



HAL
open science

The social patterning of deaths due to assault in Scotland, 1980-2005: population based study

Alastair H Leyland, Ruth Dundas

► **To cite this version:**

Alastair H Leyland, Ruth Dundas. The social patterning of deaths due to assault in Scotland, 1980-2005: population based study. *Journal of Epidemiology and Community Health*, 2010, 64 (5), pp.432. 10.1136/jech.2009.095018 . hal-00557367

HAL Id: hal-00557367

<https://hal.science/hal-00557367>

Submitted on 19 Jan 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

**The social patterning of deaths due to assault in Scotland, 1980-2005:
population based study**

Alastair H Leyland, Programme Leader, and Ruth Dundas, Investigator Scientist
MRC Social and Public Health Sciences Unit, 4 Lilybank Gardens, Glasgow G12 8RZ,
Scotland.

Corresponding author: Alastair H Leyland

E-mail: a.leyland@sphsu.mrc.ac.uk

The social patterning of deaths due to assault in Scotland, 1980-2005: population based study

ABSTRACT

Objectives: To explore the extent of the social gradient for deaths due to assault and its impact on overall inequalities in mortality. To investigate the contribution to assault mortality of knives and other sharp weapons.

Design: Analysis of death records and contemporaneous population estimates.

Setting: Scotland

Participants: Deaths between 1980 and 2005 due to assault.

Main measurements: Mortality rates were standardised to the European standard population. Time trends were analysed and inequalities were assessed, using rate ratios and the slope index of inequality, along axes defined by individual occupational socioeconomic status and area deprivation.

Results: An increase in mortality due to assault was most pronounced at ages 15-44 and was steeper among assaults involving knives. The mortality rate among men in routine occupations aged 20-59 was nearly 12 times that of those in higher managerial and professional occupations. Men under 65 living in the most deprived quintile of areas had a mortality rate due to assault 31.9 times (95% C.I. 13.1-77.9) that of those living in the least deprived quintile; for women this ratio was 35.0 (4.8-256.2). Despite comprising just 3.2% of all male deaths between 15-44 years, assault accounted for 6.4% of the inequalities in mortality.

Conclusions: Inequalities in mortality due to assault in Scotland exceed those in other countries and are greater than for other causes of death in Scotland. Reducing mortality and inequalities depends on addressing the problems of deprivation as well as targeting known contributors such as alcohol use, the carrying of knives and gang culture.

Word count

Abstract: 250, Full text: 3628

The social patterning of deaths due to assault in Scotland, 1980-2005: population based study

INTRODUCTION

The homicide rate in Scotland has been increasing since 1980.[1] This increase has accompanied rising mortality rates due to suicide (among men), chronic liver disease, and mental and behavioural disorders due to the use of drugs and alcohol.[2, 3] The changes in mortality from these causes have been most noticeable amongst younger adults, particularly young men, for whom the effect has been so strong that all cause mortality rates at these ages have begun to rise.[4]

Much of the previous research on the social patterning of homicide has been conducted in the USA; this has shown the victims of homicide to be more likely to be drawn from certain social groups: generally, homicide rates are higher among black[5-9], low income[5, 9], poorly educated[5, 6, 9], unemployed[5, 6, 9], and manual workers.[8, 10] Research from Finland has also noted elevated rates among the unemployed and manual workers[11], and in Sweden there was an association with early life socioeconomic position.[12] Area characteristics with noted associations with homicide rates include degree of urbanisation (USA)[7], income inequality (USA and internationally)[7, 9, 10, 13], per capita income (USA)[6], and deprivation or poverty (USA, the Netherlands and Great Britain).[6, 9, 14, 15]

The effect of homicide on social inequalities in mortality may be disproportionate. The (area-based) socioeconomic gradient for homicide was shown to be steeper than for many other causes of death in the Hague and, although contributing just 1.3% and 0.7% of all male and female deaths under 65, contributed 6.4% and 3.9% of the excess mortality in the quartile of regions with the highest deprivation scores compared to the quartile with the lowest scores.[14] In New York City inequalities patterned by neighbourhood poverty (as measured by the relative index of inequality, RII), for men and women combined, were 1.7 for all causes and 9.0 for homicide.[16] Neither study reported the significance of these results. In Sweden, males with manual social class in early life had a hazard ratio of death from homicide of 2.11 compared to those with non-manual social class; for all cause mortality the ratio was

1.31. For women the ratios were 1.40 and 1.18 respectively.[12] This difference was significant for men but not for women. In Estonia the rate ratio for homicide mortality comparing the lowest educated group to those with university education (2.21) was about the same as that for all cause mortality (2.38) among men, whilst the homicide rate ratio for women (5.46) was higher than that for all causes (2.23), although the difference was not significant.[17]

Earlier research has shown the increasing importance of homicides involving the use of knives or other sharp weapons among all homicides in Scotland.[1] Whilst the male homicide rate increased by 83% between 1982 and 2002, the rate involving knives or similar increased by 164% and more than trebled for those aged 15 to 34. Between 1983 and 1998 inequalities in homicide in Britain increased as homicide rates decreased in the more affluent areas whilst increasing in the more deprived areas.[15] Over this period the rate ratio in the poorest decile compared to the richest increased from 4.50 to 5.68. Murders involving a knife or a broken glass/bottle showed a social gradient[15], such a method constituting 52% of all homicide deaths in the poorest decile but only about 35% in the least poor decile. Given the high proportion of deprived areas that lie within Scotland, and the West of Scotland in particular, and the high rate of homicides involving knives in Scotland (47% in Scotland between 1981 and 2003[1] compared to 38% in England and Wales between 1993 and 1997[18]), it is possible that the social gradient reported reflects in part this high Scottish rate. The importance of knife use in assaults and homicides has led to policy changes or proposals targeting knives, including the licensing of the sale of non-domestic knives[19] and a ban on the sale of all long pointed kitchen knives.[20]

It is against this background that we investigate the social patterning of homicide in Scotland between 1980 and 2005, both by individual socioeconomic status and by area-based measures of deprivation. We explore the extent to which inequalities in homicide have increased, the extent to which this may be attributable to homicide involving the use of knives or other sharp weapons, and the contribution of homicide to all cause mortality and to inequalities in mortality.

METHODS

Data

The analyses presented in this paper are based on death records for Scotland for the years 1980-82, 1990-92 and 2000-05, obtained from the General Register Office for Scotland (GROS). Information on the death certificates includes the age and sex of the deceased as well as the cause of death and a measure of individual socioeconomic status. They also contain the postcode of residence of the deceased, enabling linkage to area-based deprivation scores. The estimation of rates for population groups defined by area of residence requires denominator populations in addition to the events (deaths); for this reason small area population estimates for these years by age and sex were also obtained from GROS.

Homicides were defined as deaths where the underlying cause was homicide and injury purposely inflicted by other persons (ICD9 E960-E969) or assault or sequelae of assault (ICD10 X85-Y09 & Y87.1). We conducted separate analyses for deaths where the cause was assault by a cutting or piercing instrument (ICD9 E966) or assault by sharp object (ICD10 X99).

The measure of individual socioeconomic status that we have used is the National Statistics SocioEconomic Classification (NS-SEC).[21] NS-SEC is based on occupation and employment status but has rules to provide coverage of the whole adult population. It is constructed to measure employment relations and conditions of employment. There are several versions of the classification and the one used here has 8 classes (subsequently detailed in table 2, together with those who could not be classified).[22] The proportion of the population assigned an NS-SEC from age 60 is low and so becomes unreliable to use. In addition the completeness of NS-SEC for ages 16-19 is also low due to delayed entry into the labour market.[2] For these reasons, analyses using NS-SEC focused on the age group 20-59. Earlier results have cast doubt on the reliability of NS-SEC coding for the analysis of female mortality[2], and we therefore restrict the analysis to men. Population estimates by NS-SEC were only available from the 2001 population Census (earlier Censuses used the alternative Social Class based on Occupation); we use these estimates for men aged 20-59 to standardise the male mortality rate by NS-SEC.

We used two different measures of area deprivation. The Carstairs score is a Census-based deprivation score derived from levels of male unemployment, social class of the head of household, overcrowding and (lack of) car ownership, and has been calculated

by adding together the standardised values of the variables following the 1981, 1991 and 2001 Censuses.[23-25] The continuous score was used to divide areas into (population-weighted) quintiles. The income domain of the Scottish Index of Multiple Deprivation (SIMD) is based on the proportion of the population living in households in receipt of means-tested benefits, and was calculated based on the numbers claiming different allowances or benefits in 2001 and 2004.[26, 27] Areas were ranked and these ranks were used to divide areas into (population-weighted) quintiles.

In 2001 the population of Scotland was 5,062,011. The Carstairs score is calculated for postcode sectors; in 2001 there were 1010 postcode sectors in Scotland (including part postcode sectors when their boundaries crossed Local Council Areas) with a mean population of 5012 (range 51-20,512). The SIMD uses a geographical area with lower mean population size and less variability in population size, the data zone; in 2001 there were 6505 data zones in Scotland with a mean population of 778 (range 476-2813). To match populations to these deprivation measures we used Census populations for 1981, 1991 and 2001 by age, sex and postcode sector; Census populations for 2001 by age, sex and data zone; and GROS population estimates for 2004 by age, sex and data zone. We confined the area-based analyses around the 1991 Census to 1991-92 because of difficulties matching addresses on death records and the Census following changes to some postcode sectors in 1990.

Statistical methods

All mortality rates and 95% Confidence Intervals (CIs) were calculated by direct standardisation to the European standard population for men and women by age group for the selected years.[28] Standardised rates were also calculated for population groups defined by NS-SEC group or quintile of area deprivation. All rates reported were per million population per year. P-values indicating the significance of trends over time or across deprivation quintiles were calculated using Poisson regression. Tests for trends were not appropriate for the analysis by NS-SEC group since this classification is not hierarchical or ordered[21], so tests of the differences between groups were conducted instead. Rate ratios and 95% CIs were calculated to show the extent of inequality at each time by making comparisons between the populations living in each of the most and least deprived quintiles and the population living in the middle three quintiles.[29] P-values indicating the significance of differences in the trends over time (from 1981 to 2001) in deaths in the most or least

deprived quintile (assessed using the Carstairs score), relative to the population in the middle three quintiles, were calculated using Poisson regression. Finally, we calculated the slope index of inequality (SII) across quintiles of the income domain of the SIMD by age and sex for 2000-02, for all causes and for homicides, and used this to assess the proportion of the inequality in mortality that was attributable to homicide.[30] We chose to examine the relative contribution of homicides to inequalities in all cause mortality for the period 2000-02 because this was the most recent period for which we were able to use populations derived from the Census rather than from estimates.

RESULTS

Based on the analysis of 1109 deaths due to assault in the 12 years covered, table 1 presents mortality rates by age and sex, with deaths due to assault further broken down into those due to the use of knives and other sharp objects and other assaults. Also shown are the total number of deaths by cause and sex in each three year period and p-values indicating the significance of trends over time. Mortality rates under the age of 1 remained high, supporting an analysis of infanticide that is separate from other forms of homicide.[11] Male rates tended to be higher between the ages of 15 and 44 than at other ages, and at these ages the rate more than doubled between 1980-82 and 2003-05. Most of these deaths, and most of the increase, can be seen to be attributable to assaults involving sharp objects; however, the increase in the all age mortality rate associated with other assaults also showed a significant increase. Female mortality rates were much lower than male rates and were not dominated by sharp objects as male rates were. The all age mortality rate showed a significant decrease over time due to decreases at older ages.

Table 2 shows mortality rates by age and NS-SEC for men in Scotland in 2000-2002. The table also shows the number and proportion of the population in each NS-SEC category. Steep social gradients are evident, with the rate among those in routine occupations (127 per 1,000,000 population) being nearly 12 times that of those in higher managerial and professional occupations (11). The gradient was steeper for those aged 20-39 than at ages 40-59, and was also steeper for assaults involving sharp objects. Table 2 highlights the fact that the 193,473 men in routine occupations form a particularly vulnerable group, with rates being more than double those for men

in semi-routine occupations. Differences between the NS-SEC groups were significant for both age groups and for assaults involving sharp objects and other assaults. High rates are also evident for the 9% of men whose occupations could not be classified (particularly at ages 20-39), but the rather low rate for the 4% who had never worked or were long-term unemployed illustrates the extent of our concerns about the coding to NS-SEC differing between death certificates and the Census. The information collected on death records in Scotland is not able to distinguish those who have never worked or are long-term unemployed with any accuracy; similar findings have been reported for England & Wales.[31]

Table 3 examines inequalities in male and female deaths according to area-based deprivation and how these have changed over time. The measures used are rate ratios comparing the rates in each of the most deprived quintile (quintile 5) and the least deprived quintile (quintile 1) with the rates in the middle three quintiles. Changes in the rate ratios for all assaults between 1980-82 and 2000-02, based on the Carstairs score for postcode sectors, showed the relative experience of those living in the most deprived quintile little changed with male rates typically 3-4 times those in the middle 3 quintiles and female rates 2-2.5 times. In contrast, the rate ratio for men of all ages in the least deprived quintile fell from 0.86 in 1980-82 to 0.28 in 2000-02 ($p=0.022$). Relative to the middle three quintiles, the rate ratio in the most deprived quintile for assaults involving sharp objects decreased over time ($p=0.035$), although in 2000-02 the rate ratio was still 3.38 (95% C.I. 2.27-5.03). No other trends were significant. When area deprivation was assessed for data zones using the SIMD income domain in 2000-02 there was a notable tendency for inequalities to be wider than for postcode sectors assessed using the Carstairs score in the same period, with the rate ratios assessed using the SIMD for the most deprived areas mostly higher and those for the least deprived areas tending to be lower. This is likely to be a result of the smaller area employed by the SIMD with its consequent ability to identify pockets of deprivation set in (relatively) more affluent surroundings and the consequent homogeneity afforded by a classification based on data zones.

Figure 1 shows how deaths that are due to assault vary as a proportion of all deaths by age for men in 2000-02. Although representing just 0.3% of male deaths at all ages, assault accounts for 1.0% of deaths under the age of 65 and 3.2% between the ages of 15 and 44. Also shown in figure 1 is the percentage of inequalities in mortality

at each age that is due to assault. The fact that the contribution to inequalities is greater than the proportion of deaths reflects the steeper social gradient that is seen for deaths due to assault than for other causes. Assault accounts for 1.1% of inequalities in male mortality at all ages, rising to 2.4% under 65 and 6.4% between the ages of 15 and 44.

DISCUSSION

Mortality rates in Scotland due to assault are high; the all age rates in table 1 of 32 and 8 per 1,000,000 men and women respectively in 2000-02 compare very unfavourably with rates of 14 and 6 per 1,000,000 for high income countries in the European region in 2000.[32] The steep social gradient is a notable feature of mortality due to assault in Scotland as in other countries. The extremely high mortality rate seen among men of working age in routine occupations (127 per 1,000,000) is comparable to the Scottish mortality rate for stroke amongst men of this age and higher than the mortality rate for colorectal cancer.[2] Although it is not possible to make direct comparisons between tables 2 and 3, inequalities (as measured by the ratio) between the most and least deprived quintiles as measured by SIMD appear stronger than those between routine occupations and higher managerial and professional occupations. For all assaults in 2000-02 the lowest rate ratio between the most and least deprived quintile by age group was that seen for all ages ($RR=5.19/0.27=19.2$); by contrast, the highest rate ratio between the extreme groups of NS-SEC was 13.5 ($=150/11$) for those aged 20-39. Whilst it is possible that the results would differ if other individual and area socioeconomic factors were employed, we believe that this work suggests that contextual influences of the neighbourhood of residence might be more important than individual characteristics in determining the victims of assault. However, we have previously noted the mismatch between the coding of NS-SEC from death certificates and that from the Census[2], and for this reason are cautious about placing too much emphasis on the interpretation of the results by individual socioeconomic status. Furthermore, formal separation of the contextual and compositional effects can only be conducted in a multilevel framework.

Mortality rates due to assault in the most deprived areas have not deteriorated significantly over time relative to those in the middle three quintiles. The only

significant increase in inequalities has been the widening of the gap between the least deprived areas and the rest of Scotland. However, the magnitude of the inequalities seen – patterned by the deprivation level of the area of residence – is extreme. Between 2000-02 a man under 65 living in the most deprived quintile was 31.9 (95% C.I. 13.1-77.9) times more likely to die due to assault than one living in the most affluent quintile; for women this ratio was 35.0 (4.8-256.2). The equivalent rate ratios for all-cause mortality were 3.5 (3.3-3.6) and 2.6 (2.5-2.8) for men and women respectively. Not only do these inequalities for assault exceed those for other causes of death in Scotland, they far exceed the ratio reported for homicide in Great Britain[15] (5.7 comparing the top and bottom deciles, 1996-2000) and that for emergency hospital admissions for assault in England[33] (6.3 comparing the top and bottom quintiles in 2005-06). The reasons for the different findings are unclear; the measures reported in these studies have some differences (for example, both refer to men and women combined and to all ages) but these could not account for the stark inequalities observed in Scotland. Earlier research has suggested that inequalities in all cause mortality are wider in Scotland than in the rest of Britain; the Scottish excess mortality in 2001 ranged from 2% in the least deprived decile to 17% in the most.[34] It is possible that the greater inequalities in mortality due to assault in Scotland reflect greater social inequalities and more acute deprivation. The prioritisation of the harm caused by violence in the Scottish Government's report of the ministerial task force on health inequalities[35] is recognition that the small numbers of deaths have a marked impact on inequalities, particularly amongst young men.

Maxwell et al showed that whilst in a single year from April 2004 to March 2005, 4891 patients were admitted to hospital in England with an assault-related stabbing injury, there were just 139 deaths in 2004 due to assault from a sharp object.[36] This figure of 35 victims requiring hospital treatment for every homicide fits in with an estimated range of 20-40 for youth violence internationally.[37] The suggestion that there might be so many hospital admissions for every fatality means that the analysis presented in this paper probably represents no more than the tip of the iceberg in terms of the number of events. Throughout Scotland it has been estimated that "*Violence costs the Scottish economy around £3 billion each year in health care, law enforcement and lost productivity*".[38]

What are the known correlates of violent behaviour? Alcohol and drug use have been shown to contribute to homicides and to violence more generally. Shaw et al estimated that alcohol or drugs (taken by the perpetrator) contributed to 45% of a national sample of homicides in England and Wales collected over three years between 1996 and 1999[39], although they believed this figure to be conservative. A similar level of alcohol use was reported in several international studies of homicide.[40] More generally, alcohol use has been shown to contribute to violent behaviour among adolescents[41], whilst in Scotland school children who used drugs were more likely to carry weapons.[42] Social correlates have also been promoted; Heath suggested that carrying a knife is another dimension of poverty.[43] The existence of inequalities between social groups has been recognised as an important risk factor for violence[44], and an ecological cross-national study showed a negative correlation between GNP per capita and a country's homicide rate.[45]

So what can be done about the high homicide rate and the associated inequalities? Brookman and Maguire made a range of policy recommendations for the reduction of homicides in the categories of domestic homicide, the killing of infants, alcohol-related homicide, and homicide with guns or knives.[40] The Scottish Government is already seeking ways to reduce alcohol-related problems including violence.[46] As a means of reducing knife crime, Hern et al advocated a ban on the sale of long pointed knives[20], something that could be considered in Scotland given the considerable role that knives play. For interventions to reduce youth violence to succeed, Kellermann et al recommended that they should take place before the age of 6 years and must either address multiple risk factors simultaneously or else should be tailored for specific target groups.[47] Addressing the gang culture is an example of such a targeted approach.[48] But the extent of the inequalities seen for assault in Scotland, coupled with high mortality rates for causes associated with alcohol and drug use and mental wellbeing among the most disadvantaged groups, emphasises the need to understand and address the multiplicity of problems associated with deprivation and poverty.

Our study has demonstrated the extent of inequalities in deaths due to assault in Scotland and the role played by knives and other sharp weapons. Although we have no information on the perpetrators of the assaults from death records, we have

offered a comprehensive insight into the inequalities that occur and the extent to which they are patterned by socioeconomic circumstances.

ACKNOWLEDGEMENT

We are grateful to the General Register Office (Scotland) for the provision of data **and to the referees for their helpful comments.**

Competing interests: The authors do not have any competing interests.

Contributors: Both authors contributed to the study design and analysis. AHL wrote the first draft of the paper. Both authors contributed to subsequent drafts and approved the final version. AHL is guarantor for the paper.

Ethical approval: This study was based on the analysis of anonymised mortality data and as such did not require ethical approval.

License statement: The Corresponding Author has the right to grant on behalf of all authors and does grant on behalf of all authors, an exclusive licence (or non-exclusive for government employees) on a worldwide basis to the BMJ Publishing Group Ltd and its Licensees to permit this article (if accepted) to be published in Journal of Epidemiology and Community Health and any other BMJPGJL products to exploit all subsidiary rights, as set out in our licence (<http://jech.bmj.com/ifora/licence.pdf>).

Funding: The Social and Public Health Sciences Unit is jointly funded by the Medical Research Council (MRC) and the Chief Scientist Office (CSO) of the Scottish Government Health Directorates. This work was funded by the Chief Scientist Office as part of the "Measuring health, variations in health and the determinants of health" programme, wbs U.1300.00.001. Neither the MRC nor the CSO had any role in study design, analysis or the interpretation of the results.

WHAT THIS PAPER ADDS

What is already known on this subject

- Scotland has a high mortality rate due to assault compared to other countries.
- Mortality from assault is known to be higher among more disadvantaged populations.

What this study adds

- Social inequalities in mortality due to assault in Scotland are of far greater magnitude than those reported elsewhere.
- The scale of these inequalities means that any attempt to address inequalities in mortality in Scotland – particularly amongst young men – must tackle the problem of assault, particularly that involving knives and other sharp weapons.

REFERENCES

- 1 Leyland AH. Homicides involving knives and other sharp objects in Scotland, 1981-2003. *Journal of Public Health* 2006;**28**:145-7.
- 2 Leyland AH, Dundas R, McLoone P, *et al.* *Inequalities in mortality in Scotland, 1981-2001. MRC Social and Public Health Sciences Unit Occasional Paper no. 16.* Glasgow: MRC Social and Public Health Sciences Unit 2007.
- 3 Leyland AH, Dundas R, McLoone P, *et al.* Cause-specific inequalities in mortality in Scotland: two decades of change. A population-based study. *BMC Public Health* 2007;**7**:172.
- 4 McLoone P. Increasing mortality among adults in Scotland 1981 to 1999. *European Journal of Public Health* 2003;**13**:230-4.
- 5 Cubbin C, LeClere FB, Smith GS. Socioeconomic status and the occurrence of fatal and nonfatal injury in the United States. *American Journal of Public Health* 2000;**90**:70-7.
- 6 Cubbin C, LeClere FB, Smith GS. Socioeconomic status and injury mortality: individual and neighbourhood determinants. *Journal of Epidemiology and Community Health* 2000;**54**:517-24.
- 7 Cubbin C, Pickle LW, Fingerhut L. Social context and geographic patterns of homicide among US black and white males. *American Journal of Public Health* 2000;**90**:579-87.
- 8 Howard G, Anderson RT, Russell G, *et al.* Race, socioeconomic status, and cause-specific mortality. *Annals of Epidemiology* 2000;**10**:214-23.
- 9 Krueger PM, Bond Huie SA, Rogers RG, *et al.* Neighbourhoods and homicide mortality: an analysis of race/ethnic differences. *Journal of Epidemiology and Community Health* 2004;**58**:223-30.
- 10 Wilkinson RG, Kawachi I, Kennedy BP. Mortality, the social environment, crime and violence. *Sociology of Health and Illness* 1998;**20**:578-97.

- 11 Kivivuori J, Lehti M. The social composition of homicide in Finland, 1960-2000. *Acta Sociologica* 2006;**49**:67-82.
- 12 Lawlor DA, Sterne JAC, Tynelius P, *et al.* Association of childhood socioeconomic position with cause-specific mortality in a prospective record linkage study of 1,839,384 individuals. *American Journal of Epidemiology* 2006;**907-915**.
- 13 Pickett KE, Mookherjee J, Wilkinson RG. Adolescent birth rates, total homicides, and income inequality in rich countries. *American Journal of Public Health* 2005;**95**:1181-3.
- 14 Middelkoop BJC, Struben HWA, Burger I, *et al.* Urban cause-specific socioeconomic mortality differences. Which causes of death contribute most? *International Journal of Epidemiology* 2001;**30**:240-7.
- 15 Shaw M, Tunstall H, Dorling D. Increasing inequalities in risk of murder in Britain: trends in the demographic and spatial distribution of murder, 1981-2000. *Health and Place* 2005;**11**:45-54.
- 16 Karpati AM, Bassett MT, McCord C. Neighbourhood mortality inequalities in New York City, 1989-1991 and 1999-2001. *Journal of Epidemiology and Community Health* 2006;**60**:1060-4.
- 17 Leinsalu M, Vågerö D, Kunst AE. Estonia 1989-2000: enormous increase in mortality differences by education. *International Journal of Epidemiology* 2003;**32**:1081-7.
- 18 Rooney C, Devis T. Recent trends in deaths from homicide in England and Wales. *Health Statistics Quarterly* 1999;**3**:5-13.
- 19 Scottish Government. Knives licensing (press release 05/06/2009). <http://www.scotland.gov.uk/News/Releases/2009/06/05112834> accessed 20 August 2009. 2009.
- 20 Hern E, Glazebrook W, Beckett M. Reducing knife crime. *British Medical Journal* 2005;**330**:1221-2.
- 21 Rose D, Pevalin D, O'Reilly K. *The NS-SEC: Origins, development and use*. Basingstoke: Palgrave Macmillan 2005.
- 22 Office for National Statistics. The National Statistics Socio-economic Classification (NS-SEC) User Manual. <http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=14066> accessed 20 August 2009. 2005.
- 23 Carstairs V, Morris R. *Deprivation and Health in Scotland*. Aberdeen: Aberdeen University Press 1991.

- 24 McLoone P. *Carstairs scores for Scottish postcode sectors from the 1991 Census*. Glasgow: Public Health Research Unit 1994.
- 25 McLoone P. *Carstairs scores for Scottish postcode sectors from the 2001 Census*. Glasgow: MRC Social and Public Health Sciences Unit 2004.
- 26 Scottish Executive. *Scottish Index of Multiple Deprivation 2004: summary technical report*. Edinburgh: Scottish Executive 2004.
- 27 Scottish Executive. *Scottish Index of Multiple Deprivation 2006: General Report*. Edinburgh: Scottish Executive 2006.
- 28 Clayton D, Hills M. *Statistical Models in Epidemiology*. Oxford: Oxford University Press 1993.
- 29 Rothman KJ. *Modern Epidemiology*. Boston: Little, Brown and Company 1986.
- 30 Regidor E. Measures of health inequalities: part 2. *Journal of Epidemiology and Community Health* 2004;**58**:900-3.
- 31 White C, Glickman M, Johnson B, *et al.* Social inequalities in adult male mortality by the National Statistics Socio-economic classification, England and Wales, 2001-03. *Health Statistics Quarterly* 2007;**36**:6-23.
- 32 Krug EG, Dahlberg LL, Mercy JA, *et al.*, eds. *World report on violence and health*. Geneva: World Health Organization 2002.
- 33 Bellis MA, Hughes K, Anderson Z, *et al.* Contribution of violence to health inequalities in England: demographics and trends in emergency hospital admissions for assault. *Journal of Epidemiology and Community Health* 2008;**62**:1064-71.
- 34 Hanlon P, Lawder RS, Buchanan D, *et al.* Why is mortality higher in Scotland than in England and Wales? Decreasing influence of socioeconomic deprivation between 1981 and 2001 supports the existence of a 'Scottish Effect'. *Journal of Public Health* 2005;**27**:199-204.
- 35 Scottish Government. *Equally well. Report of the ministerial task force on health inequalities*. Edinburgh: The Scottish Government 2008.
- 36 Maxwell R, Trotter C, Verne J, *et al.* Trends in admission to hospital involving an assault using a knife or other sharp instrument, England, 1997-2005. *Journal of Public Health* 2007;**29**:186-90.
- 37 Mercy JA, Butchart A, Farrington D, *et al.* Youth violence. In: Krug EG, Dahlberg LL, Mercy JA, *et al.*, eds. *World report on health and violence*. Geneva: World Health Organization 2002:23-56.
- 38 Violence reduction unit. <http://www.actiononviolence.com/aov/42.81.34.html> accessed 20 August 2009.

- 39 Shaw J, Hunt IM, Flynn S, *et al.* The role of alcohol and drugs in homicides in England and Wales. *Addiction* 2006;**101**:1117-24.
- 40 Brookman F, Maguire M. Reducing homicide: a review of the possibilities. *Crime, Law & Social Change* 2004;**42**:325-403.
- 41 Rossow I, Pape H, Wichstrøm L. Young, wet and wild? Associations between alcohol intoxication and violent behaviour in adolescence. *Addiction* 1999;**94**:1017-31.
- 42 McKeganey N, Norrie J. Association between illegal drugs and weapon carrying in young people in Scotland: schools' survey. *British Medical Journal* 2000;**320**:982-4.
- 43 Heath I. R-E-S-P-E-C-T - find out what it means. *British Medical Journal* 2008;**337**:a672.
- 44 Rutherford A, Zwi AB, Grove NJ, *et al.* Violence: a priority for public health? (part 2). *Journal of Epidemiology and Community Health* 2007;**61**:764-70.
- 45 Moniruzzaman S, Andersson R. Age- and sex-specific analysis of homicide mortality as a function of economic development: a cross-national comparison. *Scandinavian Journal of Public Health* 2005;**33**:464-71.
- 46 Scottish Government. Changing Scotland's relationship with alcohol: a discussion paper on our strategic approach. Edinburgh: The Scottish Government 2008.
- 47 Kellermann AL, Fuqua-Whitley DS, Rivara FP, *et al.* Preventing youth violence: what works? *Annual Review of Public Health* 1998;**19**:271-92.
- 48 Kmietowicz Z. Glasgow gang members offered way out of violent lifestyle. *British Medical Journal* 2008;**337**:a2972.

Table and figure captions

Table 1 Male and female standardised mortality rates per 1,000,000 population due to assault, assault involving sharp weapons and other assaults, Scotland, 1980-82, 1990-92, 2000-02 and 2003-05.

Table 2 Standardised mortality rates per 1,000,000 population due to assault, assault involving sharp weapons and other assaults, by NS-SEC category. Men, Scotland, 2000-02.

Table 3 Age-specific mortality rate ratios due to assault, assault involving sharp weapons and other assaults, for most and least deprived quintiles relative to the middle 3 quintiles. Men and women, Scotland, 1980-82, 1991-92 and 2000-02 based on Carstairs scores; 2000-02 and 2003-05 based on SIMD income domain.

Figure 1 Proportion of all male deaths that were due to assault (bars) and the proportion of inequalities in mortality due to assault (line), by age, Scotland 2000-02.

Table 1

Age group	Assault					Sharp weapon					Other assault				
	1980-82	1990-92	2000-02	2003-05	p	1980-82	1990-92	2000-02	2003-05	p	1980-82	1990-92	2000-02	2003-05	p
Male															
<1	40 (1-80)	70 (18-122)	59 (7-110)	37 (0-79)	0.973	0	0	0	0		40 (1-80)	70 (18-122)	59 (7-110)	37 (0-79)	0.973
1-4	13 (2-24)	15 (3-27)	9 (0-19)	3 (0-9)	0.209	3 (0-7)	0	0	0		10 (0-20)	15 (3-27)	9 (0-19)	3 (0-9)	0.346
5-14	3 (0-6)	4 (0-8)	2 (0-5)	2 (0-5)	0.473	1 (0-2)	1 (0-3)	0	0	0.324	2 (0-5)	3 (0-7)	2 (0-5)	2 (0-5)	0.765
15-24	32 (22-42)	55 (41-69)	58 (42-73)	59 (44-74)	0.002	21 (13-29)	37 (26-48)	44 (31-57)	45 (32-58)	<0.001	11 (5-16)	18 (10-26)	14 (6-21)	14 (7-21)	0.574
25-34	25 (15-34)	48 (36-61)	44 (31-57)	55 (40-70)	0.003	16 (8-23)	37 (26-47)	34 (23-46)	40 (27-52)	0.004	9 (3-15)	12 (6-18)	10 (4-16)	15 (7-23)	0.401
35-44	25 (15-36)	41 (29-53)	52 (39-65)	58 (44-72)	<0.001	12 (5-20)	19 (10-27)	34 (23-45)	34 (23-45)	<0.001	13 (6-21)	22 (13-31)	18 (10-25)	24 (15-33)	0.197
45-59	22 (14-30)	27 (18-36)	32 (23-41)	41 (31-51)	0.008	9 (4-14)	13 (7-19)	12 (6-17)	16 (10-22)	0.160	13 (7-20)	14 (8-21)	20 (13-27)	24 (17-33)	0.024
60+	16 (8-24)	16 (9-23)	14 (7-20)	11 (5-17)	0.294	4 (1-8)	7 (2-12)	3 (0-6)	1 (0-3)	0.175	12 (5-19)	9 (4-15)	10 (5-16)	10 (4-15)	0.695
15-44	27 (22-33)	48 (41-56)	51 (43-59)	57 (49-66)	<0.001	16 (12-21)	31 (25-37)	38 (31-44)	40 (32-47)	<0.001	11 (7-15)	18 (13-22)	14 (10-18)	18 (13-23)	0.115
All ages	20 (17-24)	31 (27-35)	32 (28-36)	35 (31-39)	<0.001	10 (7-12)	17 (14-20)	19 (15-22)	20 (17-23)	<0.001	11 (8-13)	14 (11-17)	13 (11-16)	15 (12-18)	0.057
Deaths	147	226	228	256		74	129	137	147		73	97	91	109	

Table 1 (continued)

Female															
<1	43	11	37	39	0.967	0	0	0	0		43	11	37	39	0.967
	(1-84)	(0-31)	(0-79)	(0-83)							(1-84)	(0-31)	(0-79)	(0-83)	
1-4	3	5	12	3	0.379	0	0	0	3		3	5	12	0	0.608
	(0-8)	(0-13)	(0-25)	(0-10)					(0-10)		(0-8)	(0-13)	(0-25)		
5-14	3	2	2	3	0.803	2	0	0	1	0.416	2	2	2	2	0.792
	(0-6)	(0-5)	(0-5)	(0-7)		(0-4)			(0-3)		(0-4)	(0-5)	(0-5)	(0-5)	
15-24	12	11	8	8	0.347	3	4	3	4	0.766	9	7	5	4	0.168
	(6-18)	(5-17)	(3-14)	(3-14)		(0-6)	(0-8)	(0-7)	(0-8)		(4-14)	(2-11)	(1-10)	(0-8)	
25-34	7	8	11	7	0.652	6	4	5	5	0.988	2	3	6	2	0.483
	(2-13)	(3-12)	(5-17)	(2-13)		(1-10)	(1-8)	(1-10)	(1-10)		(0-4)	(0-7)	(1-10)	(0-5)	
35-44	17	12	13	6	0.056	5	2	2	6	0.959	12	11	11	1	0.024
	(9-26)	(6-19)	(7-20)	(2-11)		(1-10)	(0-5)	(0-5)	(1-10)		(5-19)	(4-17)	(5-17)	(0-2)	
45-59	14	8	8	5	0.018	2	3	4	0	0.583	12	5	4	5	0.016
	(8-20)	(3-13)	(3-13)	(2-9)		(0-5)	(0-6)	(1-7)			(6-18)	(1-9)	(1-7)	(2-9)	
60+	11	9	3	3	0.002	2	1	2	1	0.515	9	8	1	2	0.002
	(6-16)	(4-13)	(1-6)	(1-6)		(0-4)	(0-2)	(0-4)	(0-2)		(4-13)	(4-13)	(0-3)	(0-5)	
15-44	12	10	11	7	0.130	5	3	4	5	0.886	7	7	7	2	0.038
	(8-16)	(7-14)	(7-15)	(4-10)		(2-7)	(1-5)	(2-6)	(3-8)		(4-10)	(4-10)	(4-10)	(1-4)	
All ages	11	8	8	6	<0.001	3	2	3	3	0.708	8	6	6	3	<0.001
	(9-13)	(6-10)	(6-11)	(4-8)		(2-4)	(1-3)	(1-4)	(1-4)		(6-10)	(4-8)	(4-8)	(2-5)	
Deaths	83	65	61	43		24	16	21	20		59	49	40	23	

P-values show significance of tests for trends over time

Table 2

NS-SEC	N (% of population)			Assault			Sharp weapons			Other assault		
	20-39	40-59	20-59	20-39	40-59	20-59	20-39	40-59	20-59	20-39	40-59	20-59
Higher managerial and professional occupations	77487 (11.2)	87446 (13.1)	164933 (12.2)	11 (0-33)	11 (0-23)	11 (0-24)	0	7 (0-17)	4 (0-8)	11 (0-33)	4 (0-11)	7 (0-19)
Lower managerial and professional occupations	132985 (19.3)	140994 (21.2)	273979 (20.2)	15 (2-29)	12 (1-23)	14 (5-22)	13 (1-26)	5 (0-12)	9 (2-17)	2 (0-6)	7 (0-15)	4 (0-9)
Intermediate occupations	53658 (7.8)	32121 (4.8)	85779 (6.3)	6 (0-17)	10 (0-30)	8 (0-19)	0	10 (0-30)	5 (0-15)	6 (0-17)		3 (0-9)
Small employers and own account workers	48268 (7.0)	82402 (12.4)	130670 (9.6)	23 (3-43)	12 (0-26)	18 (5-30)	19 (0-37)	4 (0-12)	12 (1-22)	4 (0-12)	8 (0-20)	6 (0-13)
Lower supervisory and technical occupations	96842 (14.0)	87407 (13.1)	184249 (13.6)	28 (8-48)	27 (7-47)	27 (13-41)	25 (6-44)	20 (2-37)	22 (10-35)	3 (0-9)	7 (0-17)	5 (0-11)
Semi-routine occupations	82616 (12.0)	62761 (9.4)	145377 (10.7)	65 (34-97)	48 (17-80)	57 (35-79)	46 (20-73)	16 (0-34)	31 (15-48)	19 (2-36)	33 (6-59)	26 (10-41)
Routine occupations	103228 (14.9)	90245 (13.5)	193473 (14.3)	150 (107-194)	103 (65-141)	127 (98-156)	122 (83-160)	43 (19-68)	83 (60-106)	29 (10-48)	59 (30-89)	44 (27-61)
P				<0.001	<0.001	<0.001	<0.001	0.004	<0.001	0.019	<0.001	<0.001
Never worked and long-term unemployed	31116 (4.5)	22592 (3.4)	53708 (4.0)	21 (0-51)	31 (0-74)	26 (0-52)	21 (0-51)	16 (0-46)	19 (0-40)	0	15 (0-45)	7 (0-22)
Not classified	64320 (9.3)	60086 (9.0)	124406 (9.2)	181 (103-260)	75 (34-117)	129 (84-174)	103 (44-161)	39 (8-70)	72 (38-105)	78 (26-131)	36 (8-64)	58 (28-88)
All	595084 (100.0)	583376 (100.0)	1178460 (100.0)	55 (45-65)	36 (28-44)	46 (39-52)	41 (32-50)	17 (11-22)	29 (24-34)	14 (9-20)	19 (13-25)	17 (13-21)

P-values show significance of tests for difference between groups

Table 3

	Assault					Sharp weapons					Other assault				
	Carstairs		SIMD			Carstairs		SIMD			Carstairs		SIMD		
	1980-82	1991-92	2000-02	2000-02	2003-05	1980-82	1991-92	2000-02	2000-02	2003-05	1980-82	1991-92	2000-02	2000-02	2003-05
Male															
15-39															
Dep quin 1	0.52 (0.20-1.35)	0.37 (0.16-0.87)	0.14 (0.04-0.46)	0.17 (0.05-0.53)	0.20 (0.06-0.64)	0.68 (0.19-2.37)	0.55 (0.21-1.43)	0.15 (0.04-0.60)	0.17 (0.04-0.69)	0.29 (0.09-0.95)	0.40 (0.09-1.75)	0.14 (0.02-1.06)	0.13 (0.02-1.00)	0.17 (0.02-1.27)	0.00
Dep quin 5	4.82 (3.04-7.65)	2.96 (2.00-4.39)	3.02 (2.14-4.25)	5.48 (3.83-7.84)	5.17 (3.66-7.30)	7.64 (4.03-14.48)	4.24 (2.61-6.89)	3.38 (2.27-5.03)	6.21 (4.07-9.49)	5.10 (3.35-7.76)	2.61 (1.27-5.34)	1.34 (0.65-2.79)	2.16 (1.08-4.31)	3.86 (1.94-7.65)	5.33 (2.90-9.77)
p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.005	<0.001	<0.001	<0.001
p ₁		0.090										0.481			
p ₅		0.122										0.727			
40-59															
Dep quin 1	0.29 (0.07-1.26)	0.11 (0.01-0.81)	0.43 (0.17-1.12)	0.09 (0.01-0.67)	0.59 (0.26-1.33)	0.00	0.00	0.52 (0.11-2.38)	0.00	0.49 (0.14-1.70)	0.51 (0.11-2.33)	0.20 (0.03-1.54)	0.39 (0.12-1.32)	0.17 (0.02-1.32)	0.68 (0.23-2.03)
Dep quin 5	2.61 (1.36-5.03)	2.47 (1.26-4.82)	3.88 (2.39-6.30)	4.89 (3.05-7.85)	5.93 (3.84-9.16)	3.23 (1.25-8.38)	2.66 (0.99-7.14)	6.78 (3.19-14.40)	4.78 (2.42-9.47)	6.12 (3.33-11.27)	2.14 (0.86-5.33)	2.31 (0.93-5.74)	2.45 (1.25-4.79)	4.99 (2.59-9.62)	5.74 (3.09-10.66)
p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	0.104	0.006	<0.001	<0.001	<0.001
p ₁		0.525										0.829			
p ₅		0.274										0.811			
All ages															
Dep quin 1	0.86 (0.49-1.49)	0.25 (0.12-0.51)	0.28 (0.15-0.52)	0.27 (0.13-0.56)	0.39 (0.21-0.71)	0.46 (0.16-1.33)	0.35 (0.14-0.89)	0.21 (0.08-0.58)	0.11 (0.03-0.46)	0.34 (0.15-0.79)	1.12 (0.58-2.16)	0.16 (0.05-0.51)	0.35 (0.16-0.77)	0.47 (0.20-1.11)	0.47 (0.20-1.11)
Dep quin 5	3.71 (2.64-5.21)	2.31 (1.69-3.15)	3.24 (2.49-4.22)	5.19 (3.97-6.80)	5.50 (4.24-7.14)	5.36 (3.27-8.77)	3.47 (2.28-5.28)	4.07 (2.88-5.75)	5.68 (4.00-8.09)	5.23 (3.72-7.37)	2.59 (1.59-4.22)	1.38 (0.84-2.26)	2.34 (1.54-3.56)	4.57 (3.00-6.94)	5.89 (3.93-8.80)
p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
p ₁		0.022										0.064			
p ₅		0.680										0.962			

Table 3 (continued)

Female															
15-39															
Dep quin 1	0.15	0.24	0.37	0.21	0.61	0.00	0.00	0.00	0.00	1.08	0.29	0.29	0.62	0.29	0.00
	(0.02-1.11)	(0.03-1.88)	(0.09-1.64)	(0.03-1.60)	(0.13-2.79)					(0.22-5.37)	(0.04-2.31)	(0.04-2.30)	(0.13-2.87)	(0.04-2.24)	
Dep quin 5	2.32	1.35	2.51	3.09	2.28	1.52	4.51	2.89	6.22	2.22	3.10	0.72	2.27	1.95	2.37
	(1.15-4.67)	(0.51-3.60)	(1.20-5.28)	(1.49-6.40)	(0.93-5.62)	(0.47-4.92)	(0.75-27.01)	(0.93-8.96)	(1.87-20.65)	(0.68-7.27)	(1.26-7.63)	(0.20-2.62)	(0.84-6.09)	(0.74-5.13)	(0.59-9.46)
p	<0.001	0.027	0.003	<0.001	0.049	0.077	0.155	0.004	0.005	0.253	0.001	0.085	0.151	0.011	0.091
p ₁		0.426						1.000				0.537			
p ₅		0.943						0.314				0.477			
40-59															
Dep quin 1	0.44	0.54	0.58	0.00	0.90	0.00	0.00	0.66	0.00	0.00	0.51	0.88	0.51	0.00	2.39
	(0.10-1.93)	(0.06-4.60)	(0.13-2.69)		(0.09-8.62)			(0.07-5.94)			(0.11-2.26)	(0.09-8.47)	(0.06-4.39)		(0.15-38.27)
Dep quin 5	2.02	2.56	2.48	5.17	7.90	5.08	1.64	0.85	3.48	1.56	1.54	3.14	3.83	6.45	18.50
	(0.88-4.68)	(0.69-9.53)	(0.93-6.67)	(2.00-13.34)	(2.04-30.56)	(0.85-30.40)	(0.15-18.12)	(0.10-7.63)	(0.70-17.24)	(0.14-17.18)	(0.58-4.11)	(0.63-15.58)	(1.17-12.54)	(1.94-21.42)	(2.23-153.67)
p	0.011	0.142	0.020	<0.001	0.007	0.046	0.638	0.460	0.074	0.222	0.095	0.150	0.022	0.003	0.016
p ₁		0.706						0.460				0.866			
p ₅		0.648						0.199				0.171			
All ages															
Dep quin 1	0.37	0.53	0.55	0.26	0.57	0.00	0.00	0.40	0.31	0.86	0.49	0.66	0.63	0.24	0.29
	(0.16-0.86)	(0.20-1.39)	(0.24-1.26)	(0.08-0.84)	(0.17-1.93)			(0.09-1.81)	(0.04-2.53)	(0.18-4.03)	(0.21-1.17)	(0.25-1.77)	(0.23-1.67)	(0.06-1.02)	(0.04-2.28)
Dep quin 5	2.14	2.39	2.17	3.78	4.63	2.81	3.50	2.07	5.73	3.26	1.90	2.12	2.22	3.15	5.96
	(1.37-3.33)	(1.28-4.48)	(1.29-3.66)	(2.28-6.26)	(2.54-8.44)	(1.26-6.28)	(0.94-13.04)	(0.83-5.16)	(2.29-14.37)	(1.29-8.25)	(1.12-3.24)	(1.03-4.36)	(1.17-4.19)	(1.71-5.82)	(2.70-13.13)
p	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.076	0.006	<0.001	0.011	<0.001	0.007	0.003	<0.001	<0.001
p ₁		0.269						0.581				0.514			
p ₅		0.582						0.771				0.408			

P-values show significance of tests for trends over deprivation quintiles (p) and significance of tests of differences in trends over time, from 1981-2001, in the least (p₁) and most (p₅) deprived quintile (assessed using the Carstairs score), relative to the population in the middle three quintiles

Figure 1

