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Ethnic minority suicide: a small area geographical study in south London

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ABSTRACT

Background. The relationship between ethnicity and suicide risk is ill-understood. It is unclear whether, and if so, how, the ethnic mix of local areas affects risk in local individuals.

Methods. Coroners' records of 329 suicides were used to obtain ethnic (White, Afro-Caribbean, Asian) suicide rates in South London (population 902008) for 1991–3. Geographical variation and associations of ethnic suicide rates with small area (mean population 8274) ethnic densities (proportion of residents of given ethnic groups) and deprivation, were examined with random effects Poisson regression.

Results. Adjusted for deprivation, age and gender, suicide rates in wards with larger minority groups were higher among Whites (relative rate (RR) per standard deviation (S.D.) increase in minority density 1·18; 95% CI 1·02–1·37) but lower among minority groups (RR 0·75 (0·59–0·96)) (LR-test for interaction $\chi^2 = 9{\cdot}2$ (df = 1); $P = 0{\cdot}003$). Similar patterns were also apparent for Afro-Caribbeans and Asians separately. With White suicide rates as baseline, ethnic minority status is a risk factor for suicide in wards with small, but a protective factor in neighbourhoods with large minority populations. The RR of minority *versus* White suicide declines with a factor (relative RR) 0·67 (0·51–0·87) per S.D. increase in local minority density.

Conclusions. Minority suicide rates are higher in areas where minority groups are smaller. This effect is ethnic-specific and not due to confounding by gender, age, deprivation or unbalanced migration. Dependent on address, a suicide risk factor for a White individual may protect an ethnic minority individual and vice versa. This has implications for research and prevention.

INTRODUCTION

Ethnicity is an important variable in suicide research (Holinger, 1979; Griffith, 1989). Although, in the US as well as the UK, rates are low among Black and high among certain Asian groups (Centers for Disease Control, 1991; Raleigh & Balarajan, 1992; Sorenson & Shen, 1996; Neeleman *et al*. 1997), it is unclear whether this also applies at the local level. Risk of adverse health outcomes in minority groups, ethnic or otherwise, has been suggested to vary inversely with their relative size locally (Farris & Dunham, 1939; Wechsler & Pugh, 1967; Rabkin, 1979; Halpern, 1993; Neeleman, 1998). This density hypothesis proposes that a better fit between individual and neighbourhood is associated with better health. As proportions of ethnic minority residents in local areas vary widely, in London boroughs from 5% to 45% (Balarajan & Raleigh, 1992), suicide risk associated with given ethnic backgrounds may differ according to the local ethnic mix.

This hypothesis would imply, if true, that the suicide risk of members of given ethnic groups will be higher in areas where they are fewer. Its demonstration would increase insight into sociocultural determinants of suicidal behaviour. However, tests of this hypothesis have focused exclusively on administrative incidence data of mental health outcomes other than suicide (Kraus, 1969; Rabkin, 1979; Cochrane & Bal, 1988) and are therefore subject to biases

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such as ethnic differences in help-seeking (Gillam *et al*. 1989). The present study, in 109 wards in south London, examined whether suicide rates of given ethnic groups rise from low in neighbourhoods with many, to high in areas with few members of that group. Analyses were adjusted for gender but also for variation of age structure and deprivation of local populations, as these are associated with ethnic density as well as with suicide (Jarman, 1983; Haskey, 1990; Balarajan & Raleigh, 1992; Gunnell *et al*. 1995).

METHOD

The study area

The study area consisted of the 109 electoral wards of the adjoining London boroughs Lewisham, Lambeth, Southwark and Greenwich (total $N = 902008$ of which 11% Afro-Caribbean (range 1%–27%) and 6% Asian (range 1%–21%)). Populations of the 109 wards range from 2733 to 14169 inhabitants (mean 8274) (Office for National Statistics, 1998). Proportions of ward populations represented by all minority groups combined (minority density), Afro-Caribbeans (Afro-Caribbean density) and Asians (Asian density) were computed. Correlations between minority and specific ethnic densities were high (Afro-Caribbean $\rho = 0{\cdot}923$; $P < 0{\cdot}001$) to moderate (Asian $\rho = 0{\cdot}338$; $P < 0{\cdot}001$) but Asians tended to live in other wards than Afro-Caribbeans (ρ(Asian − Afro-Caribbean density) $= 0{\cdot}045$; $P = 0{\cdot}078$). Local Jarman underprivileged area (UPA) scores were recalculated using all original variables (unemployment rates, overcrowding, unskilled workers, pensioners living alone, lone parents with children younger than 16 years, children younger than 5 years and migrants) excluding the ethnicity variable contained in this score (Jarman, 1983) so that density could be analysed separately from deprivation. The correlation between the original and the reformulated UPA scores was $\rho = 0{\cdot}990$; $P < 0{\cdot}001$, and between the original UPA minority density variable and the density variable used in the present analyses (calculated from census data), $\rho = 0{\cdot}948$; $P < 0{\cdot}001$. Associations of local deprivation were moderate with minority ($\rho = 0{\cdot}553$; $P < 0{\cdot}001$) and Afro-Caribbean ($\rho = 0{\cdot}408$; $P < 0{\cdot}001$) and weak with Asian density ($\rho = 0{\cdot}248$; $P = 0{\cdot}009$). All variables were standardized to the entire set of 109 so that relative suicide rates represent change associated with one S.D. increase of predictor variables.

The suicides

Details of all unnatural deaths of study area residents which occurred between 1 January 1991 and 31 December 1993 were obtained via local coroners and the Office for National Statistics (ONS). Deaths were considered as suicides if suicide verdicts had been given, suicide notes had been found, methods unambiguously indicated suicide and/or communications of suicidal intent had been recorded. The reliability of this method of establishing suicide as cause of death was assessed by comparing ratings given by two independent psychiatrists to a subsample of 50 consecutive unnatural deaths (16 suicide, 19 open, 11 accidental and four drug abuse verdicts; 44 Whites and six non-Whites); κ was 0·96, indicating high inter-rater agreement. The postcodes of the 329 cases of imputed suicide (172 suicide, 19 accidental, one drug dependence and 137 open verdicts) were used to link them to electoral wards so that they could be related to ethnic, gender and age specific person years at risk in their locality. Ethnicity was established by searches of coroners' inquests, police records and post-mortem photographs, and coded according to ONS census categories (Balarajan & Raleigh, 1992) but for the purpose of analysis grouped as White, Afro-Caribbean (referring to the categories Black-Caribbean and other Black), Asian and other. Ethnicity remained uncertain for six male deaths, which were excluded from comparisons between ethnic groups. Sex- and age-specific person-years at risk for the ethnic groups in the 109 wards were obtained from the 1991 census (ONS, 1998).

Statistical analysis

To assess the possible role of age as a confounder, we examined, as a preliminary to further analyses, whether, and how, age structure of the ethnic populations varied with local deprivation and ethnic mix. Logistic regression was used for this, modelling associations of local density and deprivation scores with, as the outcome, proportions of the respective local ethnic populations under 41 years of age.

As suicide counts over the wards varied more than expected on the basis of a pure Poisson

distribution (the variance of counts (0·095) being larger than their mean (0·083)), data were analysed with random effects Poisson regression adjusted for clustering of rates at ward level. This procedure adjusts for extra-Poisson geographical rate variation for reasons unrelated to the variables specified in the model (Stata Corporation, 1997) and gives suicide rate ratios (RR) with 95% confidence intervals (CI) associated with one standard deviation (S.D.) increase in the standardized independent variables (ward deprivation and density levels). Heterogeneity of overall rates across wards was examined prior to further analyses. Age and gender adjusted associations of suicide rates with deprivation and density were modelled and adjusted for confounding and effect modification by the deceased's minority (White *v*. non-White) and ethnic (White *v*. Afro-Caribbean *v*. Asian) group. The likelihood ratio test for interaction (LRI) was used to examine whether the minority (ethnic) densities in the wards modified strength of association between minority (ethnic) status and suicide risk.

Associations between RRs of suicide of ethnic minority groups (with reference to Whites) and ethnic minority densities were modelled giving a ratio of relative rates. This measure represents the degree of change of the relative suicide rate of minority *versus* White groups associated with one S.D.'s shift in ethnic or minority density. Actual values of RRs were also calculated for wards in ascending quartiles of the density distributions.

The impact of spatial autocorrelation (inflation of correlations due to similarity of adjoining areas (Richardson, 1992)) was assessed by comparing models adjusted for clustering at ward level with models adjusted for clustering at a higher level of aggregation. For this purpose three or four adjoining wards were aggregated giving 36 (instead of 109) clusters with a mean population size of 25053 (instead of 8274). In the presence of spatial autocorrelation, associations should be stronger in analyses based on the smaller aggregation level.

RESULTS

Populations were younger in more deprived wards. Proportions of residents 40 years or younger, rose, per S.D. increase in deprivation, with factors (odds ratios) of 1·13 (1·12–1·13) among Whites, 1·18 (1·15–1·21) among Asians and 1·09 (1·07–1·11) among Afro-Caribbeans. In wards with more Afro-Caribbeans, this group tended to be older, the proportion of over 40 years olds increasing by a factor 1·23 (1·22–1·25) per S.D. increase in Afro-Caribbean density. The same held for Whites, proportions of White residents younger than 41 increasing by a factor 1·13 (1·12–1·13) per S.D. decline in minority density. The reverse obtained for Asians, proportions of Asian residents younger than 41 years rising by a factor 1·02 (1·002–1·03) per S.D. increase in Asian density.

Suicide rates also varied with age. Compared to the elderly (> 60 years; $N = 54$ suicides), rates of people aged between 40 and 59 years ($N = 101$ suicides) were 1·74 (1·28–2·36) higher, of those aged between 25 and 39 years ($N = 142$ suicides), 1·75 (1·30–2·37) times higher, and of the under 25 years old ($N = 32$ suicides), 3·1 (2·0–4·73) times lower. Female suicide rates ($N = 103$ suicides) were 0·41 (0·33–0·51) times those of men.

Rates were heterogeneous across the 109 wards both before (LR test for heterogeneity $\chi^2 = 139{\cdot}1$; df $= 108$; $P = 0{\cdot}024$) and after standardization for age and gender (LR test for heterogeneity $\chi^2 = 137{\cdot}8$; df $= 108$; $P = 0{\cdot}028$).

There was a positive association between local deprivation and suicide rates but this failed to reach statistical significance (crude RR, 1·09 (0·97–1·22), $P = 0{\cdot}139$; gender and age adjusted RR, 1·11 (0·99–1·27), $P = 0{\cdot}076$; gender and age adjusted at a higher aggregation level, RR, 1·12 (1·01–1·24), $P = 0{\cdot}043$). This association increased in strength after adjustment for the deceased's minority status (White *v*. non-White) (crude RR, 1·12 (0·99–1·26), $P = 0{\cdot}065$; gender and age adjusted RR, 1·13 (1·00–1·27), $P = 0{\cdot}048$; gender and age adjusted at a higher aggregation level RR, 1·13 (1·01–1·27), $P = 0{\cdot}031$). These associations were not modified by the deceased's gender (LRI $\chi^2 = 0{\cdot}2$; df $= 1$; $P = 0{\cdot}621$), age (LRI $\chi^2 = 2{\cdot}4$; df $= 3$; $P = 0{\cdot}592$) or ethnic minority status (LRI $\chi^2 = 0{\cdot}3$; df $= 1$; $P = 0{\cdot}592$).

Overall suicide rates were higher in wards with higher minority and specific ethnic densities but not significantly so. Overall associations were weakened further after adjustment for local deprivation (Table 1, col 2). Adjustment

Table 1. *Age and gender adjusted association of suicide rates in White and non-White groups with minority and ethnic densities, before and after adjustment for deprivation levels; random effects Poisson regression adjusted for rate clustering at ward* (N = 109) *level*

Suicide rate (/10^5); 95% CI	All ($N = 329$) 12·4 (11·5–13·4)	White ($N = 274$) 13·1 (11·6–14·7)	Non-White ($N = 49$) 8·6 (6·4–11·4)
Relative Rate (95% CI) per S.D.'s increase in minority density	Unadjusted for ward deprivation		
	1·09 (0·98–1·23)[g]	1·20 (1·07–1·36)[a]	0·81 (0·63–1·03)[a]
	Adjusted for ward deprivation		
	1·08 (0·94–1·25)	1·18 (1·02–1·37)[b]	0·75 (0·59–0·96)[b]
Suicide rate (/10^5); 95% CI	All ($N = 329$) 12·4 (11·5–13·4)	White ($N = 274$) 13·1 (11·6–14·7)	Afro-Caribbean ($N = 16$) 5·5 (3·2–9·0)
Relative Rate (95% CI) per S.D.'s increase in Afro-caribbean density	Unadjusted for ward deprivation		
	1·07 (0·98–1·19)[h]	1·17 (1·04–1·32)[c]	0·72 (0·40–1·28)[c]
	Adjusted for ward deprivation		
	1·04 (0·92–1·17)	1·14 (1·00–1·29)[d]	0·77 (0·46–1·27)[d]
Suicide rate (/10^5); 95% CI	All ($N = 329$) 12·4 (11·5–13·4)	White ($N = 274$) 13·1 (11·6–14·7)	Asian ($N = 23$) 15·9 (10·1–23·8)
Relative Rate (95% CI) per S.D.'s increase in Asian density	Unadjusted for ward deprivation		
	1·09 (0·98–1·20)[i]	1·11 (1·01–1·22)[e]	0·80 (0·56–1·15)[e]
	Adjusted for ward deprivation		
	1·07 (0·97–1·18)	1·09 (0·99–1·21)[f]	0·78 (0·51–1·19)[f]

Interactions
Minority status-density
[a] LRI $\chi^2(1) = 9{\cdot}4$; $P = 0{\cdot}002$. [b] LRI $\chi^2(1) = 9{\cdot}2$; $P = 0{\cdot}003$.
Afro-Caribbean status-density
[c] LRI $\chi^2(1) = 3{\cdot}5$; $P = 0{\cdot}061$. [d] LRI $\chi^2(1) = 3{\cdot}4$; $P = 0{\cdot}065$.
Asian status-density
[e] LRI $\chi^2(1) = 2{\cdot}8$; $P = 0{\cdot}092$. [f] LRI $\chi^2(1) = 2{\cdot}3$; $P = 0{\cdot}128$.

[g] Adjustment at higher ($N = 36$) level of aggregation 1·11 (0·99–1·24).
[h] Adjustment at higher ($N = 36$) level of aggregation 1·09 (0·97–1·19).
[i] Adjustment at higher ($N = 36$) level of aggregation 1·09 (0·98–1·21).

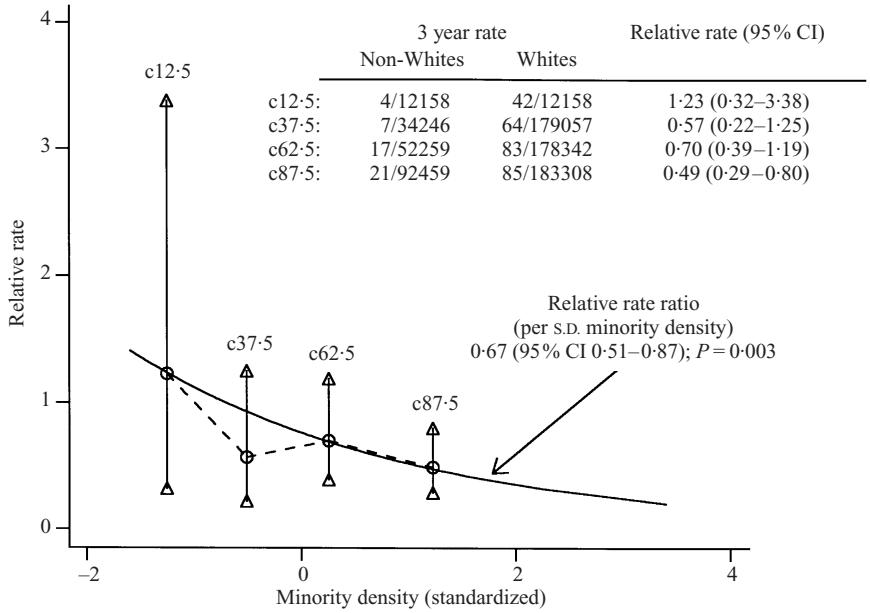

FIG. 1. Relative suicide rate of ethnic minority groups by local minority density (baseline Whites). Actual values in four quartiles and gender, age and deprivation adjusted fitted values.

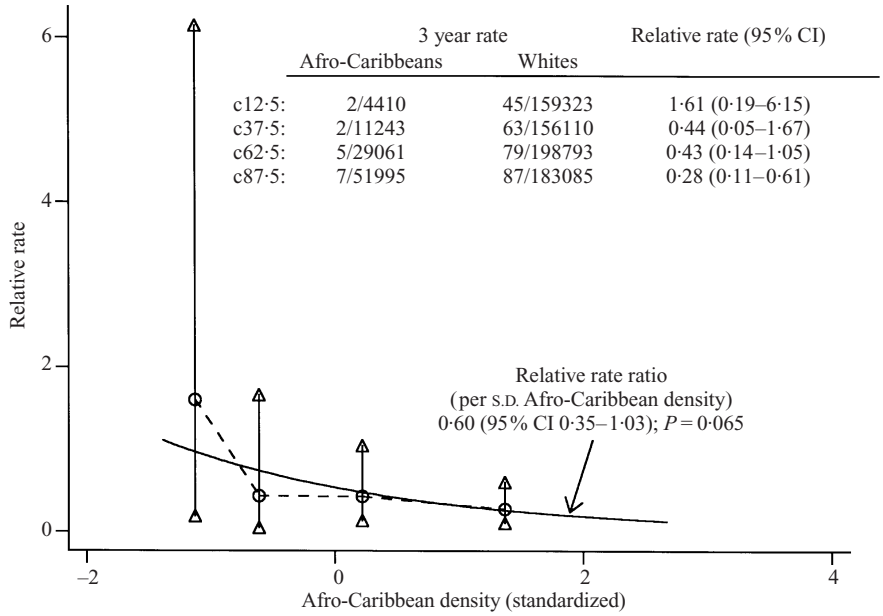

FIG. 2. Relative suicide rate of Afro-Caribbeans by local Afro-Caribbean density (baseline Whites). Actual values in four quartiles and age, gender and deprivation adjusted fitted values.

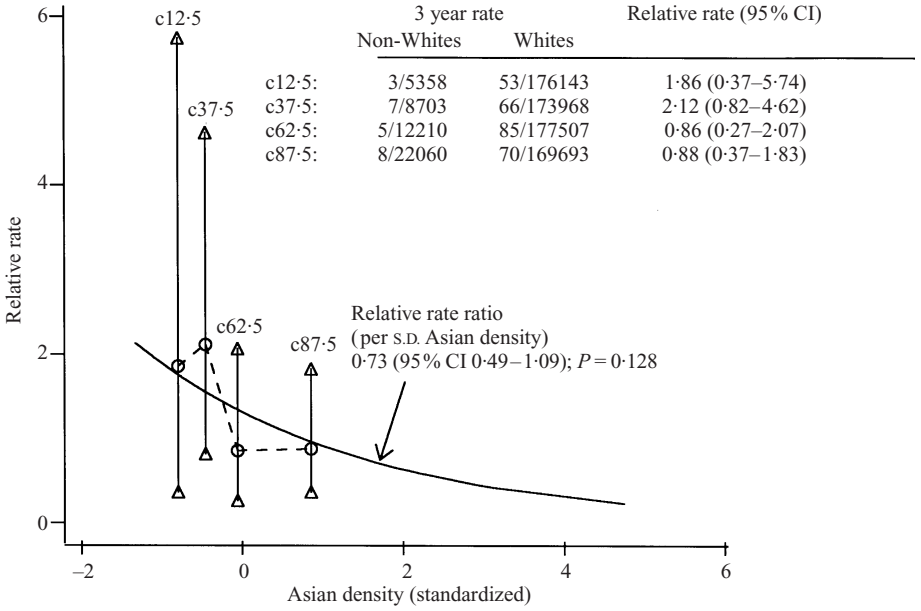

FIG. 3. Relative suicide rate of Asian groups by local Asian density (baseline Whites). Actual values in four quartiles and age, gender and deprivation adjusted fitted values.

for the deceased's minority status resulted in a positive association between minority density and White, and a negative association between minority density and minority suicide rates. The same pattern of positive associations of ethnic densities with White and negative associations

with ethnic suicide rates was apparent for the Afro-Caribbean group and the Asian groups separately although results of the LRI tests were not strictly significant at the 5% level. There was no evidence that spatial autocorrelation inflated measures of association.

As suicide rates in minority and ethnic groups are lower, and those of Whites higher in neighbourhoods with relatively more ethnic minority inhabitants, and vice versa, it follows that, with White suicide as the baseline, ethnic minority background protects against suicide in areas where more residents are of ethnic minority background. The opposite obtains in predominantly White areas where minority individuals are at higher risk than Whites. Figs. 1–3 show RRs as a function of local minority and ethnic densities.

DISCUSSION

Ethnic minority suicide rates are lower in areas where proportionally more inhabitants are members of those groups. This is the first evidence to support the ethnic density hypothesis applied to completed suicide. Suicide is an important mental health outcome that is relatively uncontaminated by differential recognition and presentation rates in various ethnic groups, contrary to mental illness admission rates on which previous evidence relating to ethnic density effects is based. The results also suggest that the density effect is specific for individual ethnic groups and not merely an association of minority status.

Individuals' minority status modified the association of suicide with minority density but not with local deprivation levels even though these ecological variables are moderately strongly correlated at the ward level. This suggests that the density effect relates to ethnic minority status rather than socio-economic deprivation.

The density effect is a special example of what has been described, elsewhere, as ecological effect modification (Greenland & Morgenstern, 1989), dependence of the strength of risk-outcome associations in individuals, on characteristics of their local context. In ecological studies of suicide rates (e.g. Durkheim, 1951; Gunnell *et al*. 1995), information on individual exposure to risk is not available so that they cannot address how risk factors at different levels of aggregation interact. Ecological effect modification implies that associations that hold at the macro-level, may not reflect those at the level of individuals. The present study, benefiting from information on ethnicity at the ecological as well as the individual level, demonstrates that ecological effect modification may in fact lead to reversal of associations from one level of aggregation to the next; high ethnic density is a (weak) ecological risk factor for higher overall suicide rates but individual ethnic minority individuals are at relatively low risk when they live in wards that carry the highest ecological risk.

Positive ecological association between rates of (attempted) suicide and deprivation in small areas has been reported (Platt & Kreitman, 1984; Gunnell *et al*. 1995). In the present study this association was strictly significantly only after adjustment for suicide victims' ethnic group. Although the absolute effect of this adjustment was small, it can be considered an example of negative ecological confounding. Deprivation levels are higher but suicide rates often lower among ethnic minority compared to White individuals which obscures the real extent to which deprivation is positively associated with suicide rates at the macro-level.

Ethnicity is a problematical variable in medical research (Aspinall, 1995) and any classification, including the one used here, will attract criticism. Within the groups studied, Afro-Caribbean, White and Asian, large heterogeneity exists. Furthermore, mixed race origin could not be taken into account. Ideally, it should be left to subjects themselves to define their own ethnic group as was done in the 1991 census in the United Kingdom. Given that the subjects in the present study were not in a position to do so, we had to rely on second-hand material including post-mortem photographs. This is the only way to examine the relation between ethnicity and suicide as coroners do not record ethnicity. However, the main thrust of this study was a comparison of local rates within rather than between groups and misclassification of ethnic group is unlikely to have been non-random with respect to electoral ward, the exposure variable of interest.

Non-random migration is a particular methodological problem affecting small area

studies (English, 1992). The variation of age structures across the wards suggests that older people, of any ethnic background, tend to move to, or stay in, less deprived areas. Older Afro-Caribbeans and Whites, contrary to the young, tend to move to, or stay in, wards with relatively larger Afro-Caribbean and White populations respectively. Despite these associations of the respective populations' age structures with the risk factors of interest, adjustment of the analyses for age clearly indicated that inter-area age differences, whether or not associated with non-balanced migration, cannot account for the density effects we observed. The fact that rates of suicide, in this inner city area, are higher among middle-aged than older groups has been commented on before (Neeleman *et al*. 1997).

Deaths were classified as suicides on the balance of probabilities (O'Donnell & Farmer, 1995) irrespective of coroners' verdict. It would not have been correct to study only those deaths which coroners had classified as suicide because this would have introduced bias; coroners under-register ethnic minority suicides (Kolmos & Bach, 1987; Neeleman *et al*. 1997). Conversely, inclusion of all undetermined deaths would have overestimated ethnic minority suicide (Sorenson *et al*. 1997). The adopted method of assigning cause of death was reliable given the high inter-rater agreement obtained. In 20 non-suicide verdict cases included in this study, suicide notes had nevertheless been found, which emphasizes the unreliability of coroners' verdicts. No minority deaths were classified differently by the two raters (one of whom was, initially unaware of the study's focus on ethnic group), which suggests that ethnicity assignment was unbiased by cause of death assignment.

The official suicide count for the three Inner London Boroughs in 1993 was 48 (Department of Health, 1995), while we identified 51 suicide verdicts for this area in the same year. This discrepancy is a likely result of the fact that, until recently, the Office for National Statistics classified deaths by year of registration rather than of death.

Numbers of deaths were low in some of the groups and this may limit the stability of the findings. This emphasizes the need for further, independent replication of our investigation but it should be noted that electoral wards, and not individual deaths, were units of observation in this analysis. More precise estimates of the main outcomes in this study, interaction terms between ethnicity of deceased individuals and ethnic densities in their neighbourhoods, could have been achieved in a study of a larger area but not necessarily when there would have been more deaths in the study area reported on here.

The present data cannot help distinguish between the various possible mechanisms that underly ethnic density effects. Increased social cohesion in larger more homogenous local ethnic groups may buffer against effects of local deprivation and other suicide and mental illness risk factors (Farris & Dunham, 1939; Jones-Webb & Snowden, 1993). However, selection effects may also play a role as the tendency to settle outside one's own subculture, even if this implies upward social mobility, might theoretically be associated with pre-existent vulnerabilities (Dohrenwend & Dohrenwend, 1981). Further research with more detailed, longitudinal, individual-level data are needed to determine the relative contributions of social selection and causation effects to the ethnic density phenomenon.

Conclusion

Density phenomena help understand the geographical distribution of suicide. Ethnic suicide rates are lower, and White suicide rates higher in areas where more ethnic minorities live and this is independent of deprivation or age effects. This has important implications for research and, possibly, prevention. Relative rates of suicide in ethnic groups with respect to Whites for large areas such as entire countries (Raleigh & Balarajan, 1992; Gunnell & Frankel, 1994) tell only part of the story. By extension, this applies to risk factors other than ethnicity as well; a good example is unemployment whose association with suicidal behaviour is stronger when unemployment is rare (Platt & Kreitman, 1984). The essential finding that relative risks are not stable across areas but variable according to local context conflicts with the prevalent view of relative risks as stable indicators of aetiological force across populations (Breslow & Day, 1980). It remains to be seen whether relative risks for other psychiatric outcomes suffer from this same context-dependence. The results imply that it is difficult to apply the frequently made distinction between high-risk and population-based stra-

tegies of prevention (Rose, 1981) to suicide (Gunnell & Frankel, 1994; Lewis *et al*. 1997) since a risk factor may confer high risk in one area and low risk elsewhere.

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