# Indirect estimation of ‘excess deaths’ in young adult men in Northern Ireland following the Troubles from all-cause mortality: Observational study and modelling.

**Abstract**

**Objective** To illustrate and estimate the number of excess deaths in young adult men in Northern Ireland which followed the onset of the ‘Troubles’ in the early 1970s.

**Design** Visualisation of all-cause mortality rates by age, gender and year on the Lexis surface. Modelling of key features on the mortality surface to produce counterfactual estimates of deaths expected in Northern Ireland if a sharp increase in young adult mortality had not occurred in the early 1970s.

**Setting** Northern Ireland

**Main outcome measure** Age, gender and year-specific mortality hazards.

**Methods** Visual exploration of mortality hazards for males and females in Northern Ireland using the Lexis surface to develop an informal ‘model’ for understanding discontinuity in mortality hazards after 1972. Production of a statistical model based on the informal ‘model’ which includes the discontinuity as a separate functional form, allowing it to be ‘switched off’ to estimate counterfactual numbers of deaths after 1972, and so the total number of additional deaths attributable to the discontinuity.

**Results** Visual exploration of mortality hazards show a sharp ‘spike’ in additional deaths in 1972, disproportionately affecting young adult males, which then decay over time. This sharp increase is not observed for females. A model based on this discontinuous feature, otherwise assuming log-linear improvements in age specific hazards, was developed. The model estimates that nearly 2800 additional deaths occurred in males in Northern Ireland between the ages of 15 and 45 years inclusive, from 1972 to 2013 inclusive. More than 1000 of these additional deaths occurred in 1972-1975, and more than 800 of the deaths in males aged 15-20 years inclusive.

**Conclusions** After the onset of the Troubles, risk of death in males increased sharply, within one year, then fell comparatively slowly, over decades. These additional deaths are visible to anyone regardless of methodological background from the demographic records alone. The rapid onset of higher mortality risks suggests a non-linear response in mortality risk to the socio-political circumstances of the time, and that if the underlying sectarian dynamics and tensions which gave rise to this non-linear response still persist, then failure to reach an appropriate solution to the Northern Irish border in EU-UK negotiations risks destabilising the region again, resulting in thousands of additional deaths over many years.