EVIDENCE-BASED PUBLIC HEALTH POLICY AND PRACTICE

The area-level association between hospital-treated deliberate self-harm, deprivation and social fragmentation in Ireland

Paul Corcoran, Ella Arensman, Ivan J Perry

J Epidemiol Community Health 2007;**61**:1050–1055. doi: 10.1136/jech.2006.055855

See end of article for authors' affiliations

Correspondence to: Paul Corcoran, National Suicide Research Foundation, 1 Perrott Avenue, College Road, Cork, Ireland; paul.nsrf@iol.ie

Accepted 5 February 2007

Background: The extensive literature on the area-level association between socioeconomic characteristics and suicide indicates that the more deprived and socially fragmented an area, the higher its suicide rate. Relatively few studies have examined the association between the incidence of non-fatal suicidal behaviour and area characteristics.

Aim: This study investigated the area-level association between hospital-treated deliberate self-harm, deprivation and social fragmentation in Ireland.

Methods: During 2002–2004, the Irish National Registry of Deliberate Self Harm collected data on self-harm presentations to 38 of Ireland's 40 hospital accident and emergency (A&E) departments, using a standardised methodology that included geocoding patient addresses to small-area level. Annual deliberate self-harm incidence rates and levels of deprivation and social fragmentation were examined nationally and by geographic area. Negative binomial regression was used to investigate the small-area association between deliberate self-harm, deprivation and social fragmentation.

Results: During 2002–2004, an estimated 32 777 deliberate self-harm presentations to A&E departments were made by 25 797 individuals. The total, male and female annual incidence rates were 204, 172 and 237 per 100 000, respectively. There were striking geographic differences in deliberate self-harm presentation rates which were largely explained by the distribution of deprivation, fragmentation, age and gender, and interactions between these factors. Deprivation, rather than fragmentation, had the stronger independent effect on small-area rates of self-harm.

Conclusions: The highest rates of hospital-treated deliberate self-harm in Ireland are in deprived urban areas. Priority should be given to these areas when implementing community-based interventions aimed at reducing suicidal behaviour.

There is extensive literature on the area-level association between socioeconomic characteristics and suicide. A systematic review of the literature dating from 1897 to 2004 identified and examined 86 publications with 221 separate analyses.[1] Almost half (45%) of the analyses reported a significant association that in most cases (70%) indicated that the poorer the socioeconomic standing of an area, the higher its suicide rate.

Arising from his development of the concept of anomie, Durkheim considered social regulation and integration to be more relevant to suicide than socioeconomic factors.[2] Congdon developed a census-based index of ''anomie'' or social fragmentation,[3] and this has been used to show that the association between fragmentation and suicide rates is independent of and stronger than the association with area deprivation.[4–7]

Despite being a major public health problem in its own right and far more common than suicide,[8 9] relatively few studies have examined the ecological association between the incidence of non-fatal suicidal behaviour and area characteristics. Furthermore, the small-area studies conducted so far have been confined to a city or region.[4 10–14] This is most probably because, in contrast to suicide, data relating to the incidence of non-fatal suicidal behaviour are not routinely available. The studies have generally found that the greater the level of deprivation or social fragmentation, the higher the rate of non-fatal suicidal behaviour, with deprivation having the stronger independent association.[4 12]

Ecological studies of suicidal behaviour and both deprivation and fragmentation have also found evidence of effect modification by geographic area, gender and age. For example, area deprivation was found to have a stronger association with suicide in Outer London than in Inner London[4] and with male rather than female rates of suicide[3] and deliberate self-harm.[12] Social fragmentation has been shown to be more strongly associated with suicide rates of middle-aged adults than with suicide rates of the young or elderly.[6 7]

Ireland has recently established a national registry of deliberate self-harm presentations to hospital Accident and Emergency (A&E) departments, the first of its kind in the world. We utilised data from the Irish National Registry of Deliberate Self Harm to investigate the area-level association between deliberate self-harm, deprivation and social fragmentation.

METHODS

The Irish National Registry of Deliberate Self Harm

The Registry aims to collect information on all deliberate self-harm presentations to the 40 hospital A&E departments in Ireland. For the study period 2002–2004, the Registry collected complete data from 34 hospitals and partial data from three hospitals in 2002, and complete data from 37 and 38 hospitals in 2003 and 2004, respectively. The definition of deliberate self-harm used is that developed by the former World Health Organisation (WHO)/Euro Multicentre Study on Parasuicide.[15]

> ''An act with a non-fatal outcome, in which an individual deliberately initiates a non-habitual behaviour that, without intervention from others, will cause self-harm, or deliberately

Abbreviations: A&E, Accident and Emergency; ED, electoral division

> ingests a substance in excess of the prescribed or generally recognised therapeutic dosage, and which is aimed at realising changes which the subject desired via the actual or expected physical consequences''.

While the definition was associated with the term parasuicide, the Registry utilises the term deliberate self-harm. All data are collected by registration officers who operate independently of the hospitals and follow the Registry's standardised methodology, described in detail in its Annual Reports.[16] This includes geocoding the addresses of self-harm patients to small-area level using the Irish Central Statistics Office Townland/Street Index.

Setting

The population of the Republic of Ireland was 3 917 203 according to the 2002 National Census.[17] The country is made up of 26 counties and, at the small-area level, 3422 electoral divisions (EDs). Dublin is by far the largest city and its expansion has urbanised almost all of Dublin county where 29% (1 122 821) of the country resides. Accordingly, and because the partial coverage of the Registry was due to Dublin hospitals, we treated Dublin county separately in all area-based analysis. Only data for the year 2004 were used for Dublin as just one major general hospital and one paediatric hospital did not participate that year. Based on the data from neighbouring hospitals, the number of persons presenting to the non-participating hospitals with deliberate self-harm was estimated and used in the calculation of incidence rates. The catchment area of the non-participating hospitals was excluded from the small-area analysis, leaving 187 Dublin EDs with a population of 635 887.

There are four other cities in Ireland (Cork, Galway, Limerick and Waterford), together consisting of 170 EDs and accounting for 7% (287 511) of the country's population. There are 54 urban districts across the country, consisting of 100 EDs and accounting for 11% (437 084) of the population. The remaining 2830 EDs in the country make up the rural districts where more than half of the country's population lived (2 069 787, 53%).

Deprivation

We used the Irish National Deprivation Index for Health and Health Services Research, calculated based on data from the 2002 National Census.[18] It is similar in design to the Townsend index employed in the UK,[19] with modifications in view of differences in definition and scope between census variables in the UK and Ireland. Principal components analysis was employed to construct a weighted combination of indicators of unemployment, social class, type of housing tenure, car ownership and overcrowding available for the 3422 EDs in Ireland. The first principal component provides a deprivation score for each ED.

Social fragmentation

The Irish Central Statistics Office Small Area Population Statistics arising from the 2002 National Census were obtained. The following four indicators of social fragmentation were calculated at ED level: percentage of persons (15 years or older) unmarried; percentage of single person households; percentage of persons in private rented accommodation; and percentage of persons at a different address 1 year ago. Congdon's measure of social fragmentation was calculated for all EDs by summing the z-scores of each indicator.[3]

Incidence rates

Annual incidence rates per 100 000 population were calculated for the total, male and female populations based on the number of individuals (rather than episodes) who presented to hospital following deliberate self-harm in each calendar year. Rates for geographically defined areas were based on the number of persons resident in the area who presented with deliberate self-harm irrespective of whether they were treated in that area or elsewhere. Population data based on the 2002 National Census were used for 2002 and the annual population estimates were used for 2003–2004.[17,20] Assuming that the number of individuals presenting with self harm (x) followed a Poisson distribution, 95% CIs for the rates were calculated using the normal approximation—that is, $CI = (x \pm 2\times\sqrt{x}) \times 100\,000/\text{population}$.

Small-area data analysis

For 3% of all deliberate self-harm presentations, no address was geocoded. The 7% of presentations by residents of institutions such as prisons and hospitals, or by homeless people or by non-residents of the country were not included in the small-area analysis. The small-area analysis was further confined to the 15–64 year age range, which accounted for 96% of all presentations. The limited number of cases of those in the large populations younger than 15 years or older than 65 years gives rise to very low rates. Seeking to explain variation in these rates at ED level was deemed to be of limited value.

One-way analysis of variance was used to investigate whether levels of deprivation and social fragmentation differed between Dublin, other cities, urban districts and rural districts. For each index, EDs were categorised as being in the lower, middle or upper tertile. This was first done for all EDs together and then separately for the EDs of Dublin, other cities, urban districts and rural districts. The number of persons resident in each ED who presented to hospital as a result of deliberate self-harm and the ED population was tabulated, for the total population aged 15–64 years and for men and women of two age groups, 15–39 years and 40–64 years.

Initially, Poisson regression analysis was carried out to model the number of individuals who presented with deliberate self-harm relevant to the ED populations. Goodness-of-fit tests indicated that the models did not fit the data well, which was likely to be due to extra-Poisson variation or overdispersion,[21] a common problem in the small area modelling of a relatively rare phenomenon. To overcome this problem, negative binomial regression models were fitted.[22,23]

Likelihood ratio tests based on negative binomial regression models were used to investigate whether the effects of deprivation and social fragmentation were modified by the type of area (Dublin, other city, urban district, rural district). For Dublin county, the effects of deprivation and fragmentation in the city EDs were compared with those in the suburban EDs. Further negative binomial regression models tested whether deprivation and fragmentation had different effects on the deliberate self-harm rates of men and women and of persons aged 15–39 years and 40–64 years.

Negative binomial regression analysis was then carried out separately for men and women aged 15–39 years and 40–64 years for the EDs of Dublin, other cities, urban districts and rural districts. The models used the classification of EDs into deprivation and social fragmentation tertiles that was relevant to the type of area. Except for the single county of Dublin, adjustment for spatial autocorrelation was made by indicating in the model that the EDs were clustered by county. A series of regression models were finally estimated based on all EDs to investigate the extent to which differences between the self-harm rates of Dublin, other cities, urban districts and rural districts could be explained by the distribution of deprivation, fragmentation, age and gender, and significant interactions between these factors. Estimated effects were reported as

incidence rate ratios with 95% CIs. All Poisson and negative binomial regression analyses were carried out using Stata 6.0.[24]

RESULTS

Incidence of deliberate self-harm

During the study period, 2002–2004, there were an estimated 32 777 deliberate self-harm presentations to A&E departments in Ireland made by 25 797 individuals (table 1). The annual incidence rate was 204 per 100 000. Women had a rate of 237 per 100 000, which was 38% higher than the male rate of 172 per 100 000. The incidence rate was relatively stable across the three study years, highest by a relatively small margin in 2003.

There were striking differences in the incidence of deliberate self-harm when examined by type of area (table 2). The total incidence rates in Dublin, other cities and urban districts were 10, 48 and 62% higher than the national rate, respectively, while the rural district population had a 32% lower rate. In Dublin and in the urban district population, the female rate was 36–37% higher than the male rate, similar to the 38% higher female rate nationally. Women had a 58% higher rate than men in rural districts, whereas the incidence of deliberate self-harm was almost identical in men and women in the cities outside of Dublin.

Levels of deprivation and social fragmentation

Levels of deprivation and social fragmentation differed between Dublin, other cities, urban districts and rural districts (table 2). On average, deprivation levels were lowest in the EDs of rural districts, somewhat higher in Dublin EDs and highest in the EDs of other cities and in urban districts. Rural district EDs also had the lowest levels of social fragmentation. Dublin EDs and urban districts had intermediate levels of fragmentation, whereas the EDs of the non-Dublin cities were highest.

Effect of deprivation and fragmentation on the incidence of deliberate self-harm

Considering the country as a whole, increased deprivation and social fragmentation were associated with increased rates of deliberate self-harm presentations by persons aged 15–64 years (table 3), with deprivation having the stronger independent effect.

Effect modification by type of area, gender and age

The likelihood ratio test arising from negative binomial regression models indicated that there was significant evidence that type of area modified the association between deprivation and deliberate self-harm rates ($\chi^2 = 17.79$, df = 4, p = 0.001). The effect of greater deprivation increasing the incidence of deliberate self-harm was weaker in rural districts than in other types of areas. Within Dublin, deprivation had a similar effect in city and suburban EDs ($\chi^2 = 0.70$, df = 2, p = 0.704). There was some evidence that deprivation had a greater effect on male rather than female rates of deliberate self-harm, though this interaction just failed to reach statistical significance ($\chi^2 = 5.69$, df = 2, p = 0.058). Deprivation did not interact with age in relation to self-harm rates ($\chi^2 = 2.93$, df = 2, p = 0.231).

Type of area also modified the association between social fragmentation and deliberate self-harm rates ($\chi^2 = 15.02$, df = 3, p = 0.002). The effect of greater fragmentation increasing the incidence of deliberate self-harm was not evident in Dublin. Within Dublin, the effect of fragmentation in the city EDs did not differ from that in the suburban EDs ($\chi^2 = 0.53$, df = 2, p = 0.769). Fragmentation did not interact with gender ($\chi^2 = 2.79$, df = 2, p = 0.248) but it did interact with age ($\chi^2 = 12.84$, df = 2, p = 0.002), being associated with a greater rate increase in deliberate self-harm by 40–64 year-olds than by 15–39 year-olds.

Independent effects of deprivation and fragmentation on the incidence of deliberate self-harm by type of area, gender and age

Because of the evidence of effect modification, the independent effects of deprivation and social fragmentation on the small-area rates of deliberate self-harm were estimated by age and gender for each of the four area types (table 4). In general, the effects of deprivation and social fragmentation estimated after adjustment for each other were not very different from the effects estimated before adjustment.

In almost all models, the independent effect of deprivation was statistically significant and stronger than that of social fragmentation. The direction of the association was the same throughout—increased deprivation associated with increased rates of deliberate self-harm. This effect was most pronounced among men and women of both age groups in Dublin and other cities.

Independent of deprivation, social fragmentation was only associated with increased rates of deliberate self-harm in the EDs of rural districts. The strength of the effect of social fragmentation equalled that of deprivation in these areas. Increased social fragmentation was associated with decreased rates of deliberate self-harm among young men and women in Dublin.

Explanation of area effects

The striking effects of type of area on the incidence of deliberate self-harm presentations to A&E were partly explained by the main effects of deprivation, fragmentation, age and gender, and further explained by interaction effects (table 5). The fully adjusted model showed that small but statistically significant effects remained for Dublin and urban districts. The least attenuation was observed for Dublin despite its modest crude effect.

DISCUSSION

This study showed that deliberate self-harm presentations to hospital A&E departments in Ireland is primarily an urban phenomenon, with marked geographic differences in incidence rates that were largely explained by the distribution of deprivation, fragmentation, age and gender, and interactions between these factors. Deprivation, rather than social fragmentation, had

Table 1 Annual incidence of hospital-treated deliberate self-harm in Ireland by gender, 2002–2004

	All			Men	Women
	Presentations	Persons	Rate (95% CI)	Rate (95% CI)	Rate (95% CI)
2002	10 503	8396	201 (196 to 205)	166 (160 to 172)	236 (229 to 243)
2003	11 182	8791	209 (204 to 213)	177 (171 to 183)	241 (234 to 248)
2004	11 092	8610	201 (197 to 206)	170 (164 to 176)	233 (226 to 239)
2002–2004	32 777	25 797	204 (201 to 206)	171 (168 to 175)	237 (233 to 241)

All rates are age-standardised per 100 000.

Table 2 Annual incidence of hospital-treated deliberate self-harm and level of deprivation and social fragmentation in Ireland by area type, 2002–2004

	Deliberate self-harm			Deprivation*	Social fragmentation*
	All	Men	Women		
	Rate (95% CI)	Rate (95% CI)	Rate (95% CI)	Mean (SD)	Mean (SD)
Dublin	224 (214 to 233)	189 (176 to 201)	258 (244 to 271)	0.30 (3.12)	3.86 (5.79)
Other cities	301 (288 to 313)	298 (280 to 316)	304 (287 to 322)	1.87 (3.02)	6.01 (6.61)
Urban districts	330 (319 to 341)	279 (265 to 294)	380 (364 to 396)	1.50 (1.03)	3.87 (1.70)
Rural districts	139 (136 to 142)	109 (105 to 113)	172 (167 to 177)	–0.25 (1.14)	–0.69 (1.68)
All	204 (201 to 206)	171 (168 to 175)	237 (233 to 241)	–0.08 (1.57)	0.00 (3.18)

All rates are age-standardised per 100 000.
* Mean and SD of the electoral division (ED) level of deprivation and social fragmentation. One-way analysis of variance, df = 3, 3237, $p<0.001$.

the stronger independent effect on small-area rates of self-harm, which is consistent with previous studies.[4 12]

This is the first national study of the association between area characteristics and the incidence of deliberate self-harm presentations to hospital. The analyses were based on data relating to >30 000 self-harm presentations made by approximately 25 000 individuals. All data were collected by registration officers operating in accordance with a standardised methodology.[16] The study considered whether the effects of deprivation and fragmentation were stable across geographic areas, something few ecological studies of suicidal behaviour have done.[4 14] That geographic area modified the ecological associations implies that the findings of city or regional studies may not generalise to other areas within a country, and findings from one country may not generalise to another.

The study focused on deliberate self-harm presentations to hospital A&E departments and hence did not include self-harm acts that were either untreated or treated in a different setting. As A&E departments are situated in urban centres, proximity to services may partly explain the higher rate of self-harm presentations by urban populations. Further work will be undertaken to establish the proportion of deliberate self-harm in the general population that results in presentation to hospital A&E departments and the association with proximity to services.

The study showed the incidence of persons presenting to hospital with deliberate self-harm to be lowest in rural districts, higher in Dublin and highest in other cities and urban districts (table 2). The study period was 2002–2004 but, because of incomplete coverage, only 2004 data were used for Dublin. While not presented, the study findings were not sensitive to this limitation. The same pattern of incidence rate differences was evident when only data for 2004 were considered. Similarly, for each type of area, the effects of deprivation and fragmentation on the age- and sex-specific rate of deliberate self-harm estimated based on 2004 data were consistent with those estimated for the study period (table 4).

Table 3 Incidence rate ratios (IRRs) (and the 95% CI) from the negative binomial regression of deliberate self-harm by persons aged 15–64 years on deprivation and social fragmentation in Ireland, 2002–2004

Explanatory variable	IRR† (95% CI)	IRR‡ (95% CI)
Deprivation tertile		
First	1.00	1.00
Second	1.15*** (1.06 to 1.24)	1.10* (1.01 to 1.20)
Third	2.14*** (1.85 to 2.48)	1.86*** (1.59 to 2.17)
Fragmentation tertile		
First	1.00	1.00
Second	1.23** (1.08 to 1.40)	1.07 (0.96 to 1.20)
Third	1.97*** (1.73 to 2.24)	1.52*** (1.34 to 1.73)

*$p<0.05$; **$p<0.01$; ***$p<0.001$. †Unadjusted effects of deprivation and social fragmentation. ‡Mutually adjusted effects of deprivation and social fragmentation.

The study limited itself to examining the area-level effects of composite measures of deprivation and social fragmentation. A number of English studies have demonstrated that composite deprivation indices, such as the one used in this study, are limited in their ability to identify rural deprivation at the small-area level.[25 26] This has also been suggested to be the case in Ireland,[27] although there is a lack of supporting empirical evidence. The absence of socioeconomic data at the individual level prohibited the carrying out of multilevel data analysis. As a consequence, we cannot conclude that the area effects noted here are more than an accumulation of risk factors at the individual level.

Analyses based on small areas more often show significant evidence that poor socioeconomic standing is associated with increased suicide.[1] Our analysis was based on small areas. The 3422 Irish EDs have a median population of 527 (range = 55–24 404) and 91% have fewer than 3000 residents. We stratified these EDs by geographic area, distinguishing between Dublin county, other cities, urban districts and rural districts. While this independent stratification has justification, it classifies many Irish towns and large suburban areas as rural. Recently in England and Wales, a new geographic hierarchy has been designed to improve the reporting of small-area statistics, and a harmonised classification of urban and rural areas has been produced.[28] Similar initiatives should be undertaken in Ireland to improve the geographic infrastructure for statistical and research purposes.

A weakness of the study relates to the reliability of the geocoding of the self-harm patients' addresses. Small-area postcodes do not exist in Ireland, and ethical constraints prohibit the Registry from involving commercial agencies in the geocoding of addresses. The Registry used the Irish Central Statistics Office Townland/Street Index, a limited database that cannot definitively determine the ED for an address on a street that crosses multiple EDs. In such cases, the local register of electors was consulted, but this is also a limited resource. Consequences of the Irish health services' inadequate geographic information systems (GIS) have previously been exemplified[29 30] and will remain an issue unless GIS resources are more readily available.

A notable finding was that increased social fragmentation was associated with reduced rates of deliberate self-harm among young men and women in Dublin. This may relate to the greater concentrations of young professionals in Dublin, people with low rates of self-harm who increase an area's level of social fragmentation by being unmarried, mobile and often living alone and/or in rented accommodation. That increased social fragmentation was associated with positive effects on the young adult population of Dublin runs counter to Durkheim's thinking[2] and warrants further investigation.

We have provided further evidence of the strong association between small-area levels of deprivation and deliberate

Table 4 Incidence rate ratios (IRRs) (and the 95% CI) from the negative binomial regression of deliberate self-harm on deprivation and fragmentation in Dublin, other cities, urban districts and rural districts in Ireland, 2002–2004

Population	Explanatory variable (reference = first tertile)	Dublin IRR (95% CI)	Other cities IRR (95% CI)	Urban districts IRR (95% CI)	Rural districts IRR (95% CI)
Men aged 15–39 years	Deprivation tertile				
	Second	1.61* (1.12 to 2.33)	1.69*** (1.35 to 2.11)	0.89 (0.58 to 1.38)	1.01 (0.86 to 1.19)
	Third	2.85*** (2.01 to 4.04)	3.01*** (2.69 to 3.36)	1.12 (0.70 to 1.81)	1.49*** (1.20 to 1.86)
	Fragmentation tertile				
	Second	0.96 (0.71 to 1.29)	1.03 (0.76 to 1.40)	1.37 (0.96 to 1.96)	0.98 (0.85 to 1.14)
	Third	0.55*** (0.40 to 0.76)	0.92 (0.71 to 1.18)	1.15 (0.80 to 1.64)	1.27* (1.04 to 1.55)
Men aged 40–64 years	Deprivation tertile				
	Second	1.35 (0.74 to 2.45)	3.92*** (2.56 to 5.99)	1.43* (1.01 to 2.02)	1.13 (0.91 to 1.40)
	Third	2.90*** (1.66 to 5.06)	5.75*** (3.18 to 10.39)	1.41* (1.01 to 1.96)	1.51*** (1.20 to 1.89)
	Fragmentation tertile				
	Second	1.33 (0.78 to 2.27)	1.05 (0.87 to 1.27)	1.32 (0.93 to 1.86)	1.20 (0.96 to 1.51)
	Third	1.64 (0.96 to 2.82)	1.56 (0.99 to 2.46)	1.24 (0.94 to 1.63)	1.59*** (1.27 to 1.99)
Women aged 15–39 years	Deprivation tertile				
	Second	1.51** (1.13 to 2.03)	1.73*** (1.27 to 2.36)	1.30 (0.99 to 1.70)	1.14* (1.02 to 1.29)
	Third	2.67*** (2.03 to 3.51)	2.46*** (2.17 to 2.79)	1.39* (1.03 to 1.86)	1.58*** (1.39 to 1.79)
	Fragmentation tertile				
	Second	0.77* (0.61 to 0.97)	1.06 (0.85 to 1.31)	1.15 (0.91 to 1.45)	1.09 (0.98 to 1.22)
	Third	0.57*** (0.45 to 0.73)	1.02 (0.83 to 1.26)	1.22 (0.93 to 1.62)	1.32*** (1.16 to 1.51)
Women aged 40–64 years	Deprivation tertile				
	Second	2.49*** (1.55 to 3.98)	2.25*** (1.87 to 2.71)	1.04 (0.69 to 1.57)	1.02 (0.83 to 1.24)
	Third	3.70*** (2.34 to 5.86)	4.23*** (3.50 to 5.12)	1.62* (1.06 to 2.48)	1.37** (1.11 to 1.68)
	Fragmentation tertile				
	Second	1.42 (0.95 to 2.11)	1.14 (0.99 to 1.30)	1.17 (0.83 to 1.66)	1.10 (0.95 to 1.29)
	Third	1.34 (0.88 to 2.03)	1.19 (0.87 to 1.62)	1.35 (0.91 to 2.01)	1.41*** (1.15 to 1.73)

*p<0.05; **p<0.01; ***p<0.001. Mutually adjusted effects of deprivation and social fragmentation.

self-harm, an association that is independent of social fragmentation and most notable within large urban centres. One ecological study showed some evidence of an independent association over time between changes in levels of deprivation and rates of deliberate self-harm,[31] but in general it has yet to be demonstrated that reducing deprivation in an area lowers self-harm rates. It has been suggested that this evidence may be provided by the quasi-experimental conditions by which city areas are subjected to urban renewal and regeneration schemes.[32] Ireland has experienced unprecedented economic growth over the past decade, but the available evidence points to an increase in the incidence of deliberate self-harm.[13 16 33] Small-area analysis of this trend is justified and may further clarify the ecological association between deprivation and deliberate self-harm.

Reducing area levels of deprivation will form part of economic and social policy irrespective of whether it has the added benefit of reducing the incidence of deliberate self-harm. Interventions aimed at reducing suicidal behaviour in specific areas include public awareness campaigns, education and training of primary care doctors, other relevant professionals and community gatekeepers, and the provision of crisis and/or health centres and helplines.[34–37] While the evidence of efficacy is limited,[34 36] knowing that the highest rates of self-harm presentations to hospital are due to deprived urban areas should lead to more targeted delivery of promising interventions and, consequently, more efficient use of resources. Further study of the ecological association between area characteristics and suicidal behaviour should improve our

Table 5 Incidence rate ratios (IRRs) (and the 95% CI) from the negative binomial regression of deliberate self-harm by persons aged 15–64 years on type of area, age, gender, deprivation and social fragmentation in Ireland, 2002–2004

Explanatory variable	IRR† (95% CI)	IRR‡ (95% CI)	IRR§ (95% CI)
Type of area			
Dublin	1.38** (1.12 to 1.70)	1.24** (1.07 to 1.44)	1.20** (1.05 to 1.38)
Other cities	2.42*** (1.98 to 2.97)	1.81*** (1.49 to 2.22)	1.02 (0.64 to 1.63)
Urban districts	2.83*** (2.48 to 2.23)	1.85*** (1.64 to 2.10)	1.34* (1.06 to 1.70)
Rural districts	1.00	1.00	1.00
Age			
15–39 years		1.00	1.00
40–64 years		0.50*** (0.46 to 0.55)	0.41*** (0.36 to 0.47)
Gender			
Male		1.00	1.00
Female		1.46*** (1.36 to 1.58)	1.57*** (1.49 to 1.66)
Deprivation tertile			
First		1.00	1.00
Second		1.18*** (1.08 to 1.28)	1.10 (0.99 to 1.21)
Third		1.77*** (1.55 to 2.02)	1.52*** (1.31 to 1.76)
Fragmentation tertile			
First		1.00	1.00
Second		1.07 (0.97 to 1.19)	1.01 (0.91 to 1.13)
Third		1.31*** (1.16 to 1.47)	1.34*** (1.18 to 1.51)

*p<0.05; **p<0.01; ***p<0.001. †Effects estimated by model including type of area only. ‡Effects estimated by model including type of area, age, gender, deprivation and social fragmentation. §Effects estimated by model including type of area, age, gender, deprivation, social fragmentation and terms representing the interactions between type of area and each of gender, age, deprivation and fragmentation, and between fragmentation and age.

What is already known on this subject

There is extensive literature on the area-level association between socioeconomic characteristics and suicide indicating that the more deprived and socially fragmented an area, the higher its suicide rate. Similar findings have arisen from the relatively few studies that have examined the association between the incidence of non-fatal suicidal behaviour and area characteristics.

What does this study add

Based on the first national registry of deliberate self-harm, this study showed that deliberate self-harm presentations to hospital A&E departments are primarily an urban phenomenon. There are marked geographic differences in incidence rates which are largely explained by the distribution of deprivation, fragmentation, age and gender, and interactions between these factors. The effects of deprivation and social fragmentation on small-area rates of deliberate self-harm were modified by geographic area, age and gender, which implies that the findings of city or regional studies may not generalise to other areas within a country and findings from one country may not generalise to another.

Policy implications

Priority should be given to deprived urban areas when implementing community-based interventions aimed at reducing suicidal behaviour.

understanding of the aetiology of suicidal behaviour and, in particular, the role environmental factors play in promoting and inhibiting the behaviour.

ACKNOWLEDGEMENTS

We would like to thank all those who have contributed to the Irish National Registry of Deliberate Self Harm, in particular the data registration officers. We would like to acknowledge the many hospital and health service personnel who have facilitated the work of the Registry. We would also like to thank Dr Alan Kelly and Conor Teljeur of the Small Area Health Research Unit in Trinity College Dublin. The Registry is funded by the Irish Government's Department of Health and Children through the National Office for Suicide Prevention.

Authors' affiliations

Paul Corcoran, Ella Arensman, National Suicide Research Foundation, 1 Perrott Avenue, College Road, Cork, Ireland
Ivan J Perry, Department of Epidemiology and Public Health, University College, Cork, Ireland

Competing interests: None.

Ethical approval for the Registry was granted by the Irish National Research Ethics Committee of the Faculty of Public Health Medicine. The Registry also received ethical approval from the relevant hospital and health service ethics committees.

REFERENCES

1 **Rehkopf DH**, Buka SL. The association between suicide and the socio-economic characteristics of geographical areas: a systematic review. *Psychol Med* 2006;**36**:145–57.
2 **Durkheim E**. *Suicide: a study in sociology* (translated by JA Spaulding and G Stimpson 1951). New York: Free Press, 1897, reprinted London: Routledge, 1993.
3 **Congdon P**. The epidemiology of suicide in London. *J R Stat Soc* 1996;**159**:515–33.
4 **Congdon P**. Suicide and parasuicide in London: a small-area study. *Urban Stud* 1996;**33**:137–58.
5 **Davey Smith G**, Whitley E, Dorling D, *et al*. Area based measures of social and economic circumstances: cause specific mortality patterns depend on the choice of index. *J Epidemiol Community Health* 2001;**55**:149–50.
6 **Middleton N**, Whitley E, Frankel S, *et al*. Suicide risk in small areas in England and Wales, 1991–1993. *Soc Psychiatry Psychiatr Epidemiol* 2004;**39**:45–52.
7 **Whitley E**, Gunnell D, Dorling D, *et al*. Ecological study of social fragmentation, poverty, and suicide. *BMJ* 1999;**319**:1034–7.
8 **Corcoran P**, Keeley HS, O'Sullivan M, *et al*. Parasuicide and suicide in the south-west of Ireland. *Ir J Med Sci* 2003;**172**:107–11.
9 **Skegg K**. Self-harm. *Lancet* 2005;**366**:1471–83.
10 **Buglass D**, Duffy JC. The ecological pattern of suicide and parasuicide in Edinburgh. *Soc Sci Med* 1978;**12**:241–53.
11 **Gunnell DJ**, Brooks J, Peters TJ. Epidemiology and patterns of hospital use after parasuicide in the south west of England. *J Epidemiol Community Health* 1996;**50**:24–9.
12 **Hawton K**, Harriss L, Hodder K, *et al*. The influence of the economic and social environment on deliberate self-harm and suicide: an ecological and person-based study. *Psychol Med* 2001;**31**:827–36.
13 **Kelleher MJ**, Kelleher MJA, Daly M, *et al*. Deliberate self-poisoning, unemployment and public health. *Suicide Life Threat Behav* 1996;**26**:365–73.
14 **Neeleman J**, Wilson-Jones C, Wessely S. Ethnic density and deliberate self harm; a small area study in south east London. *J Epidemiol Community Health* 2001;**55**:85–90.
15 **Platt S**, Bille-Brahe U, Kerkhof A, *et al*. Parasuicide in Europe: the WHO/EURO multicentre study on parasuicide. I. Introduction and preliminary analysis for 1989. *Acta Psychiatr Scand* 1992;**85**:97–104.
16 **National Suicide Research Foundation**. *National Parasuicide Registry Ireland Annual Reports 2002–2004*. Cork: National Suicide Research Foundation, 2003–2005.
17 **Central Statistics Office**. *Census 2002 volume I: population classified by area*. Dublin: Stationery Office, 2003.
18 **Kelly A**, Teljeur C. *A new national deprivation index for health and health services research*. Dublin: Small Area Health Research Unit, Trinity College Dublin, 2004.
19 **Townsend P**, Phillimore P, Beattie A. *Health and deprivation. Inequality and the north*. London: Croon Helm, 1988.
20 **Central Statistics Office**. *Population and migration estimates*. Cork: Central Statistics Office, 2004, 2005.
21 **Breslow NE**. Extra-Poisson variation in log-linear models. *Appl Stat* 1984;**33**:38–44.
22 **Hempstead K**. The geography of self-injury: spatial patterns in attempted and completed suicide. *Soc Sci Med* 2006;**62**:3186–96.
23 **Rezaeian M**, Dunn G, St Leger S, *et al*. The ecological association between suicide rates and indices of deprivation in English local authorities. *Soc Psychiatry Psychiatr Epidemiol* 2005;**40**:785–91.
24 **StataCorp**. *Stata Statistical Software: release 6.0*. College Station, TX: Stata Corporation, 1999.
25 **Barnett S**, Roderick P, Martin D, *et al*. A multilevel analysis of the effects of rurality and social deprivation on premature limiting long term illness. *J Epidemiol Community Health* 2001;**55**:44–51.
26 **Martin D**, Brigham P, Roderick P, *et al*. The (mis)representation of rural deprivation. *Environ Plann A* 2000;**32**:735–51.
27 **Pringle DG**. The geographical distribution of poverty in Ireland. *Rural Development Conference 2002: Signposts to Rural Change*. Tullamore, 12 February, 2002.
28 **Office for National Statistics**. http://www.statistics.gov.uk/geography/ons_geog.asp (accessed 10 Sept 2006).
29 **Houghton F**, Gleeson M, Kelleher K. The Askeaton Investigation and the failure of the Irish health information systems. *Irish Geography* 2003;**36**:145–52.
30 **Houghton F**, Kelleher K. Residence coding in the Hospital In-Patient Enquiry (HIPE) system: significantly worse than anticipated. *Irish Geography* 2002;**35**:95–8.
31 **Gunnell D**, Shepherd M, Evans M. Are recent increases in deliberate self-harm associated with changes in socio-economic conditions? An ecological analysis of patterns of deliberate self-harm in Bristol 1972–3 and 1995–6. *Psychol Med* 2000;**30**:1197–203.
32 **Johnston A**, Cooper J, Kapur N. Exploring the relationship between area characteristics and self-harm. *Crisis* 2006;**27**:88–91.
33 **Corcoran P**, Keeley HS, O'Sullivan M, *et al*. The incidence and repetition of attempted suicide in Ireland. *Eur J Public Health* 2004;**14**:19–23.
34 **Hegerl U**, Althaus D, Schmidtke A, *et al*. The alliance against depression: 2-year evaluation of a community-based intervention to reduce suicidality. *Psychol Med* 2006;**36**:1225–33.
35 **King E**, Frost N. The New Forest Suicide Prevention Initiative (NFSPI). *Crisis* 2005;**26**:25–33.
36 **Mann JJ**, Apter A, Bertolote J, *et al*. Suicide prevention strategies: a systematic review. *JAMA* 2005;**294**:2064–74.
37 **Pringle A**, Sayers P. It's a goal!: Basing a community psychiatric nursing service in a local football stadium. *J R Soc Health* 2004;**124**:234–8.