

Original Research

Gender differences in death during hospitalization following a survived suicide attempt in Taiwan from 1998 to 2015: a cross-sectional study

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Abstract

Background: This study examines gender differences in death during hospitalization following a survived suicide attempt. The outcome of death during hospitalization following a survived suicide attempt and yearly rate of suicide attempts ending in hospitalization is examined. **Methods:** Data on 53,670 hospitalized patients injured by suicide attempt between January 1, 1998, and December 31, 2015, were collected from the National Health Insurance Database. From 1998 to 2015, 24,052 male patients and 29,618 female patients were screened and matched by age, gender, and filing date. Multinomial logistic regression was used to analyze the risk of death in terms of gender differences and suicide and hospitalization. $p < 0.05$ was considered statistically significant. **Results:** The risk of death during hospitalization after a survived suicide attempt of hospitalized male suicide patients was 1.694 times that of females (adjusted odds ratio (AOR) = 1.694, 95% confidence interval (CI) = 1.569–1.829). The risk of suicide and hospital death for male patients older than 65 years was 3.608 times that of male patients aged 10–24 years (AOR = 3.608, 95% CI = 2.914–4.468) and 6.648 times that of females (AOR = 6.648, 95% CI = 5.105–8.658). Every 1-point increase in the Charlson Comorbidity Index score of male suicide patients increased the risk of suicide hospital death by 5.6%, which indicates that the number or severity of the complications experienced by hospitalized male suicide patients was higher than that of women. **Conclusions:** Although men comprised a smaller proportion of hospitalized individuals following a survived suicide attempt, they also arrived in more critical condition and were more likely to die during their hospitalization. The increasing trend of female suicide attempt hospitalization rates is greater than that of males and yearly rate of suicide attempts ending in hospitalization is examined.

Keywords: gender difference; suicide; epidemiology; long-term trend analysis

1. Introduction

Suicide is a serious public health problem. World Health Organization (WHO) defines suicide as the act of deliberately killing oneself and suicidal behavior as “a range of behaviors that include thinking about suicide (or ideation), planning for suicide, attempting suicide, and suicide itself” [1]. Risk factors for suicide include mental disorders, especially depression, neurological diseases, cancer, and HIV infection. Nearly 1 million people die by suicide each year, 86% of whom live in low-income/middle-income countries [1]. In 2019, the WHO’s Global Suicide Report pointed out that nearly 800,000 people die by suicide every year; that is, 1 person dies by suicide every 40 seconds [2]. Every adult who dies by suicide can have more than 20 suicide attempts [3].

Gender differences in the suicide rate have been proved to be significant, and some studies have pointed out differences in the proportion of male and female suicides and suicide deaths [4]. Studies have shown that although women have more suicide attempts than men, men die from suicide more than women do. This is referred to as the “gender contradiction in suicidal behavior” [4]. In 2008, the global proportion of male suicide deaths was 1.8 times that of females, and in 2015 it was 1.7 times [5–7]. In Western countries, the proportion of men dying by suicide is 3 to 4 times that of women [8]. The rate of suicide deaths among men older than 65 years is greater than that of women [9], and the frequency of suicide attempts in women is 2 to 4 times that of men [10–12]. Researchers attribute the difference between attempted suicide and completed suicide be-



tween men and women in part to men's use of more deadly means to end their lives [13,14]. The gender difference in suicidal ideation is not yet clear, but studies have shown that suicidal ideation is more common in women than in men, especially among young people (i.e., younger than 25 years) [15,16].

Because suicide is a consequence of multiple factors, the factors that influence suicide by gender differences remain unclear. There is a lack of studies focusing on the influence of differences in suicide between men and women [17]. Thus, because the two genders experience different processes, it is important to study gender differences and risk factors for suicide [17]. Therefore, we hypothesize that the influence of gender on fatality following a survived suicide attempt ending in hospitalization. To study the influences of gender on survival following a suicide attempt that ends in hospitalization, we used the National Health Insurance Research Database of Taiwan to select hospitalized male and female patients injured by suicide from 1998 to 2015. We conducted an analysis of the data by gender difference and suicide attempt in hospitalization and yearly rate of suicide attempts ending in hospitalization is examined.

2. Materials and methods

2.1 Participants

Study subjects consisted of 53,670 inpatients who had attempted suicide in Taiwan from 1998 to 2015 and were enrolled in the National Health Insurance Database. Of the patients, 24,052 were hospitalized male suicide patients (44.81%) and 29,618 were hospitalized female suicide patients (55.19%). The inclusion criterion was ICD-9-CM E-code E950-E959 as suicide ($n = 53,848$), and the exclusion criteria were age < 10 years and unknown gender.

2.2 Study design

Taiwan's universal health insurance system was implemented in 1995 and currently covers 99% of all Taiwanese citizens. The Data Science Center of the Ministry of Health and Welfare (HWDC, MOHW) collects all emergency department and hospitalization data. In addition, medical institutions are legally required to submit monthly declaration files for emergency department and hospitalization expenses. Therefore, the Data Science Center of the Ministry of Health and Welfare is the most authoritative data source for medical care-related research [18]. This study used a cross-sectional study design. We used inpatient medical declaration files collected from 1998 to 2015. All procedures performed in research involving human participants were conducted in compliance with the ethical standards of the institution and/or the National Research Council and comply with the 1964 Declaration of Helsinki and its subsequent amendments or similar ethical standards. All methods were carried out following the relevant guidelines and regulations. Variables included gen-

der (male, female), age (1–4, 5–14, 15–24, 25–44, 45–64, and > 65 years old), Charlson Comorbidity Index (CCI), method of suicide attempt (ICD-9-CM E-code: E950-E959 suicide), low income (yes, no), major illness (yes, no), operation or not (yes, no), history of mental illness (yes, no), nursing care (medical centers, regional hospitals, regional hospitals), degree of urbanization (high, medium, low), season (spring, summer, autumn, winter), medical services (internal medicine, surgery, gynecology, pediatrics, other subjects), length of stay (days), medical expenses (NT\$), and prognosis (survival rate, mortality). The CCI selects the first five diagnostic codes (ICD-9-CM N-code), weights them according to the scoring criteria defined by Charlson, and calculates the total score. A higher score indicates more complications or a more serious diagnosis [19]. In addition, the prognosis of the injured patients included hospitalized death and terminally ill voluntary discharge. Fig. 1 shows the research flow chart.

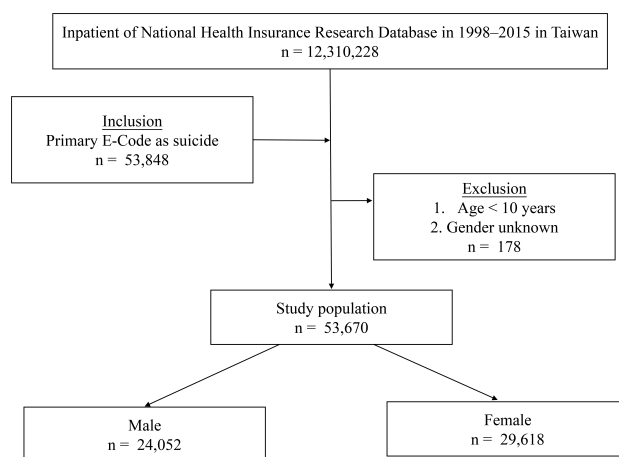


Fig. 1. Research flow chart.

2.3 Statistical analysis

This used a cross-sectional design. Descriptive statistics are presented in the form of percentages, averages, and standard deviations. We used the chi-square test, Fisher exact test, Student *t*-test, and one-way analysis of variance to assess the distribution of categorical and continuous variables between males and females. After adjusting for age, gender, comorbidities, CCI, season, location, level of urbanization, and level of care, we performed a conditional logistic regression analysis to evaluate the effect of gender differences on the risk of accident injuries. All analyses were conducted with SPSS version 26 (IBM, Armonk, NY, USA) for data analysis. A *p* value of < 0.05 was considered statistically significant.

3. Results

This study collected data on 53,670 inpatients who had attempted suicide in Taiwan between 1998 and 2015. Table 1 shows the basic characteristics of the inpatients with suicide. In terms of gender, there were 24,052 (44.81%) hospitalized male suicide patients and 29,618 (55.19%) hospitalized female suicide patients. The proportion of suicide hospitalizations for men was significantly lower than that for women. The average age of hospitalized male suicide patients was 44.79 ± 18.82 years, and the average age of hospitalized female suicide patients was 40.83 ± 17.60 years. Most hospitalizations occurred in patients between the ages of 25 and 44 years (males, 41.48%; females, 47.36%). In terms of suicide method, solid or liquid ingestion (such as sleeping pills and pesticides) were the most common methods of suicide attempt (males, 57.51%; females, 66.92%). In addition, most suicide hospitalizations occurred in patients with nonmajor diseases (males, 90.83%; females, 92.79%). With regard to psychiatric history, a greater proportion of suicide hospitalizations occurred among patients without a psychiatric history (males, 61.67%; females, 59.68%). Male suicide patients scored higher on the CCI than female suicide patients did (0.44 ± 1.33 vs 0.24 ± 0.97 , respectively), indicating that the number or severity of complications of male suicide inpatients was higher.

Table 2 uses logistic regression to analyze the prognostic factors of suicide hospital death. The risk of suicide hospital death in male patients was 1.694 times that of female patients (adjusted odds ratio (AOR) = 1.694, 95% confidence interval (CI) = 1.569–1.829). The risk of suicide in men older than 65 years was 3.608 times that of patients aged 10–24 years (AOR = 3.608, 95% CI = 2.914–4.468) and 6.648 times that of women (AOR = 6.648, 95% CI = 5.105–8.658). In terms of suicide methods, the risk of suicide in men who drowned was 7.154 times that of patients who used solid or liquid ingestion methods of suicide (such as sleeping pills and pesticides; AOR = 7.154, 95% CI = 4.121–39.780), and the risk of suicide in women who suspended themselves was solid or liquid suicide (such as sleeping pills and pesticides). The patient's 8.177 times (AOR = 8.177, 95% CI = 6.446–10.373). The risk of suicide in low-income male patients was 1.840 times that of non-low-income patients (AOR = 1.840, 95% CI = 1.353–2.502) and 2.035 times that of females (AOR = 2.035, 95% CI = 1.391–2.979). The suicide risk of male patients with major diseases was 2.614 times that of patients with non-critical diseases (AOR = 2.614, 95% CI = 2.224–3.073) and 2.964 times that of females (AOR = 2.964, 95% CI = 2.419–3.632). In terms of psychiatric history, the suicide risk of male suicide patients with mental illness was 1.347 times that of patients with nonpsychiatric diseases (AOR = 1.347, 95% CI = 1.303–1.396) and 1.394 times that of women (AOR = 1.394, 95% CI = 1.338–1.458). In addition, every increase in the CCI score of male suicide patients

increased the risk of suicide by 5.6%, and every increase in CCI score of female suicide patients reduced the risk of suicide by 96.7%, indicating that the number or severity of suicide complications in male suicide patients was higher than that of women.

Table 3 and Fig. 2 show the study population of hospitalizations following a survived suicide attempt in Taiwan from 1998 to 2015. The total number of hospitalized suicide patients in 1998 was 1939 (10.33 per 100,000 population); in 2015, it was 3824 (per 100,000 population). There are 17.82 people), The hospitalization rate showed a trend of rising first, then falling, and then rising, reaching significance. In 1998, the number of male suicide inpatients was 758 (7.90 per 100,000 population); in 2015, it was 1,703 (15.98 per 100,000 population). The hospitalization rate showed a trend of first rising, then falling, and then rising, achieving significant meaning. In 1998, the number of female suicide inpatients was 1181 (12.87 per 100,000 population); in 2015, it was 2121 (19.63 per 100,000 population). The hospitalization rate showed a trend of first rising, then falling, and then rising, achieving significant meaning.

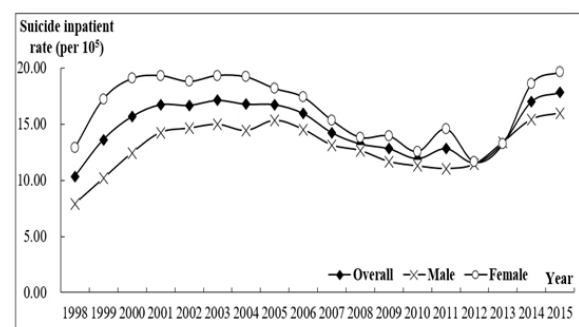


Fig. 2. The study population of hospitalizations following a survived suicide attempt in Taiwan from 1998 to 2015 (n = 4,647,058).

4. Discussion

This study shows that from 1998 to 2015 in Taiwan, men comprised a smaller proportion of individuals hospitalized after a survived suicide attempt (44.81%). The risk of suicide attempt and hospital death for male and female patients older than 65 years was greater than that for patients aged 10–24 years. Hospitalized male suicide patients have higher CCI scores than females do (0.44 ± 1.33 and 0.24 ± 0.97 , respectively), which indicates that the number or severity of complications of hospitalized male suicide patients is higher than that of females. The risk of death during hospitalization following a survived suicide attempt for male suicide hospitalized patients was 1.694 times that of females. From 1998 to 2015 in Taiwan, the rate of increase in the number of hospitalized cases of suicide attempt among females was greater than that of males ($1.32/10^5$).

Table 1. Gender difference among suicide inpatients.

Variable	Male		Female		<i>p</i> Value
	n	%	n	%	
Overall	24,052	44.81	29,618	55.19	
Age (y)	44.79 ± 18.82		40.83 ± 17.60		<0.001
Age group (y)					<0.001
11–24	3718	15.46	5701	19.25	
25–44	9977	41.48	14,028	47.36	
45–64	5911	24.58	6164	20.81	
≥65	4446	18.48	3725	12.58	
Suicide method					<0.001
Solid or liquid ingestion	13,831	57.51	19,819	66.92	<0.001
Gases in domestic use	218	0.91	308	1.04	0.882
Other gases and vapors	2518	10.47	1925	6.50	<0.001
Hanging	689	2.86	475	1.60	0.163
Drowning	5	0.02	11	0.04	0.984
Firearms	3	0.01	0	0.00	-
Cutting and piercing	182	0.76	269	0.91	0.865
Jumping	4661	19.38	5604	18.92	0.555
Others	1485	6.17	583	1.97	<0.001
Late effect	458	1.90	621	2.10	0.817
Catastrophic illness					<0.001
Without	21,847	90.83	27,484	92.79	
With	2205	9.17	2134	7.21	
Psychiatric history					<0.001
Without	14,832	61.67	17,675	59.68	
With	9220	38.33	11,943	40.32	
CCI_R	0.44 ± 1.33		0.24 ± 0.97		<0.001

p: chi-square/Fisher exact test on category variables and *t*-test on continue variables. CCI, Charlson Comorbidity Index.

Suicide is a very sensitive and complex issue with various causes. The act of suicide leads to death, which means that we can never fully understand the reasons behind it [20]. According to estimates, the suicide attempt rate in Europe is 20 times the suicide death rate. The suicide attempt rate of men is much lower than that of women, but the suicide death rate is too high. Suicide attempts with gender differences are considered to be a major cause of this gender imbalance [21]. In the entire European Union, the suicide death rate of men is 4–5 times that of women [22]. The global age-standardized suicide mortality rate has a male-to-female ratio of 1.9:1 [23]. This is a phenomenon in which men complete suicide deaths more frequently than women do, and women have a much higher rate of suicide attempts. This is referred to as the gender contradiction of suicidal behavior [22].

Many studies have tried to explain the gender differences in suicidal behavior by solving fatal problems. Current research shows that women survive attempted suicide more frequently than men do because they use fewer lethal methods [23,24], and even if the same method is used, their results are much less lethal than that of men [25]. The incidence of depression in women about twice that of men, and

depression attributed as the reason for more than half of all suicides. It has also been explained as the reason for the higher incidence of attempted suicide among women [26]. This might be a factor leading to the decline in the overall male suicide rate. However, psychological and social factors also contribute to the difference in male and female suicide behaviors. Unemployment, retirement, and being single are all important risk factors for male suicide. Except for mental illness, studies have not reported any major risk factors related to suicide in women [27].

Our study showed that although men comprised a smaller proportion of hospitalized individuals following a survived suicide attempt, men also arrived in more critical condition and were more likely to die during their hospitalization. The risk factors for men hospitalized death due to suicide attempts, were age greater than 65 years, low-income household, catastrophic illness, and psychiatric history.

With regard to the gender difference in suicide, one of the most important factors is communication. Women are more willing to share their problems with others, whereas men tend to put their problems aside and choose to stay silent. The main reason for this difference is the contin-

Table 2. Factors of suicide prognosis using multivariable logistic regression.

Gender	Adjusted OR			95% CI		<i>p</i> Value
Male	1.694			1.569–1.829		<0.001
Female	1.000 (Reference)					
Model variable	Male			Female		
	Adjusted OR	95% CI	<i>p</i> Value	Adjusted OR	95% CI	<i>p</i> Value
Age group (y)						
11–24	1.000 (Reference)			1.000 (Reference)		
25–44	1.960	1.597–2.406	<0.001	1.923	1.490–2.482	<0.001
45–64	2.746	2.226–3.387	<0.001	4.226	3.258–5.482	<0.001
≥65	3.608	2.914–4.468	<0.001	6.648	5.105–8.658	<0.001
Suicide method						
Solid or liquid ingestion	1.000 (Reference)			1.000 (Reference)		
Gases in domestic use	1.192	0.745–1.909	0.464	0.682	0.331–1.408	0.301
Other gases and vapors	0.482	0.379–0.612	<0.001	1.026	0.775–1.359	0.856
Hanging	6.198	5.058–7.595	<0.001	8.177	6.446–10.373	<0.001
Drowning	7.154	4.121–39.780	0.001	2.071	0.394–10.902	0.390
Firearms	0.000	—	0.999	—	—	—
Cutting and piercing	2.502	1.692–3.701	<0.001	4.888	3.425–6.976	<0.001
Jumping	0.379	0.314–0.458	<0.001	0.222	0.173–0.284	<0.001
Others	0.592	0.470–0.746	<0.001	1.079	0.758–1.536	0.673
Late effect	0.157	0.087–0.286	<0.001	0.203	0.125–0.329	<0.001
Low income						
No	1.000 (Reference)			1.000 (Reference)		
Yes	1.840	1.353–2.502	<0.001	2.035	1.391–2.979	<0.001
Catastrophic illness						
Without	1.000 (Reference)			1.000 (Reference)		
With	2.614	2.224–3.073	<0.001	2.964	2.419–3.632	<0.001
Psychiatric history						
Without	1.000 (Reference)			1.000 (Reference)		
With	1.347	1.303–1.396	<0.001	1.394	1.338–1.458	<0.001
CCI_R	1.056	1.026	<0.001	0.967	0.925–1.011	0.135

Adjusted OR = adjusted odds ratio: adjusted variables listed in the table, CI = confidence interval, minimum Pearson’s chi-square of goodness of fit = 12.407 (overall, $p = 0.134$), 13.578 (male, $p = 0.093$), 6.763 (female, $p = 0.562$), Nagelkerke $R^2 = 0.222$ (overall), 0.208 (male), 0.230 (female).

ued effect of longstanding social and cultural concepts that encourage men to be “strong” and prevent them from admitting that they are struggling in pain [28]. When a man feels fragile, he is unlikely to admit it to himself, his friends, or his family doctor. Thus, men have a higher defensive attitude than women do, and they tend to be more silent when visiting the doctor as compared with women.

A study published in a British medical journal pointed out that the primary care consultation rate of men was 32% lower than that of women. For example, the consultation rate for depression is evaluated based on whether the patient accepts an antidepressant prescription, and this rate is 8% lower for men than women [29]. Men seek mental health assistance less frequently than women do. It is not that men and women do not have the same psychological problems but rather that men are less likely to know what stress or mental health issues they have, and this may put them at greater risk of suicide [29]. If a person is not

aware that they have a painful illness, then they are unsure of what they can do to help themselves. Among individuals with suicide, only one-third receive mental health care treatment [1]. In addition, alcohol use is related to suicidal behavior. Alcoholism, which can lead to inhibition, impulsivity, and impaired judgment, can also lead to suicide, but it may also be used as a means to alleviate the pain associated with suicidal behavior [30]. Men may use drinking as a way of self-healing to reduce life pressure. The risk of alcohol dependence in men is almost twice that of women. Moreover, drinking can deepen depression and increase impulsive behavior. Thus, it seems indisputable that alcohol dependence is an important risk factor for suicidal behavior [31]. Most studies have found that men who die by suicide are more likely than women to have a history of alcoholism, and men’s blood alcohol level can be detected at autopsy [32,33].

Table 3. Factors of suicide prognosis using multivariable logistic regression.

Gender	Male			Female		
	Inpatient	Mid-year population of age ≥ 10 y	Rate (per 10^5)	Inpatient	Mid-year population of age ≥ 10 y	Rate (per 10^5)
1998	758	9,596,014	7.90	1181	9,173,016	12.87
1999	983	9,679,094	10.16	1599	9,280,794	17.23
2000	1214	9,773,579	12.42	1791	9,398,693	19.06
2001	1404	9,855,053	14.25	1836	9,504,792	19.32
2002	1454	9,937,419	14.63	1806	9,611,150	18.79
2003	1500	10,018,641	14.97	1878	9,714,960	19.33
2004	1457	10,099,534	14.43	1886	9,824,634	19.20
2005	1561	10,180,975	15.33	1806	9,942,117	18.17
2006	1492	10,270,945	14.53	1753	10,075,480	17.40
2007	1359	10,348,986	13.13	1564	10,197,009	15.34
2008	1314	10,400,634	12.63	1421	10,290,321	13.81
2009	1219	10,457,388	11.66	1450	10,404,297	13.94
2010	1186	10,526,592	11.27	1319	10,513,134	12.55
2011	1166	10,567,151	11.03	1543	10,592,385	14.57
2012	1212	10,602,949	11.43	1239	10,660,916	11.62
2013	1425	10,628,743	13.41	1419	10,717,850	13.24
2014	1643	10,646,390	15.43	2003	10,765,425	18.61
2015	1703	10,656,634	15.98	2121	10,805,467	19.63
Trend test						
b (sloop)	20.374	65,669,248	0.120	0.860	101,517,364	0.156
p Value	0.051	<0.001	0.228	0.946	<0.001	0.233
R ²	0.217	0.969	0.089	0.002	0.989	0.088

Other risk factors for suicide may be related to family or work [34]. For example, when an economic downturn causes the unemployment rate to rise, the suicide rate also tends to increase [35]. The increase in the suicide rate is usually 18–24 months after the recession [36]. A 2015 study found that for every 1% increase in the unemployment rate, the suicide rate increases by 0.79% [34]. Some studies have shown that unemployment is related to suicidal thoughts [37–41]. In addition, in the United States, medical insurance is usually related to employment. For example, if patients who are receiving treatment for depression or drug use lose their job, they may also lose this depression treatment and choose to suicide [42]. Another risk factor is the sense of social isolation, which can be manifested in all walks of life. Outwardly successful professionals who put career development before all other aspects of their person lives, resulting in damage to their social relationships, may find themselves at the top of the pyramid alone [43]. Social isolation is one of the main risk factors related to suicide, especially including self-reported loneliness, living alone, having few friends, family disunity, family conflicts, and so forth [44]. Observational research data show that objective social isolation and subjective loneliness should be included in the suicide risk assessment. There is a need to conduct a preventive study of suicide prevention that focuses on the individual's sense of social isolation [45].

In addition, what is interesting is the correlation between the gender differences in the brains of men and

women and suicide. Although the brains of men and women are very similar, there are huge differences between men and women in terms of hormones, biological structure, and brain development and function [46]. Gender differences have an important effect on suicide; that is, the differences in brain structures between men and women have unique effects on suicidal behavior and processes [46]. In a study published in 2018 in the journal *Cell Communications*, scientists studied the brain structure of the locus coeruleus in mice and unexpectedly found that this structure has a large molecular-level difference in the brains of male and female mice. They found that in female mice, the prostate receptor EP3 content is three times higher than that of male rats, and the levels of Slc6a15 and Lin28b are also increased, both of which are related to severe depression [47]. Women are usually 2–4 times more likely to suffer from depression or anxiety disorder than men are, and hyperactivity disorder is more common in men. What is shocking is that because of the sex differences in the brain structure of the locus coeruleus in mice, the molecular effects of these drugs on men and women are also very different. Female depression is known to be the basis for more than half of all suicides, and it is also explained as the reason for the higher incidence of attempted suicide in females [26]. The above-mentioned research shows the correlation between sex differences in brain structure and suicide.

The suicide mortality rate of men is higher than that of women at any time, in any region, in all races and so-

cioeconomic groups [48–50]. Critical analysis of male masculinity believes that under a broad social and cultural background, men are more likely to commit suicide [51]. Male masculinity does not involve harm to the body or the characteristic meaning of behavior: on the contrary, it is conceptualized as a set of different practices in society to distinguish between male and female characteristics [52]. Male masculinity varies with the economy, culture, and time environment and is related to the gender relations that prevail in society [53]. Excessive stress and masculinity increase the risk of male suicidal behavior [54,55]. Previous studies have shown that male suicidal behavior is related to unemployment, job failure, interpersonal tension, depression, despair, and substance use disorders [56–58].

Males are more likely to commit suicide because of the socialization of gender roles. If men possess more traits related to traditional male norms (independent, ambitious, responsible, persevering, rational, strong, aggressive, etc.), they are more likely to exhibit behaviors that hinder health and are less likely to participate in the promotion of healthy activities, because they are not as likely to admit that they need the help of others to solve problems and are against the social standards of traditional male norms [59]. Men tend to hide their vulnerability, ignore self-care, and only reluctantly seek medical advice or professional instructions [60]. These practices may adversely affect all aspects of men's physical and mental health and increase the risk of illness, accident injury, and death [61]. Traditional masculinity restricts men's need for seeking support or revealing their emotional status, thereby increasing the risk of suicide [62,63]. On the contrary, the socialized role of women encourages more healthy behaviors and lifestyles. In adverse health-related environments, this may provide women with more preventive and protective measures [64]. In times of danger, women show stronger protective abilities because of their social networks, family connections, and the value they place on the meaning of life, whereas men's masculinity is more likely to result in an externalization of social and personal impulses [65].

This study explored the reasons why men comprise a smaller proportion of hospitalized individuals following a survived suicide attempt and why men arrive in a more critical condition and are more likely to die during their hospitalization. Our research showed that hospitalized male suicide patients had a 1.694 higher risk of death during the hospitalization than females did.

This study has several limitations. First, data obtained from the Data Science Center of the Ministry of Health and Welfare did not provide more important information about suicide. Second, information on other variables (such as daily life (drinking and smoking) and biochemical test values) was also restricted. In this study, we had to use the E-Code to analyze suicide, but the E-Code is recorded only in hospitalization documents, and there is no E-Code annotation in outpatient and emergency documents. Thus, this

study might have underestimated the number of cases, the subset of people who attempted suicide and died immediately, who had no interval of hospitalization, and overall medical utilization. Finally, because of the use of an auxiliary database analysis in this study, the possibility of data classification errors cannot be ruled out, and information bias is present.

5. Conclusions

The study showed that as compared with women, although men comprised a smaller proportion of hospitalized individuals following a survived suicide attempt, they also arrived in more critical condition and were more likely to die during their hospitalization. The increasing trend of female patient hospitalizations due to a suicide attempt is greater than that of male patients and yearly rate of suicide attempts ending in hospitalization is examined.

Regardless of whether the focus is on suicide or gender differences, more awareness of the universality of gender differences in suicide mortality will benefit prevention efforts.

Author contributions

HCT, SHH, RJC, BLW, YCH, CHC, WCC, CAS, SMH and ILL conceived and designed this study; HCT and CHC conducted the data analysis; HCT, YCH, and SHH wrote the original draft preparation; HCT, RJC, BLW, YCH, CHC, WCC, CAS and SMH discussed the results and concluded. All authors have read and agreed to the published version of the manuscript.

Ethics approval and consent to participate

We used secondary data without any personally identifiable information. The National Defense Medical Center Tri-Service General Hospital Ethical Review Board (TS-GHIRB 1-105-05-142) approved this study, waiving the requirement for individual written informed consent.

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Conflict of interest

The authors declare no conflict of interest.

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