

## Research Article

# Physician Suicide in Taiwan: A Nationwide Retrospective Study from 2000-2013

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## Abstract

Occupational health in medical professionals is an emerging issue in Taiwan; however, little research has specifically focused on suicide among doctors. In this study, we examined 1780 death records in a nationwide insurance registry covering all deceased physicians from 2000-2013, defined the probability of suicide for each record, and investigated the associated risk factors. Univariate logistic regression analysis showed that being male, born in China, and having a non-medical school background (special exam certified) were associated with a lower risk of suicide. A younger age at death, being born in countries other than Taiwan or China, and specialties including surgery, pathology or medical imaging, emergency, psychiatry and anesthesiology, increased the risk of suicide. After adjusting for confounders, only a young age at death was associated with a significant risk of suicide. The proportionate mortality ratios for doctors aged 25-44 years were 2.18 for males and 1.88 for females. Gas poisoning, hanging, and jumping were the most common forms of suicide among young physicians, while poisoning was most common in middle age. Our findings indicate that physicians may be more vulnerable in their early career years. Supportive interventions focusing on young physicians may promote the mental health of doctors.

## Introduction

Suicide has a strong link to occupation, and an increased suicide rate may reflect particular risk factors imposed on specific professional groups [1]. Physicians constantly have to bear heavy responsibilities, long working hours, emotional strain, service system reforms, and lawsuits, and are therefore more vulnerable [2-5]. On the other hand, medical practitioners are devoted to enhancing the health of their patients, are well-trained in medical knowledge, have advantageous socioeconomic resources, and may live longer than others [6,7]. Therefore, whether or not physicians are at a higher risk of suicide remains a topic of interest.

The nature of suicide is distinct from other causes of mortality among physicians. A previous study concluded that physicians have a lower mortality rate from all causes of death compared with the general population, except for suicide [8]. Another study also stated that physicians were more likely to die from stroke, accidents, and suicide, while the rates of other causes of mortality were lower [6]. In many countries, researchers have reported that the risk of suicide among physicians is higher than that in the general population and for other professionals [6,9-11]. It has been reported that the estimated suicide rate of physicians ranges from 19 to 69 per 100,000 [9-12], and that this risk is 2- to 4-fold higher than that of the general population [10,11,13]. These findings suggest that death by suicide involves additional risk factors than other causes of death. However, Shang *et al.* reported that the overall standardized mortality ratios (SMR), including suicide (SMR = 0.14), were lower in physicians than in the general population in Taiwan, which is in contrast to studies from other countries [7].

Many studies have investigated the factors associated with

physician suicide. Some have found that the physicians who commit suicide suffer from depressive symptoms and other psychopathology, or had inadequately treated mental illnesses [14-19]. Other studies have found that job dissatisfaction, stress, and burnout can also lead to physician suicide [3-5,15,18]. Environmental exposure or access to abusive or lethal drugs [20], being female, living alone [16], particular personality traits [21-23], and certain specialties [12,24] are also considered to be potential factors contributing to physician suicide. In addition, cultural differences in attitudes toward suicide may influence the prevalence of suicidal ideation among medical students, and consequently the extent of actual attempts [25].

Although a previous study revealed that doctors in Taiwan have a lower suicide SMR than the general public, generalization of this result was limited by the confounding effects of educational background and socio-economic status [7]. In addition, the SMR may not represent the special characteristics of suicide concealed in the overall health-promoting nature of the medical profession. The insurance database of the Taiwan Medical Association includes records of all deceased physicians in Taiwan. Pan *et al.* explored physician suicide by descriptive analysis using this registry database in a preliminary study [26]. In the current study, we demonstrate the distinct impact of suicide among all-cause mortality, and further analyzed the associated risk factors for suicide for doctors in Taiwan.

## Methods

All practicing doctors in Taiwan are required to enroll in death insurance managed by the Taiwan Medical Association. Whenever a physician dies, the personal registry in the national database managed by the Taiwan Medical Association is updated. The original causes of death listed on death certificates issued by treating doctors or

coroners are recorded in the registry that families can receive death benefits. The available data from Taiwan Medical Association were delinked from the names and personal identification numbers of the deceased physicians.

We retrieved all 1780 records registered in this database from January 1, 2000 to May 9, 2013. In addition to the dates and causes of death, data including the dates and place of birth, gender, medical school from which the physician graduated, specialties, year of license registration, serving institutions and their locations were also collected.

The data were scrutinized by the first author who is a board-certificated psychiatrist with an additional background in internal medicine residency. All authors confirmed the causes of death in a consensus meeting. The ages at death were grouped into 25-44, 45-64, and 65 years or more. Places of birth were grouped into: Taiwan, China, and other foreign countries. In the early 1970s, Taiwanese government held special qualification examinations for doctors who have not attend regular medical college education but were trained in the military, and issued medical license for those who were qualified. Therefore, we categorized educational background into domestic medical school, foreign medical school, and non-medical school (special exam certification). The specialties were classified into general/internal medicine (including general medicine, family medicine, physical medicine, neurology and pediatrics), surgery (including dermatology, otolaryngology, ophthalmology, obstetrics, gynecology, orthopedics), pathology or medical imaging (nuclear medicine, radiotherapy, radiation oncology, and radiology), emergency, psychiatry, and anesthesiology. The practice settings, reviewed by the name of hospital, were categorized into private clinic, district/regional hospital, medical center, or retired (without mention of previous service settings).

The original data regarding the causes of death were recorded in a primitive and unprocessed form. For example: "pneumonia; septic shock; end-stage lung cancer with brain metastasis", "suicide with drug overdose (anesthetics)", "falling in the bathroom", or "suffocation; burning charcoal in the room". We evaluated the possibility of suicide in each death for each record in this database. Accordingly, each record was assigned to one of the three defined extents of suicide: definite, probable, and possible suicide. Definite suicide was defined as deaths clearly specified as suicide, such as "suicide", "hanging", "jumping from a height", and "poisoned by succinylcholine and midazolam". Probable cases were identified from obscure descriptions such as "drowning", "suffocation", "falling from a height", "hit by train", or "pesticide poisoning" that were unnatural causes of death. Possible cases were suspected due to uncommon causes or premature death, for example, a 56-year-old male doctor who died because of "old age", or a 42-year-old physician who died of a "skull fracture with internal bleeding". The causes of suicidal deaths were categorized by ICD-9-CM codes (E950-E958). If the cause of death was not disclosed, code E958 was assigned.

The risk factors for suicide including demographic variables, medical specialties, practice settings and locality, were analyzed by univariate and multivariate logistic regression analysis using PASW Statistics software version 18 (SPSS Inc.). The expected number of cases of physician suicide was calculated as the sum of the annual

product of physician all-cause mortality in each year from 2000 to 2013, multiplied by the age-, sex-, and year-specific suicide mortality ratio of the general population. Because the suicide mortality ratios of the general public in 2012-2013 are not yet available, the expected values of these two years were inferred from the data for 2011. PMR and 95% confidence intervals (CIs) for the physicians in Taiwan were calculated [27]. In addition, causes of suicide were examined in both genders and all age groups.

## Results

We excluded 5 records due to missing data. Among the remaining 1775 records of physician deaths between 2000 and 2013, 1738 (97.9%) cases were male, 101 (5.7%) were aged 25-44 years, 350 (19.7%) 45-64 years, and 1324 (74.6%) more than 65 years (Table 1). There were no records of death in a physician under 25 years of age. Most of the deceased physicians were born in Taiwan (922, 51.9%) and China (849, 47.8%); the rest were born in Canada, Malaysia, and the Philippines. Over half of the cases (944, 53.2%) had received domestic medical school education; the rest were educated in foreign medical schools (174, 9.8%) or qualified through special exam (657, 37.0%). Three-quarters of the registered specialties were included in general/internal medicine. Aside from the retired subjects (799, 45.0%), 627 (35.3%), 273 (15.4%), and 76 (4.3%) physicians practiced in private clinics, district/regional hospitals, and medical centers, respectively. The majority of the physicians worked in northern and southern Taiwan, where the largest urban areas are located.

Table 1 summarizes the results of univariate logistic regression analysis for suicide among physicians when a moderate standard of suicide was applied (including definite and probable cases of suicide,  $n = 52$ ). Male gender, being born in China, and a non-medical school background (special exam certification) were associated with a reduced risk of suicide. However, a younger age at death, being born in countries other than Taiwan or China, specialties of surgery, pathology or medical imaging, psychiatry, and anesthesiology were associated with significantly elevated risk of suicide. However, only earlier age at death was significantly correlated with suicide after adjusting for all risk factors, with a 60-fold increase in the risk for doctors below 45 years, and an 8-fold higher risk in those aged 45-64 years compared to those aged 65 years and older.

We then adopted narrower ( $n = 26$ ) and broader ( $n = 70$ ) standards of suicide for logistic regression analysis. The results were generally consistent, and showed an even higher adjusted risk for suicide among those who died at an earlier age (OR = 182.49 for those aged 25-44 years; 31.20 for those aged 45-64 years compared to those aged 65 years and older) if adopting stricter suicide criteria. By the moderate definition of suicide ( $n = 52$ ), the PMRs for male doctors aged 25-44 and 45-64 years were 2.18 (95% CI 1.56-3.04) and 1.06 (0.65-1.74), respectively, and the PMR for doctors over 65 was 0.61 (0.31-1.22). For female doctors, the PMRs were 1.88 (0.58-6.06) for those aged 25-44 years, and 2.93 (0.80-10.78) for those aged 45-64 years (Table 2).

Causes of suicide in both genders are listed in Table 3-1. As in the general public, hanging was the most common method of suicide, however higher rates of asphyxiation and drowning, and lower rates of intoxication and jumping from a height were observed.

**Table 1:** Unadjusted and adjusted analyses of the correlates of suicide among physicians by logistic regression (n = 1775)

	n	Definite and probable suicides (n=52)			
		Unadjusted		Adjusted	
		OR (95% CI)	p	OR (95% CI)	p
Male	1738	0.234 (0.08-0.69)	.008**	0.55 (0.16-1.87)	.342
Age at death					
25-44	101	60.02 (26.36-136.68)	.000***	58.10 (17.19-196.34)	.000***
45-64	350	8.40 (3.59-19.63)	.000***	8.29 (2.63-26.11)	.000***
65-	1324	1.00		1.00	
Place of birth					
Taiwan	922	1.00		1.00	
China	849	0.37 (0.20-0.70)	.002**	1.08 (0.50-2.34)	.851
Other countries	4	23.92 (3.28-174.52)	.002**	5.51 (0.58-51.94)	.136
Educational background					
Domestic medical school	944	1.00		1.00	
Foreign medical school	174	0.35 (0.11-1.14)	.082	1.88 (0.45-7.83)	.388
Non-medical school (special exam certification)	657	0.12 (0.04-0.34)	.000***	1.08 (0.25-4.56)	.919
Medical specialty					
General/internal medicine	1319	1.00		1.00	
Surgery	376	1.99 (1.05-3.78)	.036*	0.88 (0.42-1.84)	.737
Pathology and imaging	32	6.84 (2.24-20.84)	.001**	3.49 (0.88-13.82)	.075
Emergency	8	6.84 (0.81-57.50)	.077	0.75 (0.05-11.37)	.837
Psychiatry	22	7.56 (2.11-27.06)	.002**	2.94 (0.61-14.10)	.177
Anesthesiology	18	5.98 (1.31-27.31)	.021*	1.20 (0.21-7.00)	.837
Practice setting					
Retired	799	1.00		1.00	
Private clinic	627	4.50 (1.93-10.52)	.001**	1.88 (0.73-4.83)	.188
District/regional hospital	273	3.86 (1.42-10.46)	.008**	0.65 (0.20-2.09)	.468
Medical center	76	21.21 (8.07-55.76)	.000***	1.45 (0.43-4.86)	.551
Locality					
North-western	725	1.00		1.00	
Mid-western	294	1.24 (0.61-2.52)	.546	1.13 (0.50-2.52)	.774
South-western	658	0.63 (0.33-1.24)	.182	0.67 (0.32-1.41)	.296
Eastern	91	0.66 (0.15-2.82)	.572	0.68 (0.14-3.34)	.639
Island	7	0.00 (0)	.999	0.00 (0.00)	.999

\*p&lt;0.05; \*\*p&lt;0.01; \*\*\*p&lt;0.001

More male physicians seemed to commit suicide by drowning, and more female physicians tended to commit suicide by overdose or jumping compared to the general population. Table 3-2 shows the age distribution of the methods used for suicide. Gas poisoning and jumping were more prevalent in the 25-44 year age group, with a higher rate of intoxication in the 45-64 year age group. The rates of hanging and submersion remained consistent across all age groups.

## Discussion

A prior investigation in Taiwan found that the SMRs of suicide and drug abuse were 0.14 and 0.16, respectively, for doctors compared with the general population, and the authors concluded

that physicians live healthier lives than others [7]. Nevertheless, considering the possible effect of high socio-economic status and educational background, PMRs are an alternative way to measure the health impact of occupation in certain professionals such as doctors. In this study, we found a 2-fold increase in PMR among physicians aged 25-44 years, which may reflect exposure to certain risk factors in this population.

Only a few studies have focused on the effect of seniority, and the conclusions have varied according to the research methodology [12,28]. In our analysis, age at death was the most significant factor associated with suicide after adjusting for all variables including

**Table 2:** Age- and sex-specific observed (O) and expected (E) numbers of cases of suicide, and proportionate mortality ratios (PMR) among doctors in Taiwan from 2000-2011 (n = 1775)

	Age		
	25-44 years	45-64 years	≥65 years
<b>Male</b>			
All-cause mortality	94	333	1311
<b>Suicide</b>			
O	25	15	8
E	11.49	14.15	13.08
PMR (95% CI)	2.18 (1.56-3.04)	1.06 (0.65-1.74)	0.61 (0.31-1.22)
<b>Female</b>			
All-cause mortality	7	17	13
<b>Suicide</b>			
O	2	2	0
E	1.07	0.68	0.10
PMR (95% CI)	1.88 (0.58-6.06)	2.93 (0.80-10.78)	NA

**Table 3-1:** Distribution of causes of suicidal death by gender.

Causes of suicide	Number (%) of all deaths		
	Males	Females	All
(950) solid or liquid substances	4 (8.3)	2 (50.0)	6 (11.5)
(951) gases in domestic use	0 (0)	0 (0)	0 (0)
(952) other gases and vapors	9 (18.8)	0 (0)	9 (17.3)
(953) hanging strangulation and suffocation	15 (31.3)	0 (0)	15 (28.8)
(954) submersion (drowning)	7 (14.6)	0 (0)	7 (13.5)
(955) firearms air guns and explosives	0 (0)	0 (0)	0 (0)
(956) cutting and piercing instrument	0 (0)	0 (0)	0 (0)
(957) jumping from high place	4 (8.3)	1 (25.0)	5 (9.6)
(958) other and unspecified means	9 (18.8)	1 (25.0)	10 (19.2)
Total	48 (92.3)	4 (7.7)	52

**Table 3-2:** Distribution of causes of suicidal death by age.

Causes of suicide	Number (%) of all deaths			
	25-44	45-64	65	All
(950) solid or liquid substances	1 (3.7)	4 (23.5)	1 (12.5)	6 (11.5)
(951) gases in domestic use	0 (0)	0 (0)	0 (0)	0 (0)
(952) other gases and vapors	7 (25.9)	2 (11.8)	0 (0)	9 (17.3)
(953) hanging strangulation and suffocation	6 (22.2)	4 (23.5)	5 (62.5)	15 (28.8)
(954) submersion (drowning)	3 (11.1)	2 (11.8)	2 (25.0)	7 (13.5)
(955) firearms air guns and explosives	0 (0)	0 (0)	0 (0)	0 (0)
(956) cutting and piercing instrument	0 (0)	0 (0)	0 (0)	0 (0)
(957) jumping from high place	5 (18.5)	0 (0)	0 (0)	5 (9.6)
(958) other and unspecified means	5 (18.5)	5 (29.4)	0 (0)	10 (19.2)
Total	27 (51.9)	17 (32.7)	8 (15.4)	52

demographics, training background, specialties, practice settings and locations. We also used strict or broad definitions of suicide for regression analysis, and young age still carried a significantly higher risk in both definitions.

Despite not shown in our data, the association between young age and physician suicide may probably be mediated by numerous factors mentioned in previous works. First, perceived mistreatment or emotional exhaustion during medical school or internship has persistent negative impact on their psychological well-being during residency [4,29,30]. Second, social integration is a great challenge for young physicians. Many feel frustrated and inadequate in their career and role as a parent [31]. The complex effects of marriage on suicide have also been studied. Marriage, which is generally considered to be protective in males in the general population [32], has been found to increase the risk of suicide among physicians [15]. Third, barriers to health services such as a lack of time, concerns about confidentiality, and depression itself have been reported to hinder the treatment of mental illnesses in medical interns [17,18,33,34]. Young physicians may face the same challenges to receive professional help. We suggest that future effort may be focused on elucidating the interaction of age, medical training, social integration, perceived barriers to treatment, and suicide.

Our data demonstrated a 21-fold suicide risk for doctors working in medical centers compared to doctors who retired, but the significance was reduced after controlling for other factors. Although residents and attending physicians in medical centers in Taiwan often have heavy clinical and academic burden, the result must be interpreted with care because ten out of twelve suicide cases in medical center were below 38 years old.

We analyzed medical specialty as a determinant for suicide in this study. Similar to previous studies [12,20,24], surgery, pathology and medical imaging, emergency, psychiatry, and anesthesiology showed higher odds ratios of suicide compared with general/internal medicine. Notably, the majority (93.7%) of the heterogeneous “general/internal medicine” category consists largely of general practitioners in community clinics or internist in hospitals. The former either have not received any specialty training or may have been trained in family medicine or internal medicine. Furthermore, we found 81.3% of doctors in the “general/internal medicine” category were older than age 65, which could be attributed to the emergence of medical specialization in the past decades. This may partially explain the reduced significance of risk of certain specialties after adjustment for variables including age and practice settings.

Recent analysis of suicide methods among US physicians from 2003-2008 found that half of the suicides were by firearms, one quarter by poisoning, followed by trauma and asphyxia. In addition, slightly more physicians died from poisoning than non-physicians [15]. However, hanging and asphyxia were the most common methods of suicide for the doctors in the current study. Compared to intoxication (range 14.9%-27.5%) among the general population from 2000-2012, fewer physicians committed suicide by poisoning (11.5%) in Taiwan. Guns are prohibited in Taiwan, and no physicians were found to have died by firearms. In addition, the strict regulation of benzodiazepines and barbiturates in Taiwan may have led to the lower rate of poisoning. Therefore, specific interventions on asphyxia

and jumping suicides in middle-age doctors may be effective in lowering the rate of suicides in the future.

There are several limitations to this study. First, stigma of suicide may have led to under-reporting of unnatural deaths by the families of physicians. Nevertheless, according to the official statistics between 2009 and 2012 ([http://www.tma.tw/stats/stats\\_1.asp](http://www.tma.tw/stats/stats_1.asp)), the registry database of insurance from the Taiwan Medical Association covers 99.3% (595/599) of physician deaths. Second, there may be a tendency for young physicians to be reported as a premature death, and therefore classified as “possible suicide” in the current study. However, the effect of seniority on suicide was not compromised by adopting strict or broad definitions of suicide. Thus our findings cannot be attributed to coding bias. Furthermore, the scarcity of female physicians resulted in difficulty in assessing gender differences.

Physician suicide is an important public health issue which needs to be addressed, not only because it reflects the excessive burden on these professionals, but also because it has been reported that suicidal ideation and depression compromise the ability of the doctor and threaten patient safety [17,35,36]. Our study indicates that physicians may be more vulnerable early in their career. We hope that mental health promotion can be achieved in the near future by education to reform the culture of the medical society, de-stigmatize emotional exhaustion, and provide a supporting environment to assist in parenting.

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