# Association Between the Accessibility to Lethal Methods and Method-Specific Suicide Rates: An Ecological Study in Taiwan

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***Objective:*** To examine the association between availability of lethal methods of suicide and method-specific suicide rates at the city/county level in Taiwan.

***Method:*** Age-adjusted and age-specific suicide rates of 23 cities/counties in Taiwan for the years 1999 to 2003 were calculated. Partial correlation coefficients were used to examine cross-sectional associations between independent variables, i.e., proportion of agricultural population and proportion of households living on the sixth floor or above, and suicide rates by different methods (poisoning by solids/liquids, jumping, and hanging) after adjusting for unemployment rates and prevalence of depression.

***Results:*** The partial correlation coefficient was 0.77 ($p < .001$) for proportion of agricultural population with solids/liquids poisoning suicide rates. It was 0.73 ($p < .001$) for the proportion of households living on the sixth floor or above with suicide rates by jumping. Correlations between hanging suicide rates and proportion of agricultural population or between hanging suicide rates and proportion of households living on the sixth floor or above were not significant.

***Conclusion:*** The results showed strong positive associations between access to lethal methods and method-specific suicide rates. Controlling the availability of pesticides and fencing high buildings or installing window guards may be effective measures for suicide prevention.

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To assess the association between availability of lethal methods and method-specific suicide rates, 2 kinds of study designs have been used. The most common approach has been to examine suicide trends in relation to particular suicide methods such as domestic gases,[1–3] vehicle emissions,[4] prescription medications,[5] and guns.[6–9] Almost all studies demonstrated a decrease in method-specific suicide rates after interventions; however, some studies also showed an increase in suicide rates by other methods.[6,10,11] It is, nevertheless, very hard to determine whether any increase in suicide rate is due to underlying socioeconomic or medical causes (e.g., unemployment or poor treatment of depression patients) or to substitution of suicide methods.

An alternative approach is a cross-sectional design.[12–15] Most studies examined the differences in accessibility to guns with suicide rates by guns across countries[12] or metropolitan areas[13] or at the regional or state level.[14] Only one study explored the availability of lethal methods other than guns.[15] Marzuk et al.[15] classified suicide methods into equal-access methods (e.g., hanging, laceration, suffocation, burn, firearms, and drowning) and differential-access methods (e.g., falls from heights, overdose of prescription medications, carbon monoxide poisoning, lying before commuter train, and lying on subway track). Their results found that different counties had similar suicide rates involving equal-access methods, while virtually all of the differences in overall suicide rates among counties could be explained by differential-access methods.[15] One limitation of their study was that they confined their study to only 5 counties and did not control for other suicide risk factors.

All previous studies were done in Western countries. It is noteworthy that the dominant suicide methods differ greatly across countries, particularly between Asian and Western countries. In Asian countries, apart from the traditional method of hanging, the most common method of suicide among people living in urban areas was jumping from high buildings.[16] In contrast, those living in rural areas of Asia tended to use pesticides to kill themselves.[16] Poisoning with pesticides, jumping, and hanging were the 3 major suicide methods in Taiwan,[17] a country with 23 cities/counties characterized by marked differences in urbanization. Poisoning with pesticides was seldom dis-

cussed in previous studies concerning associations between availability of methods and suicide rates.

We hypothesized that the suicide rate by poisoning with pesticides would be positively correlated with the proportion of the city/county population that was agricultural and the suicide rate by jumping from heights would be positively correlated with the proportion of the population that resided on or above the sixth floor. In contrast, we predicted that there would be no correlation between each of these accessibility variables and the suicide rate by hanging, a method to which individuals have unlimited and universal access. The aim of our study was to examine the strength of association between availability of lethal methods (i.e., high buildings and pesticides) and method-specific suicide rates across 23 cities/counties in Taiwan after adjusting for unemployment rates and prevalence of depression.

## METHOD

### Dependent Variables: Method-Specific Suicide Rates

National electronic data files on mortality for the years 1999 to 2003 were provided by the Department of Health of the Executive Yuan of Taiwan. In Taiwan, a verdict of death from unnatural cause is jointly assigned by a public prosecutor and a coroner. All deaths from throughout Taiwan are reported to the Department of Health, Executive Yuan of Taiwan. We combined 5 years of data to minimize the effect of random fluctuations during shorter periods.

Since suicide mortality statistics are usually underestimated[18–20] and the most common category being misclassified is death from undetermined causes,[21] suicides were defined as deaths coded E950 to E959 plus deaths from undetermined causes coded E980 to E989 in the International Classification of Diseases, Ninth Revision (ICD-9).[22]

For analysis, we followed the classification of Marzuk et al.[15] and selected 2 differential-access methods, i.e., poisoning by solids/liquids (coded E950 and E980) and jumping (coded E957 and E987), and 1 equal-access method, i.e., hanging (coded E953 and E983). We did not include the accidental poisonings by solids/liquids into solids/liquids suicide for the analysis because the percentage of accidental poisonings among total poisonings was only around 7% (357/4902). Suicides among those aged under 14 years were excluded. Age-adjusted method-specific suicide rates in 23 cities/counties were calculated using the 1976 world population structure[23] as a standard.

### Independent Variables: Measurement of Availability of Suicide Methods

The proportion of the agricultural population among the total population in each city/county was used as a proxy for the accessibility to poisoning with pesticides. The higher the proportion, the more easily people could access pesticides. Data for the proportion of the agricultural population in each city/county were obtained from the 2000 Agricultural and Fishery Census.[24] Agricultural population was defined as all members of farm families, including the members who partly work at offices or other industries, who could access pesticides.

The proportion of households living on the sixth floor or higher among total households in each city/county was used as a proxy for accessibility to heights from which to jump. The higher the proportion, the more easily people could access high buildings for jumping. Data for the proportion of households living on the sixth floor or above in each city/county were obtained from the 2000 Population and Housing Census.[25]

### Statistical Analyses

Since unemployment rate[26] and mental illness,[27] particularly depressive disorders, were strongly associated with suicide, we adjusted for unemployment rates and the prevalence of depressive symptoms for each city/county in this association study to avoid the influence of these 2 suicide-related factors. Data for unemployment rates for each city/county were obtained from National Statistics of Taiwan.[28] Data on the prevalence of depressive symptoms of each city/county were obtained from the 2002 National Interview Survey conducted by the Bureau of Health Promotion, Department of Health.[29]

Data were analyzed using SPSS for Windows, Version 12.0 (SPSS Inc., Chicago, Ill.). The 95% confidence intervals (95% CIs) for suicide rates by solids/liquids poisoning, jumping, and hanging in each city/county were calculated to examine the differences across cities and counties. Scatter diagrams with linear regression lines were drawn to examine the association between method-specific suicide rates and availability of suicide methods.

Partial correlation coefficients between the proportion of agricultural population or the proportion of households 6 floors and above and suicide rates by different methods (solids/liquids poisoning, jumping, and hanging) were calculated by 4 age groups and sex and adjusted for unemployment rates and the prevalence of depressive symptoms in each city/county. The unit of analysis was city/county and the number of units was 23 throughout the study.

## RESULTS

There were 17,725 suicides during the 5-year study period in Taiwan. This number included 4545 for poisoning by solids/liquids, 6161 for hanging, and 2049 for jumping from heights. The annual age-adjusted suicide rates were around 22.6 to 28.2 per 100,000 population in males and 11.3 to 13.9 per 100,000 in females between the periods of 1999 to 2003 in Taiwan. The age-adjusted suicide

Table 1. Age-Adjusted Suicide Rates and Sociodemographic Characteristics of 23 Cities/Counties in Taiwan by Sex, 1999–2003[a]

| | Male | | | Female | | |
|---|---|---|---|---|---|---|
| Index | Range (among cities/counties) | Mean | SD | Range (among cities/counties) | Mean | SD |
| Overall suicide rate (per 100,000 population) | 13.1 to 38.4 | 25.8 | 5.9 | 9.7 to 22.0 | 13.9 | 3.2 |
| Hanging suicide rate (per 100,000 population) | 2.9 to 14.3 | 9.4 | 2.4 | 2.9 to 6.5 | 4.2 | 0.9 |
| Solids/liquids poisoning suicide rate (per 100,000 population) | 0.5 to 16.1 | 7.2 | 3.9 | 0.9 to 10.4 | 4.4 | 2.5 |
| Jumping suicide rate (per 100,000 population) | 1.0 to 4.5 | 2.2 | 1.0 | 0.7 to 3.8 | 1.8 | 0.8 |
| Population/year | 41,790 to 1,569,179 | 427,085 | 351,649 | 38,290 to 1,556,396 | 411,974 | 355,624 |
| Agricultural population (2000),%[b] | 0.4 to 49.4 | 21.9 | 16.7 | | | |
| Households living on sixth floor or above (2000),%[b] | 1 to 45 | 15 | 13 | | | |
| Unemployment rate (2000),% | 1.7 to 4.8 | 3.42 | 0.94 | 1.2 to 3.5 | 2.37 | 0.66 |
| Prevalence of depression (2002),% | 1.9 to 5.6 | 3.5 | 1.0 | 1.8 to 11.3 | 6.2 | 2.2 |

[a]Data from the Department of Health of the Executive Yuan of Taiwan (suicide rates), the 2000 Agricultural and Fishery Census[24] (agricultural population), the 2000 Population and Housing Census[25] (households living on sixth floor or above), National Statistics of Taiwan[28] (unemployment rates), and the National Interview Survey, Bureau of Health Promotion, Department of Health[29] (depression rates).
[b]These data were not broken down by sex.

rates and sociodemographic characteristics of 23 cities/counties are shown in Table 1.

For the equal-access method, i.e., hanging, the differences among 23 cities/counties were small; suicide rates ranged from 4.76 per 100,000 population (95% CI = 3.96 to 5.57) in Yilan County to 9.99 per 100,000 (95% CI = 8.39 to 11.59) in Hualien County—a 2-fold range.

For differential-access methods, i.e., solids/liquids poisoning and jumping, marked variations in the method-specific suicide rates were found across 23 cities/counties. Suicide rates for solids/liquids poisoning ranged from 0.85 per 100,000 population (95% CI = 0 to 1.81) in Penghu County to 12.41 per 100,000 (95% CI = 10.93 to 13.89) in Nantou County—a 14-fold range. The jumping suicide rates ranged from 0.98 per 100,000 population (95% CI = 0.72 to 1.24) in Taichung County to 4.16 per 100,000 (95% CI = 3.63 to 4.69) in Kaoshiung City—a 4-fold range.

Scatter diagrams with linear regression lines for method-specific suicide rates by availability of suicide methods are illustrated in Figure 1. The higher $r^2$ values of the linear regressions shown in Figures 1A and 1B revealed that the poisoning by solids/liquids suicide rate was positively correlated with the proportion of the city/county population that was agricultural and that the jumping suicide rate was positively correlated with the proportion of the population that resided on or above the sixth floor. In contrast, the very small $r^2$ values of the linear regressions shown in Figures 1C and 1D revealed no correlation between each of these accessibility variables and the suicide rate by hanging, a method to which individuals have unlimited and universal access.

Partial correlation coefficients between method-specific suicide rates and the proportion of agricultural households or households living on or above the sixth floor by sex and age in 23 cities/counties, controlling for unemployment rates and prevalence of depressive symptoms, are shown in Table 2. The partial correlation coefficients were 0.77 ($p < .001$) for the proportion of agricultural population with the suicide rates by poisoning with solids/liquids and 0.73 ($p < .001$) for the proportion of households living on the sixth or higher floor with jumping suicide rates. There was no significant correlation of hanging suicide rates with either the proportion of the agricultural population ($r = –0.10$, $p = .34$) or the proportion of households living on the sixth floor or higher ($r = –0.05$, $p = .41$).

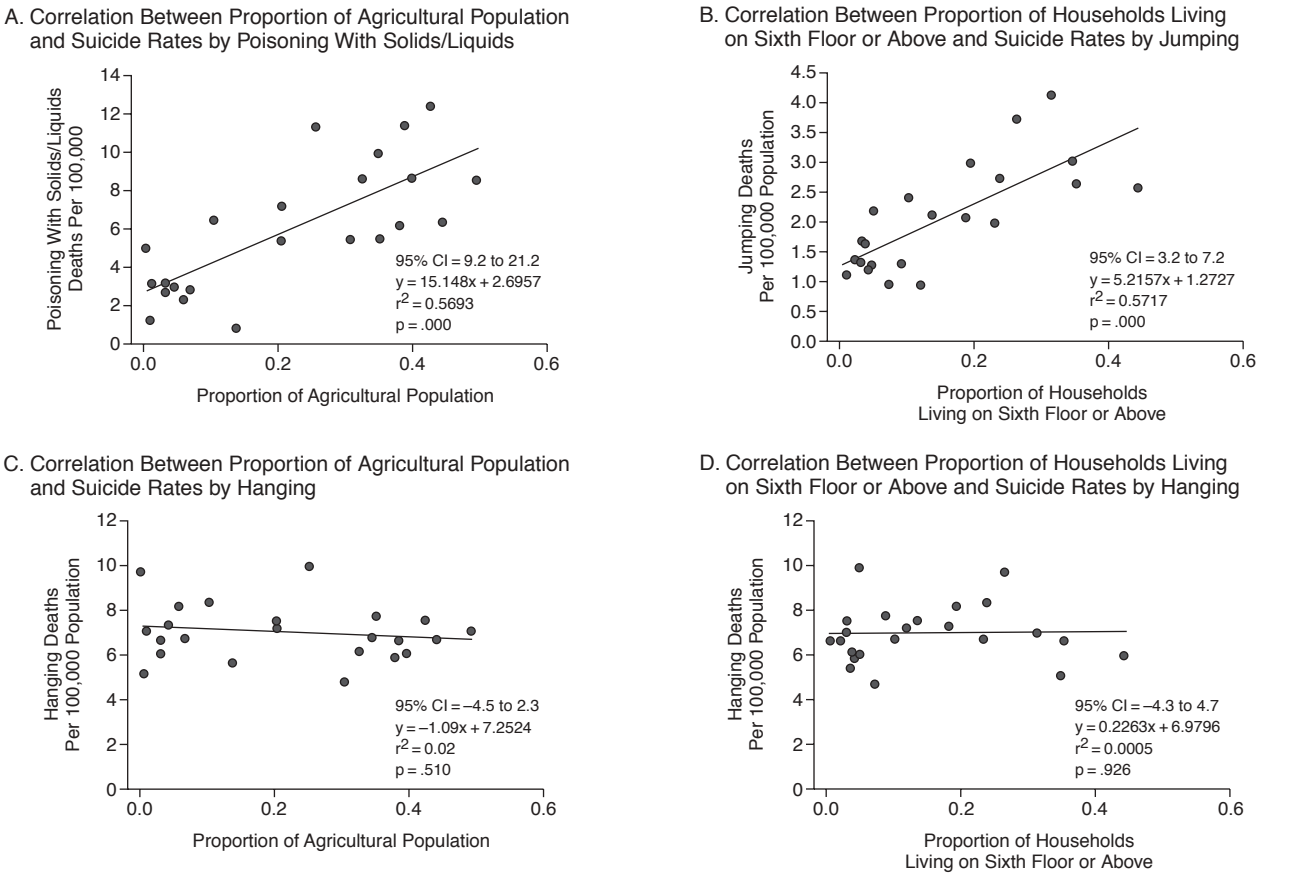
Table 2 also shows sex- and age-specific associations of accessibility to suicide methods with method-specific suicide rates after adjusting for unemployment rates and for prevalence of depressive symptoms. A higher proportion of agricultural population was strongly associated with greater solids/liquids poisoning suicide rates in males for 4 age groups and in females for the 2 age groups of 25 to 44 years and 45 to 64 years. In addition, the proportion of households living 6 floors and above was strongly and positively associated with jumping suicide rates, particularly for younger (aged 15–24 years) and older (aged ≥ 65 years) groups in both sexes.

## DISCUSSION

We found that, after adjusting for unemployment rates and the prevalence of depression, the higher the proportion of an agricultural population, the higher the rate of suicide by solids/liquids poisoning (mainly pesticides); also, the higher the proportion of households living on the sixth floor or above, the higher the jumping suicide rate. The results show a strongly positive association between access to methods of suicide and method-specific suicide rates in Taiwan.

Our results are consistent with previous studies.[12,13,15] Sloan et al.[13] found that the firearms suicide rate was higher in King County, Washington, than in Vancouver, British Columbia, where laws regarding firearms were more restrictive. Marzuk et al.[15] compared the 5 counties

**Figure 1. Scatter Diagrams and Linear Regression of Availability of Means of Suicide With Method-Specific Suicide Rates Among 23 Cities/Counties in Taiwan, 1999–2003**




in New York City and found that the jumping suicide rates were higher in counties with a higher proportion of residents living in tall structures. They also found that the suicide rate by overdose of prescription medications was higher in counties with a greater number of physicians per capita; similarly, the carbon monoxide poisoning suicide rates were highest in the 2 counties with the greatest proportion of private garages.[15] The association found in our study was stronger than that of Lester,[12] which showed lower coefficients ($r = 0.38$, $p < .01$) for the association between percentage of homicides using guns and gun suicide rates. Most studies seem to support the idea that restricting access to lethal means of suicide would result in reductions in suicide rates.

However, other studies suggested that substitution would occur if one method was restricted and that the overall suicide mortality rates would not be reduced. For example, it seems that firearms are substituted by leaping in males,[6] car exhaust is substituted by hanging in young people,[30] domestic gas is substituted by car exhaust in males,[3,10] and gassing is substituted by drug overdose in women and younger men.[11] However, it is very hard to disentangle the influences of these various factors to determine whether the increase in the suicide rate is due to underlying causes or to substitution of suicide methods.

Regardless of whether a substitution occurs, limiting the availability of methods could have great potential as a single intervention to reduce suicide rates. This perspective on prevention is described in one of the reports of the World Health Organization (WHO) on suicide prevention.[31] Restricting the availability of lethal means through gun possession control, detoxification of domestic gas, detoxification of car emission, and control of the availability of toxic substances was adopted into the suicide prevention strategy by WHO.[32] Our study adds some evidence for this approach.

From our clinical experience, different groups of suicidal people require different prevention strategies. As Gunnell and Frankel[33] state, many of those who commit suicide are suffering from long-standing mental or physical distress, and, for them, life has become unbearable. But, for others, suicide occurs as a result of a crisis—as a

**Table 2. Correlation[a] Between Method-Specific Suicide Rates and Proportion of Agricultural Population or Proportion of Households Living on the Sixth Floor or Above by Sex and Age in 23 Cities/Counties in Taiwan (1999–2003), Adjusted for Unemployment Rates and Prevalence of Depressive Symptoms**

| | Solids/Liquids Poisoning | | | Jumping | | | Hanging | | |
|---|---|---|---|---|---|---|---|---|---|
| Index | Male | Female | Overall | Male | Female | Overall | Male | Female | Overall |
| Aged 15 y and above | | | | | | | | | |
| Proportion of agricultural population | 0.79*** | 0.68*** | 0.77*** | –0.61** | –0.77*** | –0.74*** | –0.08 | –0.17 | –0.10 |
| Proportion of households living on sixth floor or above | –0.61** | –0.61** | –0.64*** | 0.64*** | 0.73*** | 0.73*** | –0.06 | –0.01 | –0.05 |
| Aged 15–24 y | | | | | | | | | |
| Proportion of agricultural population | 0.72*** | 0.39* | 0.67*** | –0.53** | –0.54** | –0.66*** | 0.39* | 0.01 | 0.15 |
| Proportion of households living on sixth floor or above | –0.62** | –0.31 | –0.58** | 0.50* | 0.61** | 0.69*** | –0.21 | –0.05 | –0.05 |
| Aged 25–44 y | | | | | | | | | |
| Proportion of agricultural population | 0.69*** | 0.67*** | 0.74*** | –0.40* | –0.63** | –0.64*** | 0.16 | 0.07 | 0.30 |
| Proportion of households living on sixth floor or above | –0.55** | –0.61** | –0.64*** | 0.38* | 0.44* | 0.50* | –0.25 | –0.16 | –0.39* |
| Aged 45–64 y | | | | | | | | | |
| Proportion of agricultural population | 0.80*** | 0.69*** | 0.79*** | –0.54** | –0.42* | –0.56** | –0.24 | –0.10 | –0.17 |
| Proportion of households living on sixth floor or above | –0.60** | –0.69*** | –0.66*** | 0.48* | 0.44* | 0.56** | 0.14 | –0.04 | 0.05 |
| Aged 65 y and above | | | | | | | | | |
| Proportion of agricultural population | 0.83*** | 0.47* | 0.63** | –0.41* | –0.45* | –0.52** | –0.33 | –0.30 | –0.48* |
| Proportion of households living on sixth floor or above | –0.59** | –0.36 | –0.46* | 0.61** | 0.62** | 0.69*** | 0.14 | 0.16 | 0.32 |

[a]Partial correlation coefficients after adjustment for unemployment rates and prevalence of depressive symptoms.
*p < .05, **p < .01, ***p < .001; N = 23 for the number of cities/counties.

result of either a relationship breakdown or financial difficulties in the context of a vulnerable personality type. The suicidal impulse may subside if sufficient time is gained by making a suicide method less accessible, i.e., if appropriate help and protection can be offered during this critical period, suicide may be prevented.[33]

There were some limitations to our study. First, the ICD-9 codes used in the mortality files in Taiwan were only 3 digits. The code E950 (and its analogous counterpart E980) is a broad category that includes suicide from all types of poisonings, such as pesticides, barbiturates, psychotropic agents, and other prescription medications. However, in Taiwan, the most frequently intentionally or unintentionally ingested poisons causing fatality were pesticides.[34] Moreover, no matter to what extent the percentage would change, the proportion of pesticide suicide deaths among all poisoning suicide deaths would be disproportionately higher in agricultural counties. So, the possible bias would tend to have increased, not reduced, the strength of the observed association. Likely, the codes E957 and E987 that we used in this study are categories for jumping from heights, not specific to residential buildings. However, the proportion of suicides by jumping from residential buildings among all suicides by jumping from heights would be disproportionately higher in the cities/counties with a higher proportion of households living on the sixth floor or above. So, the possible bias would also tend to have increased, not reduced, the strength of the observed association.

Second, the measures of the availability of suicide methods were only proxy estimates. Using the proportion of the agricultural population as the estimate of availability of pesticides is limited by possible differences in pesticide-control strategy in each city/county. In addition, different classes of pesticides with differential lethality could be used in different cities/counties with different crops (e.g., rice vs. fruits). The estimate of the number of high buildings by the proportion of households living on the sixth floor or above did not include buildings other than households, such as hotels, businesses, hospitals, and other institutions. Besides, suicide by jumping from a height also includes those who jumped from bridges or other high places.

Third, the variations between different cities/counties in reporting or coding practices for suicidal deaths could, to some degree, result in ascertainment bias. However, we tried to reduce the effect of ascertainment bias by combining undetermined deaths with suicide deaths. Besides, similar results were found if undetermined deaths, i.e., E980, E983, and E987, were excluded from the analyses.

In conclusion, our cross-sectional results for different city/county locations strongly confirm the importance of availability of suicide methods to method-specific suicide rates. However, the inferences of our study apply more to public health than to clinical treatment of an individual patient owing to its ecological nature. An implication of our results is that control of the availability of pesticides (for example, all pesticides being kept in a locked cabinet with the key held by the licensed user[35] and addition of emetic/antidote to pesticides[36]) and fencing high buildings or installing window guards may be some effective measures for suicide prevention.

## REFERENCES


1. Kreitman N. The coal gas story: United Kingdom suicide rates, 1960–71. Br J Prev Soc Med 1976;30:86–93
2. Lester D, Abe K. The effect of restricting access to lethal methods for suicide: a study of suicide by domestic gas in Japan. Acta Psychiatr Scand 1989;80:180–182
3. Lester D. The effect of the detoxification of domestic gas on suicide in the United States. Am J Public Health 1990;80:80–81
4. Mott JA, Wolfe MI, Alverson CJ, et al. National vehicle emissions policies and practices and declining US carbon monoxide–related mortality. JAMA 2000;288:988–995
5. Carlsten A, Allebeck P, Brandt L. Are suicide rates in Sweden associated with changes in the prescribing of medicines? Acta Psychiatr Scand 1996;94:94–100
6. Rich CL, Young JG, Fowler RC, et al. Guns and suicide: possible effects of some specific legislation. Am J Psychiatry 1990;147:342–346
7. Loftin C, McDowall D, Wiersema B, et al. Effects of restrictive licensing of handguns on homicide and suicide in the District of Columbia. N Engl J Med 1991;325:1615–1620
8. Carrington PJ, Moyer S. Gun control and suicide in Ontario. Am J Psychiatry 1994;151:606–608
9. Bridges FS. Gun control law (Bill C-17), suicide, and homicide in Canada. Psychol Rep 2004;94:819–826
10. Burvill PW. The changing pattern of suicide by gassing in Australia, 1910–1987: the role of natural gas and motor vehicles. Acta Psychiatr Scand 1990;81:178–184
11. Gunnell D, Middleton N, Frankel S. Method availability and the prevention of suicide: a re-analysis of secular trends in England and Wales 1950–1975. Soc Psychiatry Psychiatr Epidemiol 2000;35:437–443
12. Lester D. The availability of firearms and the use of firearms for suicide: a study of 20 countries. Acta Psychiatr Scand 1990;81:146–147
13. Sloan JH, Rivara FP, Reay DT, et al. Firearm regulations and rates of suicide: a comparison of two metropolitan areas. N Engl J Med 1990; 322:369–373
14. Miller M, Azrael D, Hemenway D. Household firearm ownership and suicide rates in the United States. Epidemiology 2002;13:517–524
15. Marzuk PM, Leon AC, Tardiff K, et al. The effect of access to lethal methods of injury on suicide rates. Arch Gen Psychiatry 1992;49:451–458
16. Cheng ATA, Lee CS. Suicide in Asia and the Far East. In: Hawton K, van Heeringen K, eds. International Handbook of Suicide and Attempted Suicide. Chichester, UK: John Wiley and Sons; 2000:29–48
17. Department of Health, Executive Yuan. Cause of death statistics. Available at: http://www.doh.gov.tw/EN/Webpage/list.aspx?dept=L&class_no=255&level_no=1&show=show&Lmenu=Lmenu6&Rmenu=. Accessed May 14, 2005
18. Sainsbury P, Jenkins JS. The accuracy of officially reported suicide statistics for purposes of epidemiological research. J Epidemiol Community Health 1982;36:43–48
19. Clarke-Finnegan M, Fahy TJ. Suicide rates in Ireland. Psychol Med 1983;13:385–391
20. Ohberg A, Lonnqvist J. Suicides hidden among undetermined deaths. Acta Psychiatr Scand 1998;98:214–218
21. Kelleher MJ, Corcoran P, Keeley HS, et al. Improving procedures for recording suicide statistics. Ir Med J 1996;89:14–15
22. World Health Organization. Manual of International Statistical Classification of Disease, Injuries, and Causes of Death, vol. 1. 9th rev. Geneva, Switzerland: World Health Organization; 1977
23. World Health Organization. World Health Statistics Annual 1995. Geneva, Switzerland: World Health Organization; 1996
24. National Statistics. 2000 Agricultural and Fishery Census. Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan. Available at: http://www.dgbas.gov.tw/ct.asp?xItem=12745&ctNode=3279. Accessed May 4, 2005
25. National Statistics. 2000 Population and Housing Census. Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan. Available at: http://www.dgbas.gov.tw/public/Attachment/5311510971.pdf. Accessed May 4, 2005
26. Platt S. Unemployment and suicidal behavior: a review of the literature. Soc Sci Med 1984;19:93–115
27. Maris RW. Suicide. Lancet 2002;360:319–326
28. National Statistics. Labor Force. Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan. Available at: http://win.dgbas.gov.tw/dgbas04/bc4/manpower/2f.asp. Accessed May 14, 2005
29. Survey and Research. Survey of health promotion knowledge, attitude and behavior in Taiwan, 2002. Bureau of Health Promotion, Department of Health, Taiwan. Available at: http://olap.bhp.doh.gov.tw/index.htm. Accessed May 14, 2005
30. Amos T, Appleby L, Kiernan K. Changes in rates of suicide by car exhaust asphyxiation in England and Wales. Psychol Med 2001;31: 935–939
31. Bertolote J. Guidelines for the Primary Prevention of Mental, Neurological and Psychosocial Disorders: Suicide. Geneva, Switzerland: World Health Organization; 1993
32. Leenaars A. Controlling the environment to prevent suicide. In: Wasserman D, ed. Suicide: An Unnecessary Death. London: Martin Dunitz; 2001:259–263
33. Gunnell D, Frankel S. Prevention of suicide: aspirations and evidence. BMJ 1994;308:1227–1233
34. Yang CC, Wu JF, Ong HC, et al. Taiwan National Poison Center: epidemiologic data 1985–1993. J Toxicol Clin Toxicol 1996;34: 651–663
35. Gunnell D, Eddleston M. Suicide by intentional ingestion of pesticides: a continuing tragedy in developing countries. Int J Epidemiol 2003;32:902–909
36. Lu TH. Changes in injury mortality by intent and mechanism in Taiwan, 1975–1998. Inj Prev 2002;8:70–73