62)	1.15 (0.86,1.53)	1.14** (1.03,1.25)	1.16** (1.05,1.28)
	25–44	1.00	1.15 (1.04,1.28)	1.14 (1.01,1.30)	1.12 (0.95,1.32)	1.09** (1.03,1.15)	1.11** (1.05,1.18)
Females	15–24	1.00	1.46 (1.05,2.04)	1.26 (0.79,1.99)	2.00 (1.07,3.72)	1.25* (1.04,1.52)	1.28* (1.05,1.56)
	25–44	1.00	0.97 (0.81,1.16)	0.98 (0.78,1.22)	1.04 (0.77,1.41)	1.01 (0.92,1.11)	1.04 (0.93,1.15)

*$p \leqslant 0.05$.

**$p \leqslant 0.01$: significance of likelihood ratio test comparing goodness of fit of models with and without the period*rurality interaction term. A significant result indicates significant rural/urban differences in suicide trends 1981–1983/1991–1993.

[a]Adjusted for changes in social fragmentation, socio-economic deprivation and age- and sex-specific unemployment.

index between 1981 and 1991 was 0.24 ($p < 0.001$), indicating the greatest increases in socio-economic deprivation occurred in urban areas. Similarly, the correlation between population density and changes in the social fragmentation score was 0.44 ($p < 0.001$).

Table 2a and b show estimates of an area's relative risk of suicide in 1991–1993 compared to 1981–1983 in relation to that area's degree of increasing rurality. In the unadjusted models, the relative risks of an increase in suicide between 1981–1983 and 1991–1993 associated with 1 SD decrease in log transformed population potential (i.e. increasing rurality) were greater than 1.00 in all age/sex groups. Controlling for socio-economic changes did not diminish the strength of risk associated with rurality, if anything the associations became stronger. Similar patterns were seen in relation to population density (Table 2b). The strongest effects were seen in 15–24-year-old females.

Do observed trends reflect changes in the lethality of popular methods of suicide?

We assessed the extent to which the observed trends in rural and urban suicide may be explained by differences in changes in the lethality of methods used for suicide in rural and urban areas. There was some evidence that poisoning and gas suicides have increased more (or decreased less) in rural than urban areas. We examined whether the same patterns were observed when overdose and gassing (mainly car exhaust gas) suicides were excluded from the analysis. The urban–rural differences were still apparent in all but one age group—25–44-year-old males (data not shown). In this group, the observed differences between suicide trends in rural and urban areas were almost entirely explained by smaller increases in gas (mainly car exhaust) and decreases in poisoning suicides in urban areas.

Firearms account for only 3–5% of all 15–44-year-old male suicides in England and Wales and are rarely used by females (only around 1% of all 15–44-year-old female suicides are firearm suicides). Over the period under investigation firearm suicides declined in both rural and urban areas, the greatest falls occurred in rural areas and so changes in the use of firearms for suicide do not account for the observed trends.

Discussion

Main findings

Over the last 18 years, the most unfavourable trends in suicide in 15–44-year olds living in England and Wales generally occurred in areas remote from the main centres of population. The patterns we observed were not as striking as those seen in Australia (Dudley et al., 1997, 1998a, b) or Norway (Mehlum et al., 1999). Between 1964 and 1993, rural areas of Australia (towns with populations <4000) experienced ten-fold rises in suicide rates of 15–24-year-old males and four-fold rises in females of the same age (Dudley et al., 1997).

The rises in England and Wales were more consistently seen when examined in relation to population potential rather than population density. Changes in social and economic factors do not seem to explain the urban–rural differences in the period 1981–1983 and 1991–1993. Furthermore, the observed adverse trends in rural areas were generally not explained by changes in the use of particular methods of suicide or in coroners' classification of possible suicide deaths. The rises were most marked in 15–24-year-old females amongst whom there was a doubling in the rate of suicide in those living in the most rural locations. Explanations for this differential effect, if real, are unclear. Women living in more remote areas may have fewer employment opportunities and so may have less financial independence. In Australia, women living in more remote rural areas suffer higher levels of domestic violence (Strong, Trickett, Titulaer, & Bhatia, 1998), although to our knowledge, similar patterns have not been demonstrated in England and Wales.

Limitations

There are three main limitations to our analysis. Firstly, there is uncertainty as to what constitutes the multi-factorial notion of rurality. In the absence of a formal definition or generally accepted measure of rurality, a number of different single measures have been suggested of which the most commonly used are population size and population density (Martin et al., 2000). In Britain, the Office for National Statistics (ONS) has produced a multivariate area-classification scheme (Wallace & Denham, 1996) but it is not possible to use it in analyses such as these as it is based on a non-ranked classification of areas on the basis of their particular geographic and social characteristics.

Secondly, we may have failed to adequately control for the effects of rural deprivation. It has been suggested that aggregate deprivation indices, such as the Townsend score, were designed to measure urban deprivation and probably fail to capture the true levels of economic hardship experienced by people in rural settings (Watt & Franks, 1993; Cox, 1998). Furthermore, because of greater heterogeneity and smaller populations in rural areas, averages do not necessarily represent rural deprivation accurately (Barnett, Roderick, Wrigley, Martin, & Diamond, 2000; Haynes & Gale, 2000).

Lastly, the time period we looked at (trends in an 18-year period and modelling of change adjusted for socio-economic variables in a 10-year period) may not be long enough to capture important long-term trends.

Possible explanations for the increase in rural suicide

Research in Britain and elsewhere has highlighted rural–urban differences in access to health care (Watt & Franks, 1993) and lower utilisation of services (Martin, Sterne, Mangtani, & Majeed, 2001; Dudley et al., 1997) in rural areas. In Australia, for example, remote areas have fewer general practitioners and hospital specialists per capita and people need to travel further to access health care (Strong et al., 1998). Such differences are less acute in more densely populated countries such as Britain. Importantly, our interest here is in explaining rural–urban differences in *trends* in suicide. Relatively stable characteristics of areas, such as remoteness from health care facilities, are unlikely to underlie observed trends.

There are a number of possible explanations for the trends in suicide we observed. Firstly, it has been speculated that the decline of the rural economy may explain the patterns seen in Australia (Dudley et al., 1997; Wilkinson & Gunnell, 2000). While the number of people employed in agriculture is decreasing in the UK, economic declines in rural areas may not be adequately captured by unemployment figures as people in rural areas are less likely to register as unemployed and more likely to move in search of a job (Cloke, Milbourne, & Thomas, 1994). Between 1981 and 1991 the number of 15–24-year olds living in the most sparsely populated wards (bottom quartile of population density) decreased by 9%, whereas the decline was only 4% in the most densely populated wards (top quartile of population density). Over the same years, the number of 25–44-year olds increased by 13% in the most sparsely populated wards compared with an increase of 22% in the most densely populated areas. Such out-migration of young people may be a further burden on the social and

economic structure of some rural communities. Furthermore, migration may be selective with healthier individuals being more likely to move to urban areas in search of employment (Bentham, 1988; Brimblecombe, Dorling, & Shaw, 1999).

Secondly, it is possible that increases in house prices in rural areas, fuelled by the desire of more affluent individuals to acquire country retreats, has led to shortages in affordable housing stock for rural workers possibly forcing them to move (Urry, 1995; Dorling, 1999). This might result in the break up of communities and support networks. In our analysis, however, controlling for changing levels of socioeconomic deprivation and social fragmentation did not influence the strength of the associations we observed.

Lastly, although there is no consistent evidence of urban–rural differences in psychiatric morbidity (Judd et al., 2002), it is possible that, in relative terms, mental health or other factors influencing suicide risk in young adults may have deteriorated more in rural areas than urban areas in recent years. Patterns of help seeking for mental disorder too may differ in rural and urban areas because mental illness may be more stigmatised in rural communities. Such stigmatisation may act as a barrier for distressed adults who might otherwise have sought help from health care services (Gift & Zastowny, 1990). Adverse trends in population mental health, in both rural and urban areas, may therefore manifest themselves with greater rises in rural suicide if people are less likely to seek professional help for mental health problems in such areas

Suicide in farmers

In contrast to our findings for overall trends in rural suicide, a recent analysis of suicides in farmers, an occupational group at recognised increased risk of suicide, indicates that their rates of suicide in England declined between 1981 and 1993 (Hawton et al., 1999). This suggests that the trends we have found reflect more general patterns of suicide mortality in rural areas, rather than the effects of a specific occupational group on population trends. These patterns contrast with those reported in Australia where suicide rates in farm managers increased between 1988 and 1997, a trend which was associated with declines in the rural economy (Page & Fragar, 2002).

Conclusion

We have observed an adverse effect of rural residence on the risk of suicide in 15–44-year-old males and females in England and Wales since the 1980s. These patterns mirror those reported in Australia and Norway and do not appear to be due to changes in the levels of socioeconomic deprivation or social fragmentation in these areas. Further research is required to identify reasons for these trends in this country and elsewhere.

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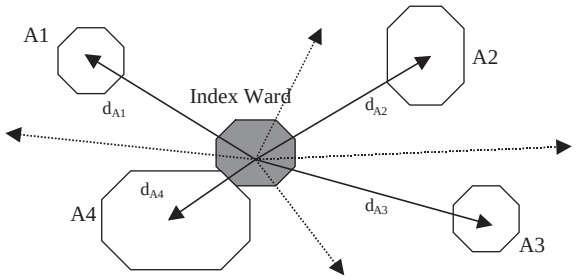
Appendix A. Calculation of population potential



To calculate the population potential for the index ward (shaded):

Let A1, A2, A3, A4, …Ai be all the other wards in Britain (including Scotland)

Ward A1 has population P_{A1} and its centre is d_{A1} kilometre away from the centre of index ward.

Ward A2 has population P_{A2} and its centre is d_{A2} kilometre away from the centre of the index ward…and ward Ai has population P_{Ai} and its centre is d_{Ai} kilometre away from the centre of the index ward.

Then,

Population potential $_{\text{of index ward}} = \Sigma_i(P_i/d_i)$ for i: all other wards in Britain.

The unit of population potential is people/metre.

In words, the population of each ward and the distance from its centre to the centre of the index ward is calculated. Then, each ward's population is divided by the distance of that population to the index ward. The sum of these is the population potential of the index ward. This is repeated for each ward in the country.

In effect this is a measure of remoteness since if ward A, for example, is only 1 km away from a ward with

population 10,000 people, this ward would add 10,000 people/1 km = 10 people/m to A's population potential. However, if A were 100 km away from this ward, it would only contribute 10,000/100 km = 0.1 people /m to A's population potential.

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