Investigation of age, period, and cohort effects to understand Scotland’s excess mortality: use of Lexis diagrams and intrinsic estimator regression modelling

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Aim
We investigated whether age, period, or cohort effects from exposure to adversity from the 1980s might explain the recent trends in suicide, alcohol-related and drug-related deaths in Scotland.

Methods
We analysed data from the National Records of Scotland on alcohol-related deaths and suicide for 1974–2013, and drug-related deaths for 1979–2013 by sex and deprivation (most deprived fifth and less deprived four-fifths) and presented them in Lexis diagrams (smoothed level pilots) and undertook intrinsic estimator regression modelling.

Results
Cohort effects were identified for those born between 1960 and 1980 for both drug-related deaths and suicide. The 1960–1980 birth cohort had roughly a 30% higher risk of suicide than other generations, and the increase in risk of drug-related deaths was at least twice as high. Both cohort effects were largely driven by male sex and people living in the most deprived areas, but the birth cohort most affected by suicide occurred slightly earlier than for drug-related deaths (figure 1). The timing of the cohort at highest risk also differed by deprivation for both suicide and drug-related deaths, being earlier for men in the most deprived group.

By contrast, an age-period effect for working-age adults, particularly in the most deprived areas, helped explain the trends in alcohol-related deaths; the risk of these deaths increased at least two times from 1990 to the mid-2000s (figure 1).

Conclusions
The results for drug-related deaths and suicide are consistent with the hypothesis that exposure to the changing socioeconomic and political contexts of the 1980s created a delayed negative health impact because the populations most affected were the same as those subsequently with higher risks of mortality. Limitations include definition of death outcomes, changes to coding, the use of year of registration, difficulties in disentangling age-period-cohort effects, and only having a partial view of each birth cohort. The use of several methods in triangulation added strength to the findings.

Further reading and references

Lexis diagrams – smoothed level plot
Rates for each single year of age over time plotted in a ‘cell’ where the value is converted to a colour via a colour scheme.

On a Lexis diagram of age (y) by year of death (x):
• age effects = horizontal lines/patterns
• period effects = vertical columns
• cohort effects = diagonal upward sloping lines from bottom left to top right.

The corresponding birth years for a cohort effect can be identified more easily by replotting a Lexis diagram as age (y) by year of birth (x), where cohort effects = vertical lines/patterns.