Geography of suicide in Taiwan: a small area analysis of spatial patterning and socioeconomic correlates


* School of Social and Community Medicine, University of Bristol, Bristol, UK
** European Centre for Environment & Human Health, Peninsula College of Medicine and Dentistry, University of Exeter, Truro, UK


Aims

To investigate geographic variations in suicide across 358 districts in Taiwan (1999-2007)

- District population size 1,700 – 548,000; median = 27,000

To investigate possible contributors to any spatial patterning

Suicide: a public health priority in Taiwan

- In 2009
  - 4,023 suicides (population: 23 M)
  - 18 per 100,000
  - 3.5% of all deaths
  - 9th leading cause of death

- In 2007 (Law et al., 2010)
  - potential years of life lost (PYLL); 3rd leading cause of death
  - NTD 32.5 billions (~$1 billion) of lost earnings

Map at the constituency level (mean pop for males aged 15-44 = 20,000)

Map at the electoral ward level (mean pop for males aged 15-44 = 1220)
Data

- Suicide data (1999-2007)
  - Taiwanese national mortality database
  - Number of suicide death by sex, age, method and area (i.e. 358 districts, based on registered address on death certificate)
  - Certified suicide (ICD-9 E950-959), undetermined death (E960-969), accidental suffocations (E913) and accidental pesticide poisonings (E863)
- Population data (1999-2007)
  - Demographic Fact Books
  - Population by sex, age and area

Area socioeconomic characteristics (2000)

- Social disintegration
  - Single-person households
  - Population mobility
  - Unmarried adult population
  - Divorced/separated adult population
  - Lone-parent households
- Other indicators
  - Population with limiting long-term illness
  - Indigenous population
  - Agricultural workers
  - Socioeconomic deprivation
    - Not-owner-occupied households
    - Overcrowded households
    - Unemployment
    - Non-schooling amongst people aged 15-17
    - Population with college or higher education
    - Median household income
  - Urbanisation level
    - Population density

Statistical analysis

- Raw (‘unsmoothed’) standardised mortality ratio (SMR)
  - Unstable estimates for suicide in small populations/areas
- Smoothed SMRs estimated by Bayesian hierarchical models
  \[ O_{ir} \sim \text{Poisson} (\lambda_{ir}) \]
  \[ \log (\lambda_{ir}) = B_0 + B_1 x_{ir} + B_2 y_{ir} + B_3 z_{ir} \]  \[ \text{(Rao et al, 1985)} \]
- Markov chain Monte Carlo (MCMC) methods implemented in WinBUGS

Study results

Maps of unsmoothed and smoothed SMRs for overall suicides in Taiwan, 1999-2007

Chang S-S et al (2011) Health & Place

Maps of smoothed SMRs for male suicides in Taiwan, by age group, 1999-2007
Maps of smoothed SMRs for female suicides in Taiwan, by age groups, 1999-2007

Maps of smoothed SMRs for suicides in Taiwan, by suicide method, 1999-2007

Associations of socioeconomic characteristics with area suicide rates in Taiwan, 1999-2007

Conclusions

- The geographic distribution of suicide in Taiwan showed distinct spatial patterning
  - Particularly high rates in the rural East; no evidence of above average rates in large cities
  - In contrast to high rates shown in central parts of some Western cities (London, Glasgow, Chicago, Sydney...)
  - Middleton et al., 2008; Exeter and Boyle, 2007; Cavan, 1928; Burnley, 1978

- No strong evidence for sex/age differences
  - Middleton et al., 2008

- Marked differences in method-specific patterns
  - Availability of methods/accessibility to treatments
  - Ajdacic-Gross et al., 2008; Levin and Leyland, 2005; Marzuk et al., 1992; Lin and Lu 2006

- Strong associations with deprivation (low income), social disintegration (higher level of population mobility and lone-parent households) and rurality (low population density).
  - Rehkopf and Buka, 2006; Middleton et al., 2004

Implications for suicide prevention

- To tackle inequality (rural-urban disparity) in suicide in Taiwan
  - Social policies addressing area deprivation and social disintegration

- Area-specific prevention strategies
  - e.g. restricting access to pesticides in rural areas and ‘hotspots’ of jumping suicide in cities