



“Geography of suicide in Hong Kong: Spatial patterning, and socioeconomic correlates and inequalities”



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ABSTRACT

Past urban research on Western nations tends to show high suicide rates in inner city and socioeconomically deprived areas. However, little is known about geographic variations in suicide in non-Western cities. We used Bayesian hierarchical models to estimate smoothed standardised mortality ratios (2005–2010) for suicide in people aged 10 years or above in each geographic unit in Hong Kong at two levels, i.e. large street block ($n = 1639$; median population = 1860) and small tertiary planning unit group ($n = 204$; median population = 14,850). We further analysed their associations with a range of area socioeconomic characteristics and a deprivation index. The “city centre” of Hong Kong, a generally non-deprived area, showed mostly below average suicide rates. However, there were high rates concentrating in some socioeconomically deprived, densely populated areas, including some inner city areas, across the city. Males had greater geographic variations in rates than females, except the elderly group. The use of smaller geographic units revealed finer detailed suicide distribution than the use of larger units, and showed that suicide rates were associated with indicators of socioeconomic deprivation (population with non-professional jobs and low median household income), and social fragmentation (proportions of unmarried adults and divorced/separated adults), but not with Gini coefficient. Sex/age groups had different associations with suicide rates. Areas in the most deprived quintile had a suicide rate more than two times higher than the least deprived. The association between suicide and deprivation was stronger in males than females and more marked in the younger populations compared to the elderly. The spatial distribution of suicide in Hong Kong showed distinct patterning and a stronger association with income compared to findings from Western countries. Suicide prevention strategies should consider tackling the marked socioeconomic gradient in suicide and high risk in young and middle-aged males living in deprived areas.

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1. Introduction

Suicide is a leading cause of premature mortality worldwide with marked geographic variations in suicide rates. National suicide rates range between close to zero and above 30 per 100,000 globally (Varnik, 2012). Within individual countries the incidence

of suicide could reveal distinct national geographic patterns (Middleton et al., 2008) or even vary substantially within cities (Gotsens et al., 2013).

More than half of the world's population now lives in urban areas, with urban growth predicted to be the greatest in continents such as Asia and Africa over the coming decades (Satterthwaite, 2007). However, past research into the spatial distribution of suicide in urban areas has mostly been restricted to cities of developed Western nations. Previous studies showed that high suicide rates tend to cluster in inner city areas in Western cities, such as Chicago (Cavan, 1928), Edinburgh (Buglass and Duffly, 1978), Sydney

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(Burnley, 1978), and London (Congdon, 1996a; Gunnell et al., 2012; Middleton et al., 2008). In contrast, little is known about geographic variations in suicide in non-Western cities. A recent study from Taiwan presented contrasting evidence from Western nations indicating that the largest city has the lowest suicide rates in its inner city areas (Chang et al., 2011).

Past research, mostly from Western nations, indicates that the spatial distribution of suicide in cities is associated with area socioeconomic circumstances (Rehkopf and Buka, 2006), with high suicide rates tending to cluster in socioeconomically deprived areas (Rezaeian et al., 2007). Some recent studies that build upon Durkheim's theory of social integration indicate that a social fragmentation or "anomie" index (Congdon, 1996b) is more strongly associated with area suicide rates than the deprivation index (Middleton et al., 2004; Whitley et al., 1999). Durkheim theorises that anomie (i.e. the breakdown of social bonds between individuals and the society) may give rise to a state of social disintegration or fragmentation and increase population suicide rates (Durkheim, 1951). Research also indicates that the association between suicide rate and area characteristics may vary by sex and age group and size of spatial unit studied (Congdon, 1996b; Middleton et al., 2004; Rehkopf and Buka, 2006; Rezaeian et al., 2006). However, little is known about whether the differential associations by socioeconomic indicator, demographic group, and unit of spatial aggregation observed in Western countries could be similarly found in non-Western settings. Recent geographic analyses from Taiwan (Chang et al., 2011) and South Korea (Hong and Knapp, 2013) reveal a strong association between suicide and income or deprivation, even after controlling for social fragmentation variables, highlighting the need of more research in this area.

Hong Kong is amongst the most densely populated areas in the world, holding a population of 7.1 million (2014) on a landmass of only 1104 square kilometres. However, much of Hong Kong's land is hilly and mountainous, with only 6.9% of the territory's land available for residential use (including: private (2.3%), public (1.4%), and "rural" (3.2%) residential areas) (Planning Department, 2014). Such large geographic variation within a relatively small territory provides a unique opportunity to study the spatial patterning of suicide. Additionally, the majority of Hong Kong's population is of Chinese ethnicity (93.6%).

After the handover in 1997, Hong Kong became a special administrative region of China, enjoying a high degree of autonomy under the "one country, two systems" principle. Impressive economic development over the last several decades has made Hong Kong one of the most affluent cities (GDP per capita USD 37,910 in 2013). However, Hong Kong has experienced a widening gap between the poor and the rich over the last two decades, with its Gini coefficient increasing from 0.451 in 1981 to 0.537 in 2011, which is higher than those in most developed economies and those in neighbouring Asian countries with a similar level of economic development (e.g. Taiwan or South Korea). In 2012, Hong Kong's suicide rate was 12.8 per 100,000, a substantial fall from 2003 when the rate was 18.8 per 100,000 (The Hong Kong Jockey Club Centre for Suicide Research and Prevention, 2013). However, with the worsening income inequality, geographic and socioeconomic inequalities in suicide are becoming a major concern in Hong Kong. The only previous analysis of spatial variations in suicide in Hong Kong was based on data from nearly two decades ago (1991–1996) and used data at a rather large geographic unit (18 districts) (Fong and Yip, 2003).

Given the high level of geographic variation and income inequality in Hong Kong compared to Western and neighbouring Asian countries, we hypothesised that Hong Kong's spatial patterning of suicide and its socioeconomic correlates would be different from those seen in Western and other Asian countries. The

aims of this study were to: i) investigate the spatial patterning of suicide; ii) the associations of suicide rates with a broad range of area socioeconomic characteristics; iii) inequalities in suicide based on areas' socioeconomic circumstances; and iv) any differences in these patterns between sex/age groups and at different geographic units in Hong Kong.

2. Methods

This study was approved by the Human Research Ethics Committee, The University of Hong Kong.

2.1. Data for suicide and population

Suicide data (2005–2010) for people aged 10 years or above in Hong Kong were extracted from the files of the Coroner's Court. In Hong Kong, all unnatural deaths including suicides are investigated by the coroners. We included all deaths certified as suicide (International Classification of Diseases, Tenth Revision [ICD-10] codes X60–X84) in the analysis. Each suicide was assigned to one of the area units based on the residential address before death recorded in the Coroner's Court files. Some previous studies of suicide have included deaths of undetermined intent as these may include some misclassified suicides. Our analysis did not include these deaths, because the number of deaths classified as undetermined intent was very small in Hong Kong (e.g. the undetermined death/suicide ratio was 0.02 in 2011) (Chang et al., 2014), and there was no obvious reason to assume a spatial pattern for the use of undetermined death codes.

Data were first compiled at the level of large street block (LSB; $n = 1639$; median population aged 10 years or above = 1860 [interquartile range 1300–4050]) and then the small tertiary planning unit group (STPUG; $n = 204$; median population aged 10 years or above = 14850 [interquartile range 5740–47,240]). STPUGs are spatial aggregates of LSBs; these two levels of spatial aggregation were used in our analysis because detailed census data provided by the Census and Statistics Department of the Hong Kong Government were available only at these levels. Population data for LSBs and STPUGs were extracted from the 2006 census ($N = 6,336,000$ for population aged 10 years or above). The boundaries of street blocks and tertiary planning units were demarcated by the Planning Department based on geographic features such as roads, coastlines, rivers, etc. Data at the two geographic levels allow an assessment of the robustness of findings.

2.2. Area socioeconomic characteristics

Data on the following 14 socioeconomic characteristics, at both the LSB and STPUG levels, were extracted from the 2006 census: the proportions of: i) single-person households; ii) people whose residences were different from those five years ago (an indicator of population mobility); iii) unmarried adults; iv) divorced or separated adults; v) lone-parent households; vi) households not owner occupied; vii) overcrowded households (i.e. households with more than one person per room); viii) unemployment rate; ix) people aged 15+ years with secondary education or below; x) adults with non-professional jobs (i.e. non-professional, non-managerial, non-administrative jobs); xi) median household income; xii) households with low income (i.e. income lower than the 50% of median household income); xiii) Gini coefficient; and xiv) households living in public housing. Gini coefficient was calculated based on detailed census data of household income distribution (17 categories defined by the Census and Statistics Department) in each area. Past research has shown area suicide rates to be associated with these aforementioned area socioeconomic characteristics

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