

A cross-ethnic comparison on incidence of suicide

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Background. Suicide rates vary widely across nations and ethnic groups. This study aims to explore potential factors contributing to inter-ethnic differences in suicide rates.

Method. Study subjects came from a case-control psychological autopsy study conducted in Taiwan, including 116 consecutive suicides from two aboriginal groups and Taiwanese Han; 113 of them each matched with two living controls. Gender-, age- and method-specific suicide rates, population attributable fraction (PAF) of suicide for five major risk factors, help-seeking before suicide and emergency medical aid after suicide were compared between the three ethnic groups.

Results. One aboriginal group (the Atayal) had significantly higher adjusted rate ratios (RR) of suicide than the other aboriginal group (the Ami) [RR 0.20, 95% confidence intervals (CI) 0.12–0.34] and the Han (RR 0.26, 95% CI 0.16–0.40). Such differences can be explained by higher PAFs of suicide for three major risk factors (substance dependence, PAF 47.6%, 95% CI 25.5–64.2; emotionally unstable personality disorder, PAF 52.7%, 95% CI 32.8–69.0; family history of suicidal behaviour, PAF 43.5%, 95% CI 23.2–60.2) in this group than in the other two groups. This higher suicide rate was substantially reduced from 68.2/100 000 per year to 9.1/100 000 per year, comparable with the other two groups, after stepwise removal of the effects of these three risk factors. Suicide rates by self-poisoning were also significantly higher in this group than in the other two groups.

Conclusions. Higher rates of specific risk factors and use of highly lethal pesticides for suicide contributed to the higher suicide rate in one ethnic group in Taiwan. These findings have implications for developing ethnicity-relevant suicide prevention strategies.

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Key words: Ethnicity, incidence, population attributable fraction, suicide.

Introduction

It is well known that suicide rates vary widely across different nations (Barraclough, 1988; Neeleman *et al.* 1997) and suicide rates among some native ethnic groups have been found to be considerably higher than the non-native in the same country (Clayer & Czechowicz, 1991; Cheng, 1995; LeMaster *et al.* 2004; Beautrais & Fergusson, 2006; Hunter & Milroy, 2006; Lester, 2006). Such differences are difficult to explain since suicide is a complex behaviour involving multiple genetic, biological and socio-environmental factors (Gould *et al.* 1996; Stoff & Mann, 1997; Cheng *et al.* 2000; Marusic & Farmer, 2001).

Few studies have used the same research method to compare suicide rates and associated risk factors

across different ethnic groups. The present study aims to conduct such a comparison among three ethnic groups in Taiwan (two aboriginal and the Han), using data collected from a psychological autopsy of suicides (Cheng, 1995). The age-standardized incidence rates of suicide were found to be much higher in one aboriginal group, the Atayal [68.2/100 000 per year, 95% confidence intervals (CI) 43.1–93.3] than in the other aboriginal group, the Ami (15.6/100 000 per year, 95% CI 9.9–21.2) and the Han Chinese (18.0/100 000 per year, 95% CI 13.2–22.9). In this study, we further investigated the risk factors contributing to such differences in suicide rates among the three groups and hypothesized that the highest rate of suicide will be observed in the ethnic group in which the people with completed suicides have a significantly higher proportion of major suicide risk factors, a significantly higher proportion using highly lethal suicide methods, a significantly lower proportion seeking medical/psychiatric help before suicide and a

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significantly lower proportion receiving emergency intervention after suicide.

Material and methods

The psychological autopsy study of suicides in East Taiwan

The methodology of this study has been described in detail elsewhere (Cheng, 1995; Cheng *et al.* 1997, 2000) and will be briefly summarized here. Study subjects included all 117 consecutive suicides (72 men and 45 women) identified in 1979–1981 from Han Taiwanese ($n=57$) and two aboriginal groups (the Atayal and Ami, $n=30$ for each) in East Taiwan. According to prosecutors' and coroners' reports, all unnatural non-homicidal deaths that occurred during the study period were first screened and reclassified into 'accidental', 'potentially suicidal' and 'undetermined' groups. All potential suicides and undetermined deaths were then examined through fieldwork by three interviewers. Finally, the results of the fieldwork were jointly discussed by the interviewers to decide which cases were suicides. Only one death lacking a full consensus between them was classified as 'undetermined'.

Of all suicides, 113 were matched with two living controls for age (± 5 years), gender, ethnicity and area of residence during the year before death. Controls were randomly selected from the census records for the relevant area of residence.

Psychological autopsy interviews were carried out with key informants of suicides and their controls during a home visit about 1 month after the death occurred. Information regarding the family tree and key persons familiar with the suicides and controls were first obtained to find as many potential interviewees as possible. The mean number of interviewees was six for suicides and five for controls. The research team comprised one psychiatrist (A.T.A.C.) and two clinical psychologists.

The semi-structured psychological autopsy interview was designed to assess prior mental disorder, personality disorder, physical disorder, personal history, family history of psychopathology and suicidal behaviour in first-degree relatives, stressful life events and sociodemographic data. Additional medical information and any suicide notes were collected from the family, medical practitioners and coroners. A Chinese version of the Standardized Assessment of Personality, ICD-10 version (Mann *et al.* 1981) was included to assess personality disorders. An *a-priori* and two *post-hoc* inter-rater reliability studies of the interview items and psychiatric diagnoses were reported to be acceptable (Cheng, 1995; Cheng *et al.* 1997, 2000).

Stressful life events preceding suicide were assessed using a Chinese version of the 12-category List of Threatening Experiences (Brugha *et al.* 1985), plus three additional categories relevant to the society in Taiwan (Cheng, 1989). All the events gathered from the interviews were further categorized according to the concept and definition of loss developed in the Life Event and Difficulty Schedule (Brown & Harris, 1989). They were classified into loss (health, a significant person, a cherished idea and employment/material possessions) and non-loss events (Cheng *et al.* 2000).

Statistical analysis

Since all the consecutive suicides identified in this study were aged ≥ 15 years, crude suicide rates were calculated based on people aged ≥ 15 years as the denominator. The official population statistics with gender and age during the study period were obtained for each of the three ethnic groups to calculate incidence of suicide. The crude gender-specific incidence rates of suicide across different age groups were estimated based on the formula (suicidal cases number/the person-year on the subpopulation for each stratum). In addition, the method-specific suicide rates in the three groups were calculated and compared.

Based on the number of consecutive suicides and the total population in which the suicidal events occurred, a negative binomial regression model was used to examine whether there was any significant difference in suicide rates among the three ethnic groups. In this model, the occurrence of suicides was handled as a rare event and the rate ratio (RR) of suicides, adjusting for age and gender, was estimated.

In the previous case-control analysis with 113 suicides and 226 matched controls, five major risk factors for suicide, including loss event, suicidal behaviour in first-degree relatives, ICD-10 major depressive episode, emotionally unstable personality disorder (EUPD) and substance dependence (largely alcohol), were identified from multivariate conditional logistic regression (Cheng *et al.* 2000). These five risk factors were then further compared in this study of 116 suicides in three ethnic groups, together with the suicide method used and the availability of emergency medical assistance after the suicidal incident, to examine if these factors accounted for the difference in suicide rates between ethnic groups.

Univariate conditional logistic regression was then applied to assess the relationships between the five major factors and suicide in each of the three ethnic groups with all 339 matched suicides and controls. Effects of individual factors on suicide were calculated by odds ratio (OR). The interactive effect between ethnicity and each of the major risk factors on suicide

was also examined in the statistical model. The population attributable fraction (PAF) was then applied to assess the fraction of suicide risk attributable to a specific significant factor in each of the groups. The (single-factor) PAF was calculated using the prevalence of the factor (p) among suicides and the OR associated with the factor as follows: $PAF = p \times (OR - 1) / OR$ (Miettinen, 1974). The bootstrap method was then employed to estimate the 95% CI of PAFs. We then estimated what the ethnicity-specific suicide rates would be if certain risk factors were eliminated by stepwise elimination of factors with the strongest inter-ethnic difference based on the following formula: $(1 - \text{multi-factor PAF}) \times \text{ethnicity-specific suicide rate}$. In calculating the multi-factor PAF, for stability concerns we pooled the ORs for a factor in those ethnic groups that showed no significant factor \times ethnicity interaction. Data analyses were performed using the SAS software (version 9.1; SAS Institute, USA).

Since all the suicides initially found alive were sent to local emergency medical departments, the time-lag between being found and being treated is crucial to the outcome of emergency medical assistance. We therefore compared the mean time-lag among the three groups by one-way analysis of variance (ANOVA).

Results

Crude suicide rates and adjusted RR

Crude gender-specific suicide rates across ethnic and age groups are shown in Fig. 1. The age trends in suicide rates are different across the three groups in both genders. While suicide rates increased with age in Han in both genders, higher rates were observed in young-adult (25–44 years) and middle-aged (45–64 years) groups in the Ami and in all age groups in the Atayal except the young age group (15–24 years) in men. There were clear differences in the age trend of suicide rates across the three groups in both genders. In females, suicide rates were much higher in the Atayal than in the other two groups in all age groups. Between the Ami and the Han groups, while rates in both the 25–44 and 45–64 year age groups were higher in the former, a much higher rate in the elderly was observed in the latter. In males, the same age trends of higher suicide rates in the Atayal than in the other two groups was found except that a similar high rate was found in the elderly in both the Atayal and Han groups. The same age trend of suicide rate in females between the Ami and Han groups was again observed in males.

In the negative binomial regression model, the adjusted RR for suicide was significantly higher in the Atayal than in the other two groups after controlling

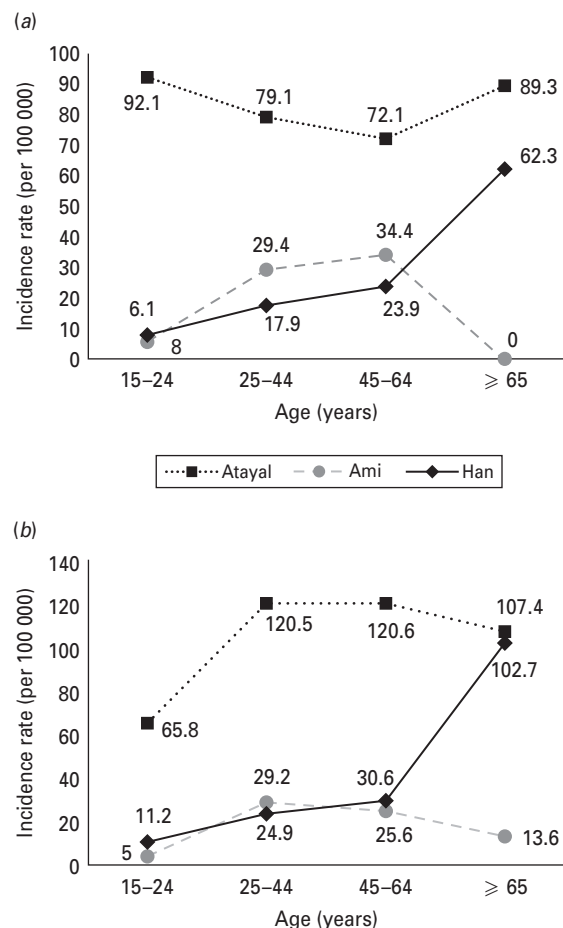


Fig. 1. Crude gender-specific incidence rates (per 100 000 per year) for suicide by age (years) in both genders in three ethnic groups in Taiwan (95% confidence intervals).

(a) female: 15–24 years: Atayal 29.9–214.9; Ami 0.16–34.1; Han 1.0–28.7; 25–44 years: Atayal 21.6–202.5; Ami 11.8–60.6; Han 7.2–36.8; 45–64 years: Atayal 8.7–260.4; Ami 12.6–74.9; Han 7.8–55.8; > 65 years: Atayal 2.3–497.5; Ami 0–0.0005; Han 20.2–145.4; (b) male: 15–24 years: Atayal 17.9–168.5; Ami 0.13–27.8; Han 2.3–32.8; 25–44 years: Atayal 55.1–228.7; Ami 13.4–55.4; Han 12.4–44.6; 45–64 years: Atayal 32.9–308.8; Ami 8.3–59.8; Han 13.2–60.4; > 65 years: Atayal 2.7–598.5; Ami 0.35–76.0; Han 58.7–166.7.

for gender and age (Table 1). The adjusted RR for suicide in Atayal was five times that in the Ami and 3.8 times that in the Han. Both the Atayal males and females had a significantly higher risk for suicide than the other two ethnic groups, adjusting for age, except that the suicide risk in the Atayal was not statistically different from that in the Han in people aged ≥ 65 years.

Risk factors for suicide

As previously reported, a very high proportion of suicides (97–100%) suffered from at least one type of

Table 1. Adjusted rate ratio (RR) for suicide by gender and age among three ethnic groups in Taiwan^a

Variable	Ami v. Atayal ^b		Han v. Atayal ^b	
	Adjusted RR (95% CI)	<i>p</i> value	Adjusted RR (95% CI)	<i>p</i> value
Gender				
Female	0.18 (0.09–0.35)	<0.001	0.27 (0.15–0.48)	<0.001
Male	0.24 (0.11–0.52)	<0.001	0.23 (0.11–0.48)	<0.001
Age (years)				
15–24	0.07 (0.02–0.33)	0.001	0.10 (0.03–0.32)	<0.001
25–44	0.28 (0.14–0.59)	0.001	0.21 (0.10–0.43)	<0.001
45–64	0.30 (0.11–0.82)	0.019	0.28 (0.11–0.74)	0.010
>65	0.07 (0.01–0.75)	0.028	0.82 (0.19–3.53)	0.789
Males and females, all ages	0.20 (0.12–0.34)	<0.001	0.26 (0.16–0.40)	<0.001

CI, Confidence interval.

^aNegative binomial regression analysis.

^bReference group.

mental illness before suicide in all three ethnic groups (Cheng, 1995). Rates of major depressive episode in suicides were similar across the three groups (83.4–89.3%), whereas a significantly higher rate of substance dependence was found in the Atayal (56.7%) than in the Ami (43.3%) and the Han (17.9%) suicides ($p=0.001$). Rates of EUPD were highest in the Atayal (56.7%), followed by the Han (39.6%) and the Ami (26.7%) groups, but the difference is only marginally significant ($p=0.054$). More suicides in the Atayal and Ami had met with loss events in the last year before suicide (90.0% and 93.3%, respectively) than in the Han group (73.2%) ($p=0.03$). A family history of suicide and attempted suicide was significantly more prevalent in the Atayal (50.0%) than in the Ami (13.3%) and Han (1.9%) groups ($p<0.001$).

Table 2 shows results from univariate conditional logistic regression with the five major risk factors for suicide in each of the three groups. There was a statistically significant difference in the strength of association between family history and suicide risk across the three ethnic groups (p value for family \times ethnicity interaction = 0.03). The Atayal with such history had an elevation in the odds of developing suicide (OR 7.7, 95% CI 2.2–27.0), whereas the same ORs in the Ami (OR 8.0, 95% CI 0.9–71.6) and Han (OR 0.5, 95% CI 0.06–4.5) were not statistically significant. There was no statistically significant interaction between ethnicity and each of the other four factors, however.

The PAF can be interpreted as the fraction of suicides over a specified time that would be prevented following elimination of an aetiological factor. In the Han and Ami groups, major depressive episode and loss events contributed significantly to suicide,

whereas substance dependence, family history and EUPD had relatively minor effects on suicide. However, in the Atayal group, in addition to the significant contributions from major depressive episode (PAF 77.3%) and loss event (PAF 78.3%), all the other three risk factors also have a considerable influence on suicide. The PAF of suicide risk in the Atayal was estimated to be 47.6% for substance dependence, 52.7% for EUPD and 43.5% for family history of suicidal behaviour.

As shown in Fig. 2, the difference in suicide rates between the three ethnic groups can be explained by these three factors. When the effect of family history on suicide rate was first removed from the actual population rate, the remaining estimated suicide rate of the Atayal was much reduced, from 68.2 to 38.5/100 000 per year, while there was hardly any appreciable impact on suicide rate in the Han and Ami groups. When EUPD was next added to the elimination, the estimated suicide rate in the Atayal was further reduced to 19.8/100 000 per year, and a much smaller reduction in suicide rates was also observed in the Han and Ami groups. When, finally, the effect of substance dependence was also eliminated, the remaining suicide rate was 9.1/100 000 per year in the Atayal (86.7% reduction from the original suicide rate), 10.1/100 000 per year (43.9% reduction) in the Han and 8.3/100 000 per year in the Ami (46.8% reduction). It is interesting to see that the remaining suicide rates were similar across the three groups after eliminating the effect of the three risk factors.

Suicide methods

There were more completed suicides in the Atayal group by self-poisoning with pesticides than the Ami

Table 2. Odds ratio (OR) and population attributable fraction (PAF) of suicide for five major risk factors in three ethnic groups ($n = 339$)^a

Ethnic group/variable ^b	% in suicides	OR (95% CI)	<i>p</i> value	% PAF (95% CI)
Han				
Depression	94.3	119.5 (21.7–∞) ^c	<0.0001	94.3 (86.8–100.0)
Substance	18.9	4.0 (1.2–13.1)	0.02	14.2 (2.8–24.0)
EUPD	39.6	9.4 (3.2–27.7)	<0.0001	35.4 (21.9–48.0)
Family	1.9	0.5 (0.056–4.5)	0.54	–1.9 (–39.7–2.3) ^d
Loss	75.5	9.4 (3.9–22.6)	<0.0001	67.5 (52.5–78.6)
Ami				
Depression	86.7	32.7 (4.4–244.7)	0.0007	84.0 (63.7–95.2)
Substance	43.3	6.0 (1.9–18.6)	0.0019	36.1 (16.4–52.1)
EUPD	26.7	6.6 (1.4–31.8)	0.0184	22.6 (5.9–37.2)
Family	13.3	8.0 (0.9–71.6)	0.0629	11.7 (–1.2–23.1)
Loss	93.3	14.2 (3.3–61.1)	0.0004	86.8 (64.3–96.2)
Atayal				
Depression	83.3	13.8 (3.2–59.8)	0.0005	77.3 (55.1–90.3)
Substance	56.7	6.3 (2.1–19.1)	0.0012	47.6 (25.5–64.2)
EUPD	56.7	14.1 (3.2–61.7)	0.0004	52.7 (32.8–69.0)
Family	50.0	7.7 (2.2–27.0)	0.0015	43.5 (23.2–60.2)
Loss	90.0	7.7 (2.2–26.7)	0.0013	78.3 (49.7–91.1)

CI, Confidence interval.

^a Including 113 suicides (30, 30 and 53) and 226 matched controls (60, 60 and 106) in Atayal, Ami, and Han, respectively.

Univariate conditional logistic regression was exercised.

^b Denotes ICD-10 major depressive episode (Depression), substance dependence (Substance), emotionally unstable personality disorder (EUPD), suicidal behaviour in first-degree relatives (Family) and loss event in the past year (Loss).

^c Exact conditional logistic regression.

^d Negative value for PAF indicating protective effect; 95% CI including zero indicating non-significant.

and Han groups (77%, 67% and 54%, respectively), whereas more Han suicides used hanging than the Atayal and Ami suicides (41%, 17% and 17%, respectively) ($p = 0.03$). Fig. 3 illustrates the crude method-specific suicide rates in the three groups. Rates for poisoning, hanging and others were all higher in the Atayal than in the other two groups, but the most striking finding was the very high incidence of suicide by poisoning (largely by pesticides) in this group (49.7/100 000 per year), which was higher than the corresponding rates in the Ami (10.7/100 000 per year) and Han (11.0/100 000 per year) as compared with the incidence RR. While suicide rates by poisoning were also the highest among all methods in the Ami and Han groups, rates by hanging were significantly higher in the Atayal than in the Ami. Currently, both self-poisoning with pesticides and hanging are still the major methods of suicide (together with charcoal burning) in Taiwan.

Help-seeking and availability of emergency medical aids

There is no statistically significant difference in the frequency of counselling among suicides in the last

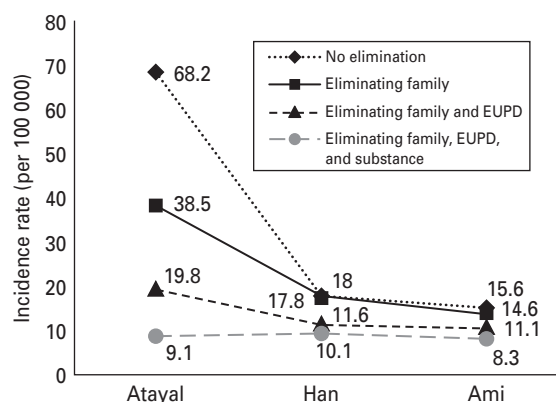


Fig. 2. Remaining ethnic-specific incidence rates (per 100 000 per year) of suicide after stepwise elimination of three risk factors in three ethnic groups in Taiwan including suicidal behaviour in first-degree relatives (Family), emotionally unstable personality disorder (EUPD) and substance dependence (Substance). Based on the following formula: $(1 - \text{multi-factor PAF}) \times \text{ethnicity-specific suicide rate}$. PAF, population attributable fraction.

3 months before suicide across three ethnic groups (5–13%) ($p = 0.19$). The Han suicides had a higher proportion (68%) of consultation with a psychiatrist or

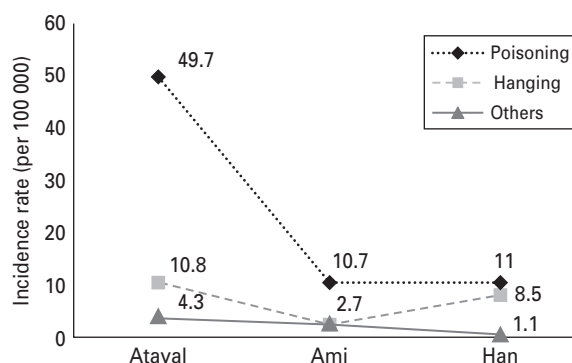


Fig. 3. Crude method-specific incidence rates (per 100 000 per year) of suicide in three ethnic groups. Rate ratio (95% confidence interval); p value based on Fisher's exact tests. Poisoning: Ami *v.* Atayal = 0.22 (0.11–0.41), $p = 0.000$; Han *v.* Atayal = 0.22 (0.12–0.40), $p = 0.000$. Hanging: Ami *v.* Atayal = 0.25 (0.06–1.08), $p = 0.038$; Han *v.* Atayal = 0.78 (0.29–2.63), $p = 0.599$. Others: Ami *v.* Atayal = 0.62 (0.10–6.51), $p = 0.566$; Han *v.* Atayal = 0.26 (0.03–3.05), $p = 0.181$.

a medical doctor in the last 3 months before suicide than the Atayal and Ami groups (43% and 50%, respectively) ($p = 0.11$). However, as previously reported (Cheng, 1995), only 4% of all 116 suicides received antidepressant treatment and none of these had sufficient dosage and duration.

Among suicides initially found alive, the mean time-lag between being found and being treated was 1.2 h (s.d. = 0.44) in the Atayal, 1.7 h (s.d. = 2.16) in the Han and 2.1 h (s.d. = 3.02) in the Ami. The differences among the three groups were not statistically significant (one-way ANOVA: $F_{2,51} = 0.722$, $p = 0.49$).

Discussion

Relatively higher suicide rates have been previously reported among specific ethnic groups and explanatory models have been proposed (Lester, 1997; Hunt *et al.* 2003). The high suicide rates in certain ethnic minorities have been attributed to biological factors, availability of medical assistance and the lethality of suicide methods (Marusic & Farmer, 2001; Hunt *et al.* 2003).

Studies in Australia and Canada reported that native peoples had excessive mortality from suicide owing to difficulties with the high degree of industrialization and cultural confusion (Clayer & Czechowicz, 1991; Garlow *et al.* 2005). The pervasive socially disadvantageous status of native peoples has previously been proposed as a predisposing factor to suicide (McKenzie *et al.* 2003; Hunter & Milroy, 2006). These reports have, however, rarely focused on people in non-Western societies. In this study, we have investigated several potential risk factors for the

significant difference in suicide rates among three ethnic groups in Taiwan, using the same standardized, cross-culturally valid and reliable assessments.

Major risk factors and suicide rates

In this study of the impact of individual major risk factors for suicide on differential suicide rates among the three groups, we first calculated the PAF of these factors, which also enabled us to assess the potential of population-specific intervention strategies.

It was found that suicidal behaviours in first-degree relatives, substance dependence and EUPD had the highest PAF in the Atayal population compared with the other two groups. Once the contributing effects from these three factors were eliminated, the remaining estimated suicide rate in the Atayal became similar to the corresponding figures in the other two groups. In other words, findings in this study suggest that these three factors are able to explain the significantly higher rate of suicide in the Atayal compared with the Ami and Han groups.

Family history of suicidal behaviour

The impact of family history of suicidal behaviour on suicide has been viewed as a complex interaction between genetic and environmental factors. Viana *et al.* (2006) reported that a family history of suicide attempts is associated with a raised suicidal risk and that familial suicide attempts are also related to the use of more lethal suicide methods (Viana *et al.* 2006). One study showed that suicide attempters with a family history of suicidal behaviour had the highest impulsive scores, compared with those in people without suicidal attempts or in people without a family history (Roy, 2006). The individual susceptibility to suicide might stem from an impulsive characteristic of a family (Roy, 2006). This study found that a family history of suicidal behaviour had different impacts on suicide risk across the three ethnic groups. It had a significant contribution to the high suicide rate in the Atayal suicides, but not in the other two groups. The Atayal had the highest PAF for both family history of suicidal behaviour and EUPD than the other two groups, echoing the link between family history of suicidal behaviour, impulsivity and suicide.

A solid association between suicide and certain sociodemographic factors has been reported (Gould *et al.* 1996). In an early publication from this psychological autopsy study, a number of socio-environmental factors were found to be significantly associated with suicide risk in a univariate statistical model (Cheng *et al.* 2000). They include marital disruption, unemployment, living alone, recent migration and low socio-economic status (SES). However, all these factors

were not statistically significant in subsequent multivariate analyses.

SES has been regarded as an important potential factor in cross-ethnic differences of suicide risk (McKenzie *et al.* 2003; Hunter & Milroy, 2006). We have examined the effect from SES on our cross-ethnic comparison. The interactive effect between low SES and suicide risk across the three ethnic groups did not reach statistical difference (p value for SES \times ethnicity interaction = 0.34).

Method-specific suicide rates

Lethality of suicide methods has been consistently found to be an important factor for suicide. This study revealed a strong association between method-specific suicide rate and ethnicity. The Atayal suicides had the highest proportion using self-poisoning (largely with pesticides) and suicide rate for self-poisoning in this group is significantly higher than in the other two ethnic groups.

The availability of lethal means to self-harm affects suicidal mortality (Gunnell & Eddleston, 2003). Toxic pesticides such as paraquat and organophosphorous compounds can cause severe toxicities and have a high lethality if chosen for suicide (Banerjee *et al.* 2009). The excess of completed suicides in the Atayal may have been at least in part related to the use of pesticides for suicide. Highly lethal pesticides such as paraquat are often kept in the houses of the Atayal in their rural villages and are readily available. Our finding has again echoed the importance in suicide prevention of reducing access to lethal methods of suicide (Gunnell *et al.* 2007).

Help-seeking and availability of emergency medical aids

Early detection and effective management of depressive illness has been one of the main suicide prevention strategies in all nations (Department of Health, 2002). In our study, there was no significant difference in the frequency of counselling or consultation with psychiatrists or medical doctors among suicides in the three groups before suicide. Moreover, only a tiny proportion (4%) of all 116 suicides received antidepressant treatment with insufficient dosage and duration (Cheng, 1995). Therefore, the difference in suicide rates among the three groups cannot be explained by any difference in mental health service.

Our findings also do not support our hypothesis that a lower availability of medical resuscitation after suicide contributes to the high suicide rate in the Atayal. This might be explained by the lack of difference in the availability of an emergency medical

service between rural and urban settings and the convenience in transportation in rural Taiwan in recent years. This is in contrast with rural China, where poor access to emergency medical care has been reported to be an important factor contributing to high suicide rates (Phillips *et al.* 2002).

The two aboriginal groups

The Ami and Atayal are the two largest aboriginal groups in Taiwan. The Ami settled in the eastern plain area of Taiwan. They were the first among all the Taiwanese aboriginal groups to have contact with the Han Chinese and have undergone assimilation for over a century. In consequence, they are the most assimilated, generally better educated, with a higher proportion of skilled workers than other Taiwanese natives. The Atayal originally lived in the central mountains of northern Taiwan. Geographical distance and their aggressive nature considerably delayed their contact with the Han Chinese until the 1960s, much later than the Ami and several of the other aboriginal groups.

Based on this psychological autopsy study, a higher risk of suicide was reported to be associated with a lower degree of social assimilation in the Atayal and in men, even after controlling for major depressive episode and EUPD (Lee *et al.* 2002). Hence, low acculturation might be one of the risk factors for the higher suicide incidence in the Atayal compared with the Ami.

Limitations

There are limitations in this study. First, PAF is a widely used efficient measure for quantifying the extent of disease reduction through preventive strategies. In the calculation of a PAF for a certain risk factor, it is assumed that those who are exposed to the risk factor will suffer the same disease rates as those who are not, if the preventive strategy toward eliminating the risk factor is implemented in the population. However, this cannot be true when the 'factor' under concern is only associated with the disease but is not a cause for it. In that case, eliminating the factor but not the root cause will have no effect on disease rate in the population. Second, if an unmodifiable risk factor was considered in the assessment of PAF, its practical implication is then limited (Rockhill *et al.* 1998). In this study, for example, it would be difficult to modify the risk family history of suicidal behaviour in the short term through general public health promotion. Under such circumstances, the quantitative value of PAF would be theoretical, until long-term cross-generation preventive approaches could be implemented.

There was, however, an interesting example of a natural experiment showing the reduction of suicide rates after the reduction of alcohol consumption in an anti-alcohol campaign during the perestroika (restructuring) period in the former Soviet Union in 1985–1990. In a population-based investigation, the attributable fraction of alcohol for suicide in the USSR in 1990 was estimated to be 27% for women and approximately up to 50% for men (Wasserman & Varnik, 1998). However, suicide rates rose again in several independent countries of the Former Soviet Union after the breakdown of USSR.

Implications

The identified risk factors for the much higher suicide rate in the Atayal have implications for developing specific suicide prevention strategies in this group, aiming at reducing factors with high PAF, including family history of suicidal behaviour, substance dependence (mainly alcoholism) and EUPD. The strategy should also include the reduction of availability and lethality of suicide methods (in particular, pesticides). Effective health education and family intervention, as well as a culturally relevant, better mental health service should also be implemented.

To what extent our findings can be replicated in other nations or ethnic groups awaits future studies. The identification of common risk factors responsible for elevated suicide rates can facilitate global collaboration in suicide prevention.

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Declaration of Interest

None.

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