

Suicide and unemployment rate in Taiwan, a population-based study, 1978–2006

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Abstract

Objective Both the suicide rate and unemployment rate have showed an upward trend in Taiwan since 1994. This study aimed to explore the association between the suicide rate and the unemployment rate. This information is useful in developing specific suicide prevention strategies related to unemployment.

Methods All the cases of suicide by those aged 15 years and above during 1978–2006 in Taiwan ($n = 74,064$) were included in this study. Time series models were used to analyze the monthly age-standardized suicide rate by gender and age-subgroup (15–24, 25–44, 45–64, and 65+).

Results With regard to the age range and gender subgroup, the association between age-standardized suicide and the unemployment rate was comparatively high for

males and those aged from 45 to 64 years. Among males and those aged from 45 to 64 years, a 1% increase in the absolute unemployment rate was associated with a 4.9% (95% confidence interval: 1.7–8.2) increase in the relative age-standardized suicide rate in the monthly average from 1978 to 2006 in Taiwan.

Conclusions Suicide prevention strategy for the unemployed should be more focused especially on males aged from 45 to 64 years in Taiwan.

Keywords Suicide rate · Unemployment rate · Seasonal circulation

Introduction

Since Durkheim postulated a relationship between economic change and suicide, there has been evidence of a general association between the aggregate data for unemployment and suicide. Durkheim suggested that the suicidal tendency of each social group depends on the degrees of social integration and whether social regulation is too high or too low. Unemployment thus became an important “social fact” in his analysis of suicide because of its impact on the integration of the individual into society and the social regulation placed on the individual [1]. Quantitatively, the association has been variable, and it is clear that due to differing cultural, social, and individual determinants of suicide, the relationship is complex [2]. A review of previous studies revealed that unemployment is a risk factor for suicide and deliberate self-harm [3]. In the Office for National Statistics longitudinal study, a record linkage study based on a sample of the population of England and Wales, data from a 1% sample of the census were linked to mortality data [4]. This 10-year longitudinal study of

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English and Welsh showed that unemployment is related to a doubling of the suicide rate [4]. Another recent U.S. National Longitudinal Mortality Study also supported the link between suicide and unemployment [5]. It has been argued that a modern financial support system can mitigate the impact of unemployment [6]. However, one recent study showed that unemployed people, social benefit recipients, and those in receipt of disability pensions all had a higher risk of suicide [7].

The relationship between suicide and unemployment was stronger for males than for females in New Zealand [8], Australia 1907–1990 [2], Hong Kong [9], and Japan [10]. However, a cohort longitudinal analysis in the USA showed this relationship to be more enduring and stronger among women. While for men the unemployment effect is stronger in the earlier years of follow-up, for women, the unemployment increases the risk of suicide regardless of the number of follow-up years [5]. Based on data from Japan between 1971 and 2001, however, the correlation between suicide mortality and the unemployment rate was negative even for females ($R = -0.69$) [10].

Taiwan has experienced rapid economic growth and industrialization in the past 30 years. Suicide was the ninth leading cause of death between 1999 and 2006 in Taiwan [11]. The suicide rate has increased from 12.8 in 1993 to 19.3 in 2006 per 100,000 individuals, and is now well above the world average of 14.8 per 100,000 individuals [12]. In spite of the resurgence of suicide found in the late 1990s [13], little is known about the economic factors related to this change. This study aimed to explore the association between the suicide rate and the unemployment rate. This information is useful in developing specific suicide prevention strategies related to unemployment and may offer insights different from those derived in other countries.

Materials and methods

Time series data

The nationwide mortality database of those aged 15 years and above was provided by the Department of Health of the Executive Yuan of Taiwan for the years 1978–2006. Since suicide mortality statistics are usually underestimated, and the most commonly misclassified category is death from undetermined causes [14, 15], suicide deaths were defined in this study as those coded E950–E959 and E980–E989 according to the International Classification of Diseases (ICD-9). There were 74,064 suicides during the period 1978–2006 in Taiwan, including 48,457 male suicides and 25,607 female suicides, with a male-to-female ratio of 1.9 [16].

In order to investigate the association between the age-standardized suicide rate and the unemployment rate, time series data on the unemployment rate and population by the month, from 1978 to 2006, were obtained. The unemployment rate came from the monthly manpower survey report in Taiwan [17]. The population data came from the monthly statistics of population affairs in Taiwan.

Statistical analysis

For the time series monthly data in this study, spectral analysis and harmonic regression were used to detect and control seasonal circulations. The autoregression model, which includes harmonic regression to control seasonal circulation, was used to reveal whether there was a relationship between the age-standardized suicide rate and the unemployment rate during the period 1978–2006 [18]. First, time series data were removed time trend through general cubic polynomial regression, and probably periods were found by spectral analysis. Second, the previous probable periods were included in multiple harmonic regression and backward elimination was used to select dominant periods. Finally, we added these dominant periods into the autoregression model to extract the effect of autocorrelation, which was controlled from lag 1 to lag 6. Only significant time lags were included in the model. Crude suicide rates were age-standardized based on the 2000 world standard population structure for comparisons between different annual suicide rates. The monthly age-standardized suicide rate from 1978 to 2006 served as a response. A consecutive unemployment rate of time lag order from the last one (order 1) to the last four months (order 4) were also included in the autoregression model to examine the time-lag effect of the past unemployment rate on the suicide rate. The Chow test was performed to reveal the probable structural breaking point of the suicide rate and the unemployment rate [19].

The model was tested first among the total group of suicides, then among subgroups according to gender and age (15–24, 25–44, 45–64, and 65+). SAS version 9.1 was used to estimate the models.

Results

The seasonal circulation of the suicide and unemployment rates

The raw data were plotted with the age-standardized suicide rate and unemployment rate, respectively, in Fig. 1a, b. These figures suggested a long-term increase in the suicide rate that may be related to the increases in the unemployment rate. Seasonal circulations within the years were found in the age-standardized suicide rate and

Fig. 1 Monthly age-standardized suicide rate and unemployment rate from 1978 to 2006 in Taiwan **a** Age-standardized suicide rate; **b** Unemployment rate

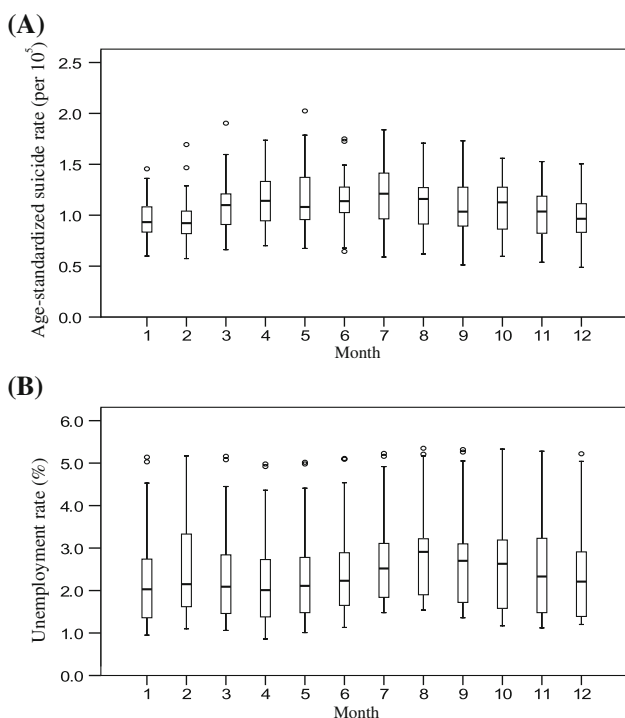
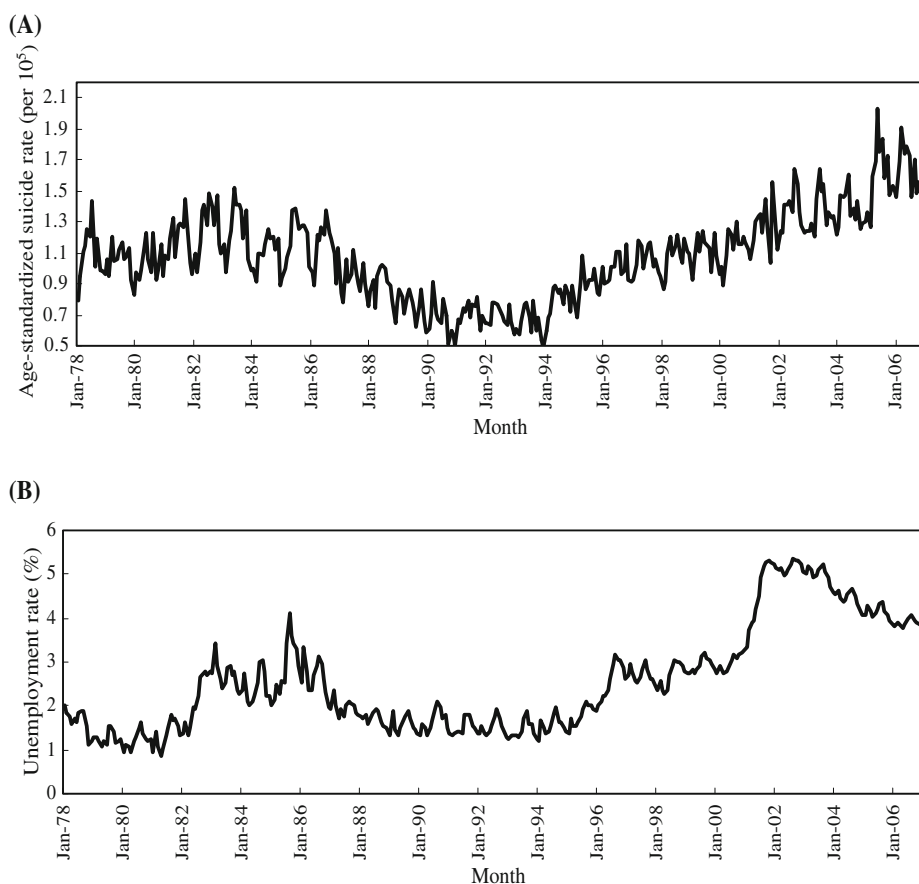


Fig. 2 Boxplots of the age-standardized suicide rate and unemployment rate by month from 1978 to 2006 in Taiwan **a** Age-standardized suicide rate; **b** Unemployment rate

unemployment rate. In Fig. 2a, b, we provide box plots of the age-standardized suicide rate and unemployment rate for each month, respectively. Those figures suggested there were lower levels of suicide and unemployment in the winter than in the late spring or early summer. In order to detect the seasonal circulation structure, we employed harmonic regression for both the age-standardized suicide rate and the unemployment rate.

Using harmonic regression models which included 12-, 6- and 3-month periods and performing backward elimination, the annual (12 months), semi-annual (6 months), and quarterly circulations were found for the age-standardized suicide rate. The same seasonal circulations were also found in the female subgroup. However, only annual and semi-annual circulations were found in the male subgroup. The annual, semi-annual, and quarterly seasonal circulations were also found in the unemployment rate.

The association of the suicide rate and the unemployment rate

By controlling the seasonal circulations and the autocorrelation, the unemployment rate had positive associations with the age-standardized suicide rate for total cases and the

Table 1 Adjusted age-standardized suicide rate associated with the unemployment rate by gender and age subgroup in Taiwan, 1978–2006

Subgroup	<i>n</i>	Effect estimate of unemployment rate (95% confidence interval)	<i>P</i> value
	74,064	0.016 (0.002–0.031)	0.028
Gender			
Male	48,457	0.036 (0.009–0.064)	0.010
Female	25,607	0.009 (–0.002–0.019)	0.105
Age			
15–24	8,680	0.001 (–0.005–0.007)	0.902
25–44	27,574	0.028 (0.002–0.054)	0.033
45–64	21,231	0.053 (0.014–0.093)	0.009
65+	16,579	0.041 (–0.022–0.104)	0.203
Age by gender			
Male			
15–24	5,141	0.010 (–0.009–0.029)	0.323
25–44	18,139	0.051 (0.008–0.095)	0.021
45–64	14,546	0.106 (0.037–0.176)	0.003
65+	10,631	0.077 (–0.032–0.185)	0.168
Female			
15–24	3,539	–0.002 (–0.018–0.014)	0.847
25–44	9,435	0.024 (0.003–0.045)	0.025
45–64	6,685	0.041 (0.009–0.073)	0.013
65+	5,948	0.042 (–0.026–0.110)	0.222

Autoregression analysis of monthly data, adjusted for the effects of seasonal circulations and autocorrelations (sixth-order autoregression)

male subgroup (Table 1). The average monthly age-standardized suicide rate from 1978 to 2006 in Taiwan among males 45–64 years old was 2.15 per 100,000. Among males and those aged from 45 to 64 years old, a 1% increase in the absolute unemployment rate was associated with a $0.106 \times 100/2.15 = 4.9\%$ (95% confidence interval: 1.7–8.2) increase in the relative age-standardized suicide rate in the monthly average from 1978 to 2006 in Taiwan.

Time structural breaking point

There was a most important breaking point in the age-standardized suicide rate in January 1994 (Chow test, $F = 68.9$, P value <0.001) for total cases. The most important breaking point of the male age-standardized suicide rate occurred in September 1993 (Chow test, $F = 56.53$, P value <0.001), as did the most important breaking point of the unemployment rate (Chow test, $F = 43.94$, P value <0.001). The most important breaking point of the female age-standardized suicide rate (Chow test, $F = 45.09$, P value <0.001) occurred in February 1995.

Discussion

Seasonal circulation of the suicide rate in Taiwan

Annual, semi-annual, and quarterly circulations in the total age-standardized suicide rate were found in this

study. It has been reported that a single cycle per year, with the lowest incidence in the winter months, was found in Hong Kong and Taiwan from 1981 to 1993 [20]. However, a spring peak and later summer peak with a trough in the winter months were reported in the USA for the two sexes; spring and autumn peaks for females, but only spring peaks for males were found in European countries and Australia [21]. The reason for the difference requires further exploration. The seasonal circulation pattern in the total age-standardized suicide rate was similar to that in the unemployment rate. The quarterly circulations indicated the time series data, with the pattern of a one-month increase and then a one-month decrease. These patterns were predominant in the latter half of the year in both the suicide rate and the unemployment rate. The close association among seasonal circulations between the suicide rate and the unemployment rate revealed the strong rhythmic relationship between them.

Adjusted association strength of the suicide and unemployment rates

Our findings suggested that the unemployment rate had a positive association with the suicide rate for the last 29 years in Taiwan only among males, when controlling for seasonal circulations and time series autocorrelation. Among the age groups, the association between suicide and unemployment for males 45–64 years old was comparatively high. Our finding of men predominantly associated

with unemployment was consistent with most previous studies [2, 8–10]. It has been hypothesized that men respond more strongly to poor economic conditions [22]. There was a non-association between the unemployment rate and the suicide rate for males and females less than 25 years old. Compared with previous results, the association between the suicide rate and the unemployment rate was higher among males between 15 and 24 years old in a recent period (1966–1990) in Australia [2] and between 18 and 24 years old in New Zealand [8]. It has been suggested that many factors influence the differences in the gender and age effect of unemployment, including differing role expectations, alternate sources of economic support and social cohesion and resilience [23]. The differences between Taiwan and Western countries in the age subgroups with the highest risk could be due to the differences in financial support provided by the social systems and the social expectations placed on the young men in these cultures. In Taiwan, it is commonly accepted in the culture that young people are to receive financial support from their parents until they have securely established their career. Besides, the obligatory two-year military service for 20-year-old men in Taiwan also serves as a social protection. Military conscription delays both employment and the stress of financial independence.

Middle-aged men in Taiwan, on the contrary, are culturally expected to provide financial support for their young children until they are financially independent. As a result and as shown in our findings, unemployment has a more devastating impact on middle-aged men in Taiwan. Therefore, unemployment insurance and other social welfare programs aimed at supporting the unemployed, especially unemployed middle-aged men with a low economic status are very important and need to be strengthened in Taiwan. Furthermore, it is possible that similar findings may be uncovered in other cultures where a strong financial burden is placed on middle-aged men. One study has revealed that, in the 1980s, unemployment was one of the major determinants of an increased suicide rate among middle-age men in Japan [24].

Time structural breaking point of suicide and unemployment rate

The time structural pattern of the age-standardized suicide rate and that of the unemployment rate were quite similar. The result suggested that the most important time structural breaking point of the age-standardized suicide rate in January 1994 was highly associated with unemployment, which has been known to be associated with increased mortality in Taiwan [25]. During this period, the rapid pace of political and socio-economic change in Taiwan placed people under heavy stress. The Chinese Nationalist Party

(KMT) had controlled Taiwan from the 1940s to 1980s. From the late 1980s, the major opposition party, the Democratic Progressive Party (DPP) began to develop and the democratic structure gradually emerged. However, due to the fierce competition between these two parties, civil society became relatively unstable. In the 1990s, the DPP became stronger and its leader was elected president in 2000. Since then, the conflict between these two parties has worsened and the political climate deteriorated. In the meantime, economic development in Taiwan began slowing down compared with the rapid development during the 1970s–1980s. This study supports the notion that the dramatic structural change in the macro-economic climate in the early 1990s played an important role and had a long-term impact on suicide in Taiwan.

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