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Original Research

Gender Differences in Committing Suicide in Thailand

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Abstract

Background: The purpose of this study was to investigate gender differences in suicide in Thailand. **Methods**: The observational investigation was carried out by scrutinizing existing historical data over a 25-year period, from 1994 to 2020. Data were obtained from the Thai Department of Mental Health and WHO cause of death data. We use the codes ICD-10 (X60-X84) to identify mortality due to different methods of suicide. **Results**: During a 25-year study period, the range of suicide rates per 100,000 people varied between 3.97–8.59, and the mean (standard deviation, SD) was 6.66 (0.99). Male rates were higher than female rates (t = 23.43; $p < 0.001$). The mean suicide rate (SD) for men was 10.44 (1.56) and 2.97 (0.56) in women. There were statistically significant differences between genders in terms of suicide rates among age groups ($p < 0.001$). Suicide rates were higher in men and in all those aged 20–59 years and 60 years and older. Age 30–39 years were the majority group of the suicide rate, the mean (SD) was 9.99 (2.21), 16.82 (3.89) in men, and 3.17 (0.60) in women. The most common means of suicide during the study period is hanging (62.32%); it also has an increasing trend each year in both men and women. Followed by pesticide poisoning (20.66%), and unspecified means (7.70%). Hanging, pesticides, gun and firearm, and drug overdose were found to be the highest incidence in men between 20 and 39 years of age. The incidence rate of suicide was found to be higher in men in all suicide methods with gender ratios 6:1. Gun and firearm were the highest proportion of means of completed suicides in males (15:1), followed by sharp objects, other specified means, and alcohol suicide (the same ratio 6:1). **Conclusions**: Compared to women, in all ages, men have a higher rate of completing suicide. Several suicide completers employed violent means of self-harm that were impossible to rescue, especially hanging, guns, and firearms, and jumping from high places. Therefore, suicide screening and suicide monitoring systems need to be advocated and implemented on a regular basis.

Keywords: gender differences; commit suicide; suicide means; suicide rates; self-harm

1. Introduction

One of the global mental health concerns is suicide. This is one of the leading causes of premature mortality that every country is taking into account to investigate and understand the phenomenon that contributes to the development of appropriate solutions. The World Health Organization reported global epidemiology of suicide that was approximately 800,000 persons die by self-harm [1], and more recent data show that over a million persons died from suicide per year [2]. Globally, the annual age-standardized suicide rate was 11.4 per 100,000 people (15.0 for males and 8.0 for females), which increased from 2000 to 2016 by 30% [2]. Suicide is a complicated and diverse phenomenon with numerous factors that contribute to and facilitate it. The interaction of different elements, such as family and personal history, neurobiology, stressful experiences, and sociocultural factors, may be determining factors [3]. Moreover, gender plays an important role in health consequences. The difference between genders is the suicide rate. In many countries, men are most frequently reported as having a higher rate of suicide than women. There is also a differentiation in sex by age groups [4]. However, sociodemographic factors and cultural values for each nation may contribute to the dissimilarity of the suicide rate [4].

According to age-standard suicide rates, males committed suicide at a higher rate than females in all parts of the world. The top three regions that had a highest suicide rate were found in Africa, Europe, and America, accounted for 18.0, 17.1, and 14.2 per 100,000 population, respectively. South-East Asia was ranked fourth, with approximately 12.0 per 100,000 population. In most regions, the suicide rate among women was approximately 5.0 per 100,000. Notably, the suicide rate in Southeast Asia (about 8.1 per 100,000 people) was the highest suicide rate and greater than the global female average (around 5.4 per 100,000 population) [5].

Globally, death rates from suicide were substantially higher in males than females, with a male-to-female ratio ranging from 2–4 to 1 in various nations among all age groups, except for adolescents (15–19 years) [6]. The gender ratio (male-to-female) of suicide rate in Spain [7] America, Australia, Japan, and Korea, accounted for 4.0, 3.9, 3.3, 2.7, and 1.8 [8]. While the differences between men and women in some parts of India and China are being lower than in other parts of the world [9]. The suicide rate among Indian adolescents and adults is twice that of the global suicide mortality rate, and in the age range of 15 to 39, suicide is the leading cause of death compared to other causes of death [9]. In mainland China, there was a report on women

in the 15–24 age group committed suicide at about double the rate of men in the same age group [10]. Furthermore, suicide studies in many regions have shown that suicide mortality increased in the senior population as life expectancy increased [11]. The suicide rates among the elderly adults over the world were approximately 27.5 per 100,000 population [11]. Turkey, the USA, and South Korea found the same rising trends in suicide mortality in elderly people [11–13]. Sex ratio (male-to-female) in suicide in older adults in Turkey, the USA, and South Korea, accounted 4, 3, and 3, respectively [14–16].

This means that, based on the evidence mentioned above, regional and individual characteristics need to be taken into account. The rate of suicide-related deaths varies by gender and age group. Furthermore, defining age- and gender-specific suicide methods can serve as evidence to support suicide prevention plans. The most common methods of suicide worldwide, such as hanging, intoxication, guns, and firearms, have been reported in many countries [4]. However, suicide methods vary throughout time and across nations. For example, in 2000, dangerous drug ingestion was the most commonly used suicide method in Finland, while firearms and explosives were the most frequently used suicide means in Columbia and South Africa, then 15 years later hanging took the first place in these three nations in 2015 [6]. Regarding gender differences in suicide means, women may use more drug poisoning than men, and men prefer to choose more deadly ways, such as using weapons or hanging to self-harm themselves [17]. The execution method could be one of the reasons for the difference in lethality, and the severity of death is determined by how the attempted suicide was intervened in or interrupted [17].

Suicide rates in Thailand peaked at 8.6 per 100,000 populations in 1999, according to a survey conducted between 1998 and 2003, and dropped to 7.1 in 2003, while the male to female ratio was 3.4:1 during 1998–2003 [18]. Suicide rates among men aged 25–29 years peaked at 21.9 per 100,000, but female suicide rates varied less with age [18]. Hanging and ingestion of agriculturally harmful chemicals were the most common methods of suicide [18]. Comparing two periods of time, between 1998–2000, and 2013–2016, the crude suicide rate was 5.62 per 100,000 Thai citizens, with 9.7 male and 2.4 female suicide rates, and Thailand's youth suicide rate dropped by half from 2000 to 2016 [19].

Previous studies on suicide in Thailand have not focused on gender differences and only covered specific short time periods. To fill this research gap, we investigate gender differences in suicide in Thailand over a 25-year period, 1994 to 2020. We focused on gender differences in suicide completed cases, the suicide rate by sex, by age group and sex, and the differences between the sex ratio of suicide means.

2. Methods

2.1 Procedures

This observational investigation was conducted by investigating historical data for a 25-year period between 1994 and 2020. The study was carried out using existing data recorded on two publicly official websites, such as WHO's mortality database last updated in June 2021, and data from the websites of the Thailand Department of Mental Health and the Office of the Permanent Secretary of MOPH, Ministry of Public Health. The data was collected from Thailand's website consisted of numbers of mortality and suicide rate by gender (between 1994 and 2020) and age groups (between 2010 and 2020) from 10–14 to 90–94 years, and 95+ years. Methods of suicide by gender were gathered from WHO mortality database between 1994 and 2019 (2020 no data). We use the codes ICD-10 (X60-X84) to identify mortality due to different methods of suicide and focus on intentional self-poisoning and self-harm: X60-64 exposure to drugs; X65-66 exposure to alcohol, organic solvents, and related; X67 and X77 exposure to gases and vapours; X68-69 exposure to pesticides and unspecified chemicals; X70 hanging, strangulation, and suffocation; X71 drowning and submersion; X72-75 guns and firearms; X76 smoke, fire, and flames; X78 sharp and blunt objects; X80-81 jumping from a high place and related; X82 crashing of motor vehicle; X83 other specified means; and X84 unspecified means.

Numbers of suicides between the two sources of data was verified for data accuracy validation after collecting data from the WHO mortality database and data from Thailand's Ministry of Public Health website. There was no difference between the two sources.

All data used in this investigation came from public sources. No ethics approval was, therefore, requested.

2.2 Statistical Analysis

For categorical variables, descriptive analyzes were performed using frequencies and percentages, and for continuous variables, means, and standard deviations. Continuous variables were analyzed using independent *t*-tests. Significant levels at $p \leq 0.05$ were analyzed. A comparison of the ratio of completed suicides was focused on the odds ratios (OR) for each age group by gender. The 95 percent significance level confidence interval (CI) depicts the degree of uncertainty surrounding the impact measure.

3. Results

3.1 Suicide Rates by Sex from 1994 to 2020

During a 25-year study period from 1994 to 2020, the age-standardized suicide rate per 100,000 Thai population ranged between 3.97 and 8.59. The mean and standard deviation were 6.66 (0.99). Men had a higher suicide rate than women ($t = 23.43$; $p < 0.001$). The mean (SD) suicide rate was 10.44 (1.56) and median (25th and 75th quartile) were

Table 1. Suicide rates by sex (the age-standardized suicide rate per 100,000), between 1994 and 2020 in Thailand.

Sex	Suicide rate				Statistics
	Min	Max	Mean (SD)	Median (Q1–Q3)	t (*p*-value)
Male	5.55	13.32	10.44 (1.56)	10.29 (9.54–11.18)	23.43***
Female	2.28	3.91	2.97 (0.56)	2.72 (2.56–3.49)	
Both	3.97	8.59	6.66 (0.99)	6.35 (6.03–7.30)	

Q1, 25th quartile; Q3, 75th quartile. *** $p < 0.001$.

10.29 (9.54–11.18) in men, while mean (SD) and median (25th and 75th quartile) in females were 2.97 (0.56) and 2.72 (2.56–3.49) (Table 1).

In the 25-year study period from 1994 to 2020, the odds ratio of men committing suicide (female as baseline) significantly increased from 2.32 in 1994 to 4.59 in 2020 (Fig. 1).

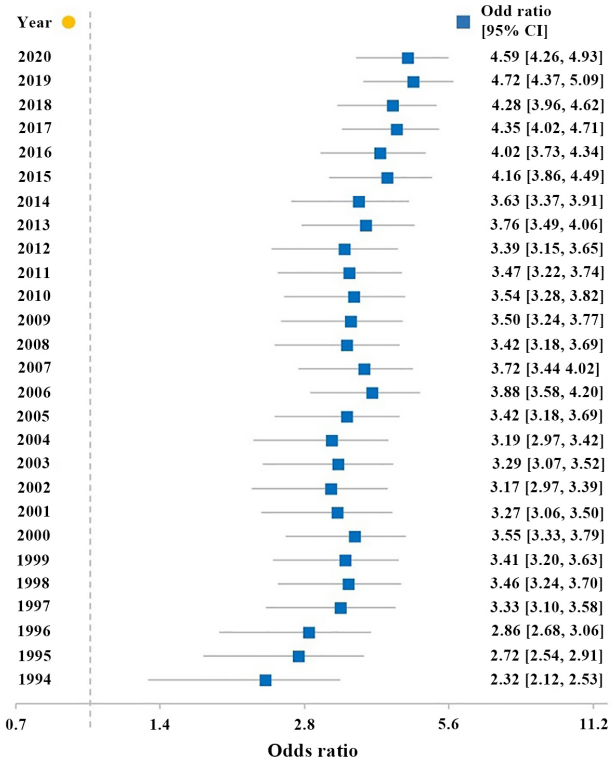

Fig. 1. The odds ratio for suicide in men (female as a baseline line), between 1994 and 2020. Horizontal lines indicate corresponding 95% confidence intervals around odd ratio. Suicide rates by age group and sex from 2010 to 2020.

Between 2010 and 2020, men aged 30–39 were found to be the largest group of suicide completers, followed by those aged 40–49 and 60 years and older, while women had the same ranges and patterns of completed suicide numbers across five age groups. However, compared to each age group, women 60 years and older were shown to have a greater increase than women of other ages (Fig. 2).

Suicide rates among age groups differed significantly by sex ($p < 0.001$). The suicide rates were higher in men and in all age groups. Age 30–39 years were the majority group of the suicide rate, the mean (SD) was 9.99 (2.21), 16.82 (3.89) in men, and 3.17 (0.60) in women. Followed by age 40-49 years with mean (SD) 9.09 (2.00) in both genders, 14.77 (3.63) in men and 3.71 (0.49) in women (Table 2).

Table 3 presents the statistical significance of comparing the ratio of completed suicides across different age groups by males and females (aged 10–19 as a baseline or reference group) across the years 2010–2020. Over a period of 11 years, men aged 30 to 39 years had the highest odds ratio, with growing trends every year. In 2020, the highest odds ratio of males committing suicide (OR = 7.82, 95% CI: 6.54–9.35). Compared to women of different ages, older women 60 and older had a higher odds ratio.

Fig. 3A shows that throughout the 11-year period between 2010 and 2020, the odds ratio of a male committing suicide was higher than 1 (men aged 10–19 as the baseline). The growing odds ratio patterns were similarly in all five age groups. Men aged 30 to 39 years had the highest odds ratio and outperformed the overall trend, compared to men of other ages. All age groups had the fluctuate trend of odds ratio of females committing suicide over the 11-year period. Pre-elderly (50–59 years) and older women with 60 years and over were the top two that had the highest OR, compared to women of other ages (Fig. 3B).

3.2 Methods of Suicide by Sex from 1994 to 2019

Males had a greater percentage (77.41%) of incidence in all the methods of suicide with gender ratios 6:1 (t = 3.56; $p < 0.001$). The most common means of suicide during a 25-year study period is hanging (62.32%). The ratio between male and female was 4:1, it also has an increasing trend each year in both genders. Followed by pesticide poisoning (20.66%) and unspecified means (7.70%). It is interesting to note that the gun and the firearm were the highest proportion of the means of completed suicides in men (15:1), followed by sharp objects, other specified means, and alcohol suicide (the same ratio 6:1). Crashing of motor vehicles was found to be the cause of suicide only in men over a 25-year study period (Table 4).

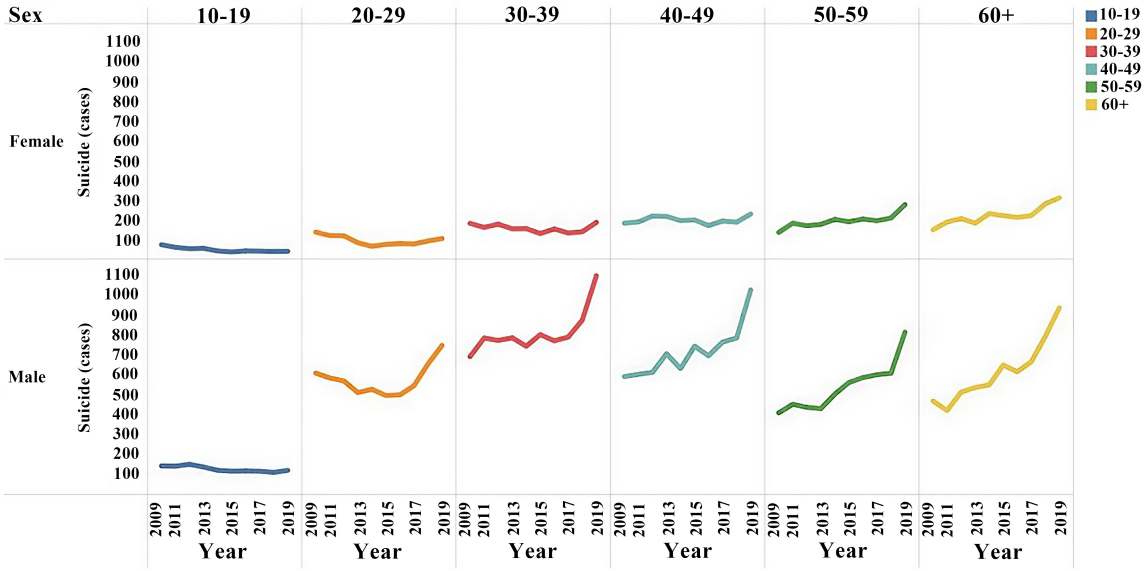

Fig. 2. Number of suicides by gender and ages (10–60+ years), between 2010 and 2020.

Table 2. Suicide rates by age group and sex, 2010 and 2020.

Age group (years)	Study group	Male	Female	Statistical analysis (*p*-value)
	Mean (SD)	Mean (SD)	Mean (SD)	
	Median (Q1–Q3)	Median (Q1–Q3)	Median (Q1–Q3)	
10–19	2.05 (0.23)	2.91 (0.24)	1.15 (0.25)	16.86***
	1.98 (1.87–2.22)	2.91 (2.71–3.02)	1 (0.98–1.28)	
20–29	7.36 (1.43)	12.48 (2.46)	2.07 (0.52)	13.72***
	7.3 (6.29–7.77)	11.98 (10.84–12.99)	1.93 (1.64–2.52)	
30–39	9.99 (2.21)	16.82 (3.89)	3.17 (0.60)	11.50***
	9.06 (8.95–9.77)	15.16 (14.92–16.79)	2.98 (2.85–3.34)	
40–49	9.09 (2.00)	14.77 (3.63)	3.71 (0.49)	10.01***
	8.6 (7.8–9.07)	13.61 (12.12–14.96)	3.51 (3.44–3.93)	
50–59	8.69 (1.54)	13.61 (2.75)	4.25 (0.55)	11.01***
	8.39 (7.85–8.51)	13.25 (11.95–13.48)	4.06 (3.98–4.42)	
60+	8.99 (1.36)	14.91 (2.49)	4.23 (0.59)	13.85***
	8.34 (8.17–9.27)	14.09 (13.41–15.44)	4.29 (3.72–4.5)	

Q1, 25th quartile; Q3, 75th quartile. *** $p < 0.001$.

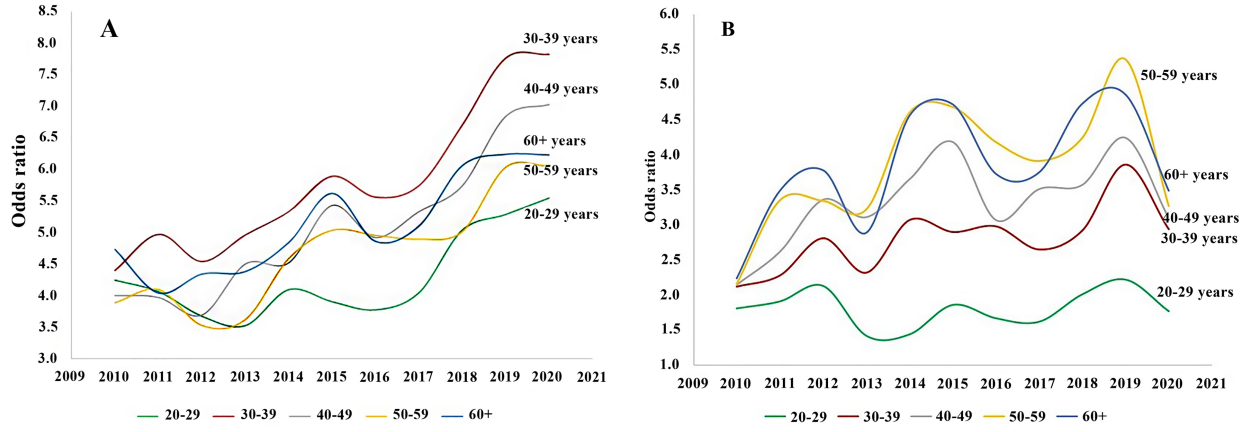

Fig. 3. The odds ratios for men (3A) and women (3B) by age groups (aged 10–19 years as baseline, $p < 0.001$) higher than 1 for the occurrence of suicide for the 11-year period from 2010 to 2020.

Table 3. Comparison of the ratio of completed suicides between ages by males and females, between 2010 and 2020.

Year	Variables age (years)	Male	Female
		Odds ratio (95%)	Odds ratio (95%)
2010	10–19	1 (Reference)	1 (Reference)
	20–29	4.24 (3.53, 5.09) ***	1.81 (1.36, 2.41) ***
	30–39	4.40 (3.68, 5.27) ***	2.12 (1.61, 2.79) ***
	40–49	4.00 (3.33, 4.80) ***	2.15 (1.64, 2.83) ***
	50–59	3.88 (3.21, 4.70) ***	2.16 (1.62, 2.88) ***
	60+	4.73 (3.92, 5.70) ***	2.24 (1.69, 2.97) ***
2011	10–19	1 (Reference)	1 (Reference)
	20–29	4.06 (3.38, 4.87) ***	1.91 (1.40, 2.62) ***
	30–39	4.97 (4.16, 5.95) ***	2.28 (1.69, 3.07) ***
	40–49	3.97 (3.30, 4.76) ***	2.62 (1.96, 3.52) ***
	50–59	4.09 (3.39, 4.94) ***	3.35 (2.50, 4.50) ***
	60+	4.04 (3.34, 4.88) ***	3.49 (2.66, 4.59) ***
2012	10–19	1 (Reference)	1 (Reference)
	20–29	3.67 (3.06, 4.39) ***	2.13 (1.53, 2.95) ***
	30–39	4.54 (3.81, 5.41) ***	2.81 (2.07, 3.84) ***
	40–49	3.69 (3.09, 4.41) ***	3.36 (2.48, 4.55) ***
	50–59	3.52 (2.93, 4.24) ***	3.34 (2.45, 4.56) ***
	60+	4.34 (3.62, 5.20) ***	3.78 (2.78, 5.12) ***
2013	10–19	1 (Reference)	1 (Reference)
	20–29	3.52 (2.92, 4.25) ***	1.42 (1.00, 2.00) ***
	30–39	4.96 (4.14, 5.94) ***	2.32 (1.70, 3.16) ***
	40–49	4.50 (3.75, 5.40) ***	3.11 (2.31, 4.20) ***
	50–59	3.61 (2.98, 4.37) ***	3.22 (2.37, 4.36) ***
	60+	4.38 (3.63, 5.28) ***	2.89 (2.13, 3.92) ***
2014	10–19	1 (Reference)	1 (Reference)
	20–29	4.09 (3.36, 4.99) ***	1.44 (0.97, 2.13) ***
	30–39	5.33 (4.40, 6.46) ***	3.07 (2.17, 4.33) ***
	40–49	4.52 (3.72, 5.49) ***	3.65 (2.61, 5.12) ***
	50–59	4.58 (3.76, 5.59) ***	4.60 (3.29, 6.44) ***
	60+	4.84 (3.97, 5.89) ***	4.56 (3.27, 6.36) ***
2015	10–19	1 (Reference)	1 (Reference)
	20–29	3.90 (3.19, 4.77) ***	1.86 (1.25, 2.77) ***
	30–39	5.89 (4.85, 7.15) ***	2.90 (2.01, 4.20) ***
	40–49	5.43 (4.47, 6.60) ***	4.18 (2.93, 5.96) ***
	50–59	5.03 (4.12, 6.13) ***	4.68 (3.27, 6.68) ***
	60+	5.62 (4.61, 6.84) ***	4.72 (3.31, 6.71) ***
2016	10–19	1 (Reference)	1 (Reference)
	20–29	3.77 (3.09, 4.61) ***	1.67 (1.14, 2.44) ***
	30–39	5.56 (4.58, 6.75) ***	2.98 (2.11, 4.21) ***
	40–49	4.92 (4.04, 5.98) ***	3.07 (2.19, 4.33) ***
	50–59	4.95 (4.06, 6.03) ***	4.18 (2.99, 5.85) ***
	60+	4.86 (4.09, 6.06) ***	3.73 (2.67, 5.22) ***
2017	10–19	1 (Reference)	1 (Reference)
	20–29	4.04 (3.30, 4.93) ***	1.62 (1.11, 2.38) ***
	30–39	5.74 (4.73, 6.97) ***	2.65 (1.86, 3.78) ***

Hanging was the method of suicide in men that considerably increased between 1994 and 1998 and fluctuated significantly between 1998 and 2016. The second wave began in 2016 and accumulated to a peak of 3,746 cases in 2019. Pesticide poisoning fluctuated with the same trend over the 23-year period (Fig. 4A).

Table 3. Continued.

Year	Variables age (years)	Male	Female
		Odds ratio (95%)	Odds ratio (95%)
	40–49	5.33 (4.39, 6.48) ***	3.51 (2.50, 4.94) ***
	50–59	4.89 (4.01, 5.96) ***	3.91 (2.78, 5.50) ***
	60+	5.10 (4.19, 6.21) ***	3.75 (2.67, 5.25) ***
2018	10–19	1 (Reference)	1 (Reference)
	20–29	5.03 (4.12, 6.16) ***	2.01 (1.38, 2.94) ***
	30–39	6.70 (5.50, 8.16) ***	2.92 (2.04, 4.19) ***
	40–49	5.74 (4.70, 7.00) ***	3.57 (2.52, 5.07) ***
	50–59	5.01 (4.09, 6.13) ***	4.24 (3.00, 6.00) ***
	60+	6.06 (4.97, 7.39) ***	4.73 (3.37, 6.64) ***
2019	10–19	1 (Reference)	1 (Reference)
	20–29	5.28 (4.35, 6.39) ***	2.22 (1.54, 3.21) ***
	30–39	7.76 (6.43, 9.36) ***	3.86 (2.73, 5.45) ***
	40–49	6.84 (5.67, 8.26) ***	4.24 (3.02, 5.96) ***
	50–59	6.03 (4.98, 7.30) ***	5.36 (3.83, 7.50) ***
	60+	6.24 (5.17, 7.55) ***	4.86 (3.48, 6.78) ***
2020	10–19	1 (Reference)	1 (Reference)
	20–29	5.54 (4.62, 6.65) ***	1.77 (1.30, 2.41) ***
	30–39	7.82 (6.54, 9.35) ***	2.94 (2.21, 3.91) ***
	40–49	7.03 (5.88, 8.40) ***	3.10 (2.34, 4.11) ***
	50–59	6.05 (5.05, 7.25) ***	3.27 (2.47, 4.33) ***
	60+	6.23 (5.21, 7.46) ***	3.49 (2.66, 4.59) ***

CI, Confidence Interval; *** $p < 0.001$.

Table 4. Suicide means by sex, between 1994 and 2019 (2020 no data).

Methods	Study group		Male		Female		Ratio (M/F)	Statistical analysis
	Cases	%	Cases	%	Cases	%		(*p*-value)
Hanging	66,166	(62.32)	53,310	(64.87)	12,856	(53.6)	4:1	
Pesticides	21,936	(20.66)	14,703	(17.89)	7233	(30.16)	2:1	
Unspecified means	8174	(7.70)	6470	(7.87)	1704	(7.11)	4:1	
Drug Overdose	4832	(4.55)	3073	(3.74)	1759	(7.33)	2:1	
Gun and firearm	4291	(4.04)	4021	(4.89)	270	(1.13)	15:1	
Sharp object	243	(0.23)	210	(0.26)	33	(0.14)	6:1	
Jumping from high places	202	(0.19)	156	(0.19)	46	(0.19)	3:1	3.56***
Drowning	115	(0.11)	76	(0.09)	39	(0.16)	2:1	
Smoke, Fire and flames	78	(0.07)	65	(0.08)	13	(0.05)	5:1	
Gases and vapours	76	(0.07)	51	(0.06)	25	(0.1)	2:1	
Other specified means	22	(0.02)	19	(0.02)	3	(0.01)	6:1	
Crashing of motor vehicle	16	(0.02)	16	(0.02)	0	(-)	-	
Alcohol	13	(0.01)	11	(0.01)	2	(0.01)	6:1	
Total	106,164	(100)	82,181	(77.41)	23,983	(22.59)	6:1	

*** $p < 0.001$.

Hanging among women had a similar trend as among men that surged significantly between 1994 and 1998 and fluctuated significantly between 1998 and 2016. There was a second wave of an increasing trend starting in 2016 and accumulated to a peak of more than 800 cases in 2019. Pesticides fluctuated with the same trend over the 23-year period (Fig. 4B).

Hanging, pesticides, gun and firearm, and drug overdose were found to be the highest incidence in males between 20 and 39 years of age (Fig. 5A–D).

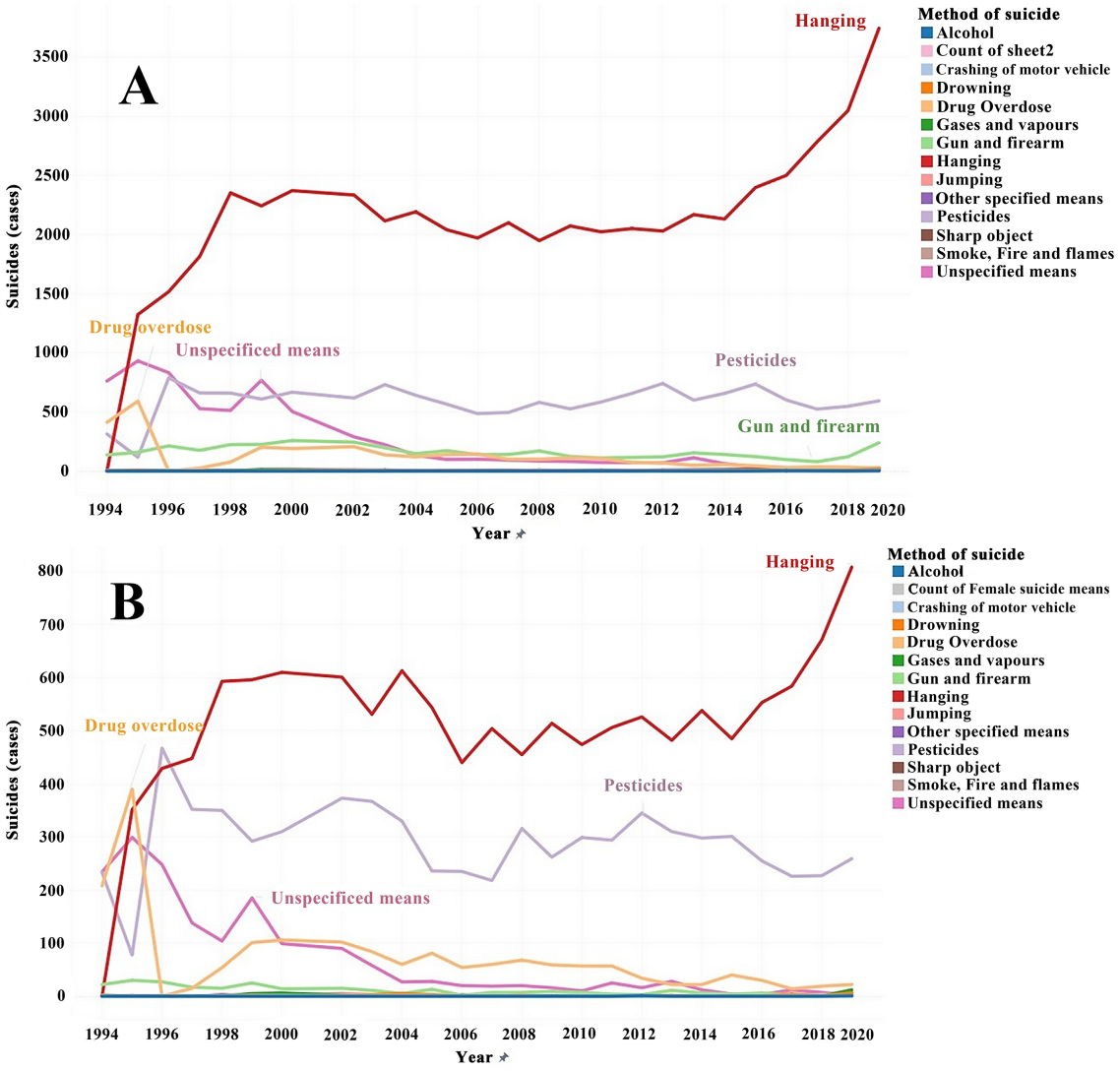

Fig. 4. (A) Male suicide means according to years and (B) female suicide means according to years.

4. Discussion

4.1 Suicide Rates by Sex

From 1994 to 2020 the mean (SD) age-standardized suicide rate per 100,000 was 10.4 (1.6) in men, and in 3.0 (0.6) in women in Thailand, which is lower than global figures (15.0 for males and 8.0 for females) [2], but higher than, for example in Turkey (6.1 in men and 2.0 in women) [6]. Males outnumbered females in yearly suicide rates in all Asian nations except Bangladesh, China, and Myanmar, with the highest male-female ratios (>5:1) reported in Afghanistan, Armenia, Georgia, Kazakhstan, Oman, Qatar, and Russia [20]. In the 25-year study period from 1994 to 2020, the odds ratio of men committing suicide (female as baseline) significantly increased from 2.32 in 1994 to 4.59 in 2020. The higher increase in suicide in men than women may be related to several dimensions of social determinants, such as socioeconomic status, divorce, and alcohol misuse [21,22]. Income per capita, also known as Gross Domestic Product (GDP) per capita, is one of the factors that contributes to the increase in both male and female suicide rates. In other words, there is a positive relationship between decreasing income and the incidence of suicide [22]. However, this relationship could be used to predict suicide prevalence at a specific point in time. In the future, estimation should be considered in parallel with other social determinates [22]. Divorce is another determinant of suicide in both sexes. Divorced individuals who have experienced domestic violence are more likely to commit suicide [21]. Compared to divorced women, divorced men had more than eight times the degree of self-harm and suicide [23]. In contrast, married people or couples who have children to care for are more likely to have a lower risk of suicide [24]. Moreover, binge alcohol drinking has a strong correlation with suicide [22]. Alcohol is the cause of loss of self-control and stimulated people suffering from mental health conditions to commit suicide [22]. A qualitative study in Thailand found that suicide in men can be attributed to ‘pressure from being the leader of the family and drinking

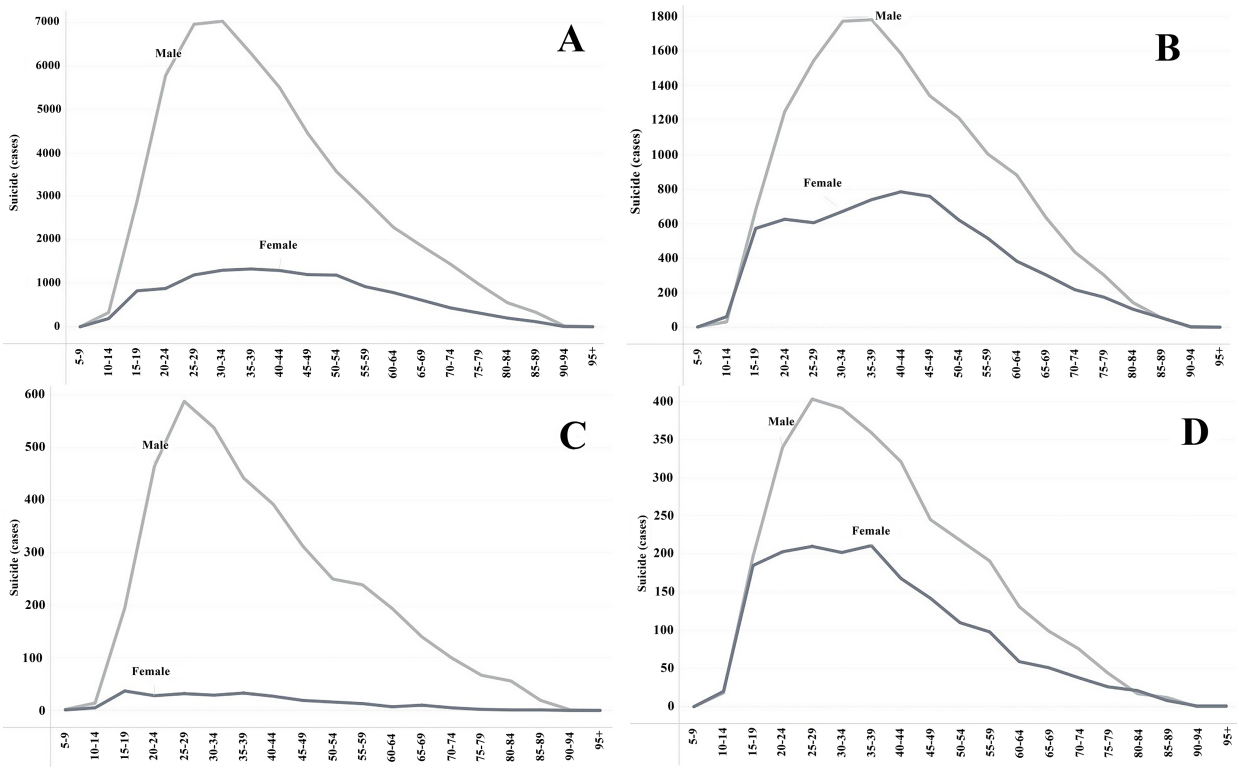

Fig. 5. Cumulative number of male and female suicides according to age group and methods, a period of 25 years from 1994 to 2019: (A) hanging; (B); pesticides; (C) gun and firearm; (D) drug overdose.

alcohol, perceived as masculine' [25]. It has been indicated that when facing social transition, males are less effectively able to reduce unpleasant emotions compared to females, particularly in early adulthood when people need to take on several responsibilities after getting married [18]. The factors contributing suicide attempt between genders are different. In men who have more conflict with their parents, unstable sexual relationships, lower level of coping skills, and drinking reduce stress, a trend toward suicide attempts [18]. Female, on another point, unrequited love and domestic violence, are two significant factors around females to attempt suicide [18]. Another point that should not be ignored is that of mental disorders and related psychological symptoms, particularly depression, psychiatric disorders, and substance misuse [6,24,26]. For example, 90% of suicides were found in people diagnosed with psychiatric disorders [4]. A study in Japan indicated that mental disorders, especially major depressive disorders and any mood disorder, were found to have a higher prevalence in suicide cases, with an OR of 6.2 and 5.9, respectively [27]. Depression is one of the main motivators of suicidal behavior. Women are two to three times more likely than men to be diagnosed with depression. They, however, may not have a higher risk of suicide than men. This may be explained by the fact that depressed men are more likely to experience emotional irritation, other negative feelings, and lower levels of controllable impulsivity. This feeling may be linked to substance and alcohol abuse in some cases of men living with depressive symptoms, which is one of the major risk factors for suicide and self-harm in the last stages of life in men more than women [4]. Although women tend to receive depression therapy more often than men [28].

4.2 Suicide Rates by Age Group and Sex

The study found a significantly higher rate of suicide among men than among women in all age groups, including the age group of adolescents. In contrast to this, some studies did not find significant gender differences in the rate of suicide in the adolescent age group, for example in Turkey [6]. In the present study, age 30–39 years were the majority group of suicide rate, the mean (SD) was 9.99 (2.21), 16.82 (3.89) in males, and 3.17 (0.60) in females. Suicides in Egypt were more common among people aged 20–30 years [29]. The suicide rate in Australia for men revealed a bimodal distribution, with the age group 35–44 years having the highest rate, followed by over 65 years of age with older men aged 85 years having the highest rates. In female adults 35–59 years, they had the highest suicide rate, compared to other age groups [30].

For decades, the highest prevalence of suicide was found among young adult men compared to elderly adults, and this has remained low [18]. However, in the West, the risk of suicide increases as one gets older [18]. Suicide rates are similarly positively related to age in other Asian nations, including China, Hong Kong, Japan, and Taiwan [18]. One of the protective factors against suicide in old age are so-

cial values. Compared to other Asian societies, the elderly in Thailand is considerably more likely to get honor and respect. The elderly adults are cared for by their offspring and young adults. This is the important role and responsibility that most Thai people are willing and happy to take care of their aging parents until the end of life [18]. However, after 2016, most of the age groups (except 10–19 years) had a rising trend in suicide rates per 100,000 population. The top two ranges in males were found at ages 30–39 and 40–49 years, while the top two ranges in females were found at ages 50–59 and 60+ years. It can be said that adult males and pre-elderly and elderly females are the groups most at risk of suicide in Thailand.

We found that males' early adulthood and early middle age (age 30–39, followed by age 40–49) are the most at-risk groups for suicide in Thailand. There is a similar pattern of suicide fatalities between 2004 and 2013 in Australia, hitting a peak at the age of 30–44 [31]. Although in the Canadian suicide mortality database from 1981 to 2017, the highest number of suicides was found in late middle age males (ages 45–64). Men of middle age who are unemployed or experiencing an economic crisis are more likely to commit suicide. This evidence was found in Europe and the United States [32]. In Korea [33], Taiwan [34], and Japan [35], the economic crisis is linked to a growing number of suicides. Low-socioeconomic and unemployed groups are actively related to the increasing number of suicides. The suicide rate in unemployed men in Taiwan in 1959–2012 is higher than in unemployed women [34]. Similarly, a report on a suicide study in Thailand suggests that economic factors, such as poverty, low income, or insufficient income, are the main causes of suicide in men rather than women. Labors, agricultures, and no-income families made up the top three groups of completed suicides, respectively [36].

In the cases of suicide in pre-elderly and older adults. There is a perspective from the Thai Department of Mental Health to describe why pre-elderly and older adults tend to self-harm and commit suicide today [37]. The risk groups for suicide are the home-bound or abandoned. Due to urbanization and change in family structure, young adults need to go to work or have their own family to care of; they lack the time to take care of, communicate with or spend time with their older parents. This causes displeasure and alienation and leads to depression and risk of suicide. Moreover, the significant triggers which arouse elderly people's suicidal ideation, attempting or committing suicide are psychological health problems, such as loneliness, hopelessness, and mental health problems, especially depression [37]. Life dissatisfaction is a significant variable that contributes to the development of depressive symptoms and also increases the risk of suicide [38].

In the present study, hanging and pesticide were the most preferred means among both men and women, while the third preferred means was for unspecified men's means, followed by guns and firearms and drug overdose. The third preferred means was for women drug overdose, followed by unspecified means, and guns and firearms. The methods of suicide in many countries follows the same patterns. However, suicide techniques change with the advent of advanced technology and social structures, and they have distinct age and gender features. It is found that hanging is the most frequently used means of committing suicide in many countries, such as Turkey [6], Japan [39], Korea [40], Taiwan [41], Singapore, Malaysia [42], India [43], and Indonesia [44].

Jumping off from high places was reported higher ranged the second means in Japan women, while men are frequent used gas and petrochemical, and sharp objects. Jumping suicide was a rising trend in both genders aged 15–24, 25–44 and 45–64 years [45]. Autopsy reports in Kuala Lumpur indicated that in 2000–2004 hanging (43%) was the most common means of suicide in Malaysia [42]. However, jumping from the high places (47%) was ranked first place instead of hanging during 2007–2009. Similar trend in Singapore and Hong Kong, jumping was the leading method of suicide for Singaporeans (2000–2004) and Hong Kong people (2003), accounting for 72.4% and 46%, respectively [42]. While jumping from high places in Thailand was the seventh most common means of suicide in Thailand, the number of suicides is lower than in other countries, with approximately 200 cases in a 24-year study.

In terms of the second most common suicide means, pesticide intoxications. In Egypt, women used organophosphates to self-harm and stop living [29]. Chemicals poisoning suicide was found approximately one-fifth of suicides and higher rate in low-middle income counties [46]. In contrast, Turkey has reported a lower rate of suicide by intoxication, especially in agriculture. This is because the policies and regulations on agricultural chemical control have an effect that is accessible to suicide means. The method of suicide has been shifted from pesticides to hanging [6].

Suicide means can be classified as violent and non-violent, and men may be more likely to use 'violent' means than women [47]. This is similar to our finding that the ratio of violent methods in males is higher than in females. Although the number of committed suicides by guns and firearms is lower than hangings and pesticide poisonings, it has the highest ratio of differences in suicide methods between genders (males: 15, females: 1), followed by sharp objects (6:1) and hanging (4:1). At the same time, the ratio of non-violent methods between males and females, such as pesticide poisonings and drug overdoses, was 2:1. Although men seemed to have a higher ratio of non-violent than women, comparing suicide rates by means and genders, we found that women died by violent, non-violent, and unspecific means, accounting for 55%, 38%, and 7%, respectively. While for men, it was 70%, 22%, and 8%, respectively. This is to say, comparing the percentage of suicide means between genders, women had a higher percentage of preferred non-violent methods of committing suicide

than men did. Women more likely to select non-violent methods may be attributed to them having less knowledge and technical skills for the "violent" methods of suicide, as well as their desire to avoid serious injury to the body and face [48]. Men, on the contrary, have a higher intent on completing self-harm for ending life. Therefore, men are more likely to choose violent methods for lethality [48]. Moreover, compared to men, women may not really want to die. Attempting suicide, women use methods that have the potential to save their lives, such as agriculturally hazardous chemicals or drug overdoses, which can be intervened in with therapeutic approaches. Additionally, women compared to men are less accessible to have own guns and firearms [49]. In Taiwan, non-violent methods such as chemical farming substances (Herbicides: Paraquats; Insecticide: organophosphate and methomyl) was the most common method in suicides of elderly adult women (2006–2008) [41]. A study of attempted suicide of hospitalized women in Poland found that women preferred overdosing on pharmaceutical medications and exsanguination as a means of suicide, while men preferred hanging and suffocation. Females also employed a wider variety of suicide techniques than males. According to the findings, women are more likely to try suicide rather than commit suicide, but men are more likely to commit suicide and choose more violent suicide techniques. Consequently, women are the "attempters" and "survivors" of suicide attempts [50].

In Thailand, over a 25-year study period, we found that hanging and agricultural chemical intoxication are the leading methods of committing suicide, in the same pattern as suicide in India [51]. Most commonly in India, suicide is committed by hanging or ingesting organophosphate insecticides. Additionally, self-immolation is also a somewhat prevalent method of suicide among India men and women [43], but this method is rarely found in both genders in Thailand.

Hanging is the most common means of suicide in adult males aged 20–44 years in Thailand. This method is used by suicidal people who intend to end their lives, and most of them have fewer chances of saving lives. The second deadly method is pesticides and herbicides. Even though agricultural chemical suicide is a non-lethal method, by this suicide means, killed over 20,000 Thai populaces [18]. Agricultural chemical products are not difficult to access in Thailand, especially in rural areas during pre-harvesting activities. The two main uses of agricultural organic compounds to commit suicide, namely methomyl and carbamate insecticides [18].

Physical health illness has been reported to have a significant intercorrelation with psychological health impacts. People living with infectious HIV/AIDS, for example, are at increased risk of suicide. Almost 40% of the suicides found in a psychological autopsy were HIV-infected patients and most of them were young [18]. The same investigation method by the psychological autopsy in nearly 400 cases in rural areas of China found that one in three of the young suicides preferred using agricultural organic substances to kill themselves [52]. There was no statistically significant difference between all self-harming methods in the expected lethality between genders. Furthermore, this study did not find a significant correlation between mental disorders, impulsivity, and violent or nonviolent methods. Therefore, suicide prevention should focus on access to suicide means to understand how self-lethality is regulated and implement interventions in cases of suicide risk [52].

Thailand has been proactive in suicide prevention between 2020 and 2021 focusing on three risk groups, including patients with chronic diseases, patients with psychiatric diseases, and suicide attempters [53]. The program is offered in community and health care settings. In a community setting, there are family members, caregivers, and village health volunteers (VHV) as the first lines of screening for those at risk of suicide and referring them to the healthcare settings. In healthcare settings, Health Promoting Hospitals (HPH) supported screening, home visits, basic counseling, follow-up, etc. At the hospital care levels, the services were supported by all services and in addition to what HPH did, such as crisis intervention, psychological resilience, psychological support, and psychological therapy (cognitive behavior therapy, and problem solving therapy). Psychiatric hospitals supported all services and provided intervention with specialists, such as symptom management, adherence therapy, supportive psychotherapy, Satir model, etc. [53].

5. Conclusions

Even though the suicide rate in Thailand is not a huge phenomenon compared to other nations, it is a leading cause of premature mortality and has a long-term effect on the people left behind, as well as affects the community and the national economy. The suicide rate in Thailand is still growing every year, especially after 2016 and the effects of the pandemic crisis of human-to-human transmission of the coronavirus. The economic crisis is without a doubt one of the significant factors influencing the development of suicide risk. It affects socioeconomic status, well-being, and psychological health outcomes. Suicide is a serious health issue, yet it may frequently be avoided. Suicide prevention initiatives should, therefore, be encouraged by considering the context of each country's unique circumstance. This is due to the fact that there are age-and gender-specific suicides. Suicide screening and suicide monitoring systems need to be advocated and implemented on a regular basis. Furthermore, vulnerable populations at risk of suicide, especially those with suicide ideation and suicide attempts, dependent elderly women, young adult men with significant family disputes and substance misuse, people living with physical illness and mental disorders, HIV/AIDS, chronic diseases, and depression, need comprehensive care throughout their lives.

6. Limitation

Our investigation on gender differences in suicide by sex, by age group and sex, and suicide means by sex provide new findings on Thailand. We had to collect data from two sources, such as the WHO mortality database (there is no reported suicide rate by gender and age group) and Thailand's government website (there is no reported data on suicide methods by gender). Therefore, the data needs to be checked for accuracy between the two sources. Moreover, due to limitations of data, we could not present a period of time studying in the same year (suicide rates by sex from 1994 to 2020, suicide rates by age group and sex from 2010 to 2020, and suicide methods by sex from 1994 to 2019).

Author Contributions

PS and KP designed the research study. PS and KP performed the research. MS provided help and advice on data collection. PS analyzed the data. PS and KP wrote the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

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Conflict of Interest

The authors declare no conflict of interest.

References

[1] World Health Organization. Mental health. 2021. Available at: https://www.who.int/data/gho/data/themes/mental-health (Accessed: 22 December 2021).

[2] Levi-Belz Y, Gvion Y, Apter A. Editorial: The Psychology of Suicide: From Research Understandings to Intervention and Treatment. Frontiers in Psychiatry. 2019; 10: 214.

[3] Turecki G, Brent DA. Suicide and suicidal behaviour. The Lancet. 2016; 387: 1227–1239.

[4] Barrigon ML, Cegla-Schvartzman F. Sex, Gender, and Suicidal Behavior. In Baca-Garcia E (ed.) Behavioral Neurobiology of Suicide and Self Harm (pp. 89–115). Springer International Publishing: Cham. 2020.

[5] World Health Organization. Suicide Worldwide in 2019: Global Health estimates. World Health Organization Press: Geneva, Switzerland. 2021.

[6] Emiral E, Emiral GO, Cevik ZA, Canturk N, Canturk G. Investigation of suicide deaths in Turkey between 2015 and 2019. Journal of Men's Health. (in press)

[7] Mejías-Martín Y, Luna Del Castillo JD, Rodríguez-Mejías C, Martí-García C, Valencia-Quintero JP, García-Caro MP. Factors Associated with Suicide Attempts and Suicides in the General Population of Andalusia (Spain). International Journal of Environmental Research and Public Health. 2019; 16: 4496.

[8] Hee Ahn M, Park S, Ha K, Choi SH, Hong JP. Gender ratio comparisons of the suicide rates and methods in Korea, Japan, Australia, and the United States. Journal of Affective Disorders. 2012; 142: 161–165.

[9] Vijayakumar L, Chandra PS, Kumar MS, Pathare S, Banerjee D, Goswami T, *et al*. The national suicide prevention strategy in India: context and considerations for urgent action. The Lancet Psychiatry. 2022; 9: 160–168.

[10] Li J. Suicide Among Chinese Women. In Li J (ed) A Study on Suicide: Diagnosis and Solutions (pp. 57–90). Springer: Singapore. 2019.

[11] He J, Ouyang F, Qiu D, Li L, Li Y, Xiao S. Time Trends and Predictions of Suicide Mortality for People Aged 70 Years and Over From 1990 to 2030 Based on the Global Burden of Disease Study 2017. Frontiers in Psychiatry. 2021; 12: 721343.

[12] Karbeyaz K, Çelikel A, Emiral E, Emiral GÖ. Elderly suicide in Eskisehir, Turkey. Journal of Forensic and Legal Medicine. 2017; 52: 12–15.

[13] Conejero I, Olié E, Courtet P, Calati R. Suicide in older adults: current perspectives. Clinical Interventions in Aging. 2018; 13: 691–699.

[14] Demir M. Who commits suicide most? Suicide by gender and age. Forensic Research and Criminology International Journal. 2018; 6: 505–510.

[15] National Institute of Mental Health. Suicide. National Institute of Mental Health (NIMH). 2021. Available at: https://www.nimh.nih.gov/health/statistics/suicide (Accessed: 22 January 2022).

[16] Cheong K, Choi M, Cho B, Yoon T, Kim C, Kim Y, *et al*. Suicide rate differences by sex, age, and urbanicity, and related regional factors in Korea. Journal of Preventive Medicine and Public Health. 2012; 45: 70–77.

[17] Shelef L. The gender paradox: do men differ from women in suicidal behavior? Journal of Men's Health. 2021; 17: 22–29.

[18] Lotrakul M. Suicide in Thailand during the period 1998–2003. Psychiatry and Clinical Neurosciences. 2006; 60: 90–95.

[19] Snowdon J. Rates and Age Patterns of Suicide and Undetermined Death in Thailand. Journal of Psychiatry and Behavioral Science. 2021; 4: 1046.

[20] Tandon R, Nathani MK. Increasing Suicide Rates across Asia-A Public Health Crisis. Asian Journal of Psychiatry. 2018; 36: A2–A4.

[21] Chanagul C. Determinants of Suicide Rates in Thailand. Journal of Community Development Research (Humanities and Social Sciences). 2019; 12: 15–24.

[22] Chansarn S. Economic Development, Economic Problems, and Suicide in Thailand: Empirical Evidence Based on Provincial Data. Asia-Pacific Social Science Review. 2017; 17: 88–104.

[23] Scourfield J, Evans R. Why might Men be more at Risk of Suicide after a Relationship Breakdown? Sociological Insights. American Journal of Men's Health. 2015; 9: 380–384.

[24] Cano-Montalbán I, Quevedo-Blasco R. Sociodemographic Variables Most Associated with Suicidal Behaviour and Suicide Methods in Europe and America. A Systematic Review. European Journal of Psychology Applied to Legal Context. 2018; 10: 15–25.

[25] Rungreangkulkij SR, Kotnara I, Thamnoi R, Yodklang O, Anusak B. Experience of Suicide Attempt: Gender differences. Journal of the Psychiatric Association of Thailand. 2013; 58: 245–256.

[26] Booniam S, Wongpakaran T, Lerttrakarnnon P, Jiraniramai S, Kuntawong P, Wongpakaran N. Predictors of Passive and Active Suicidal Ideation and Suicide Attempt Among Older People: A Study in Tertiary Care Settings in Thailand. Neuropsychiatric Disease and Treatment. 2020; 16: 3135–3144.

[27] Hirokawa S, Kawakami N, Matsumoto T, Inagaki A, Eguchi N, Tsuchiya M, *et al*. Mental disorders and suicide in Japan: a nation-wide psychological autopsy case–control study. Journal of Affective Disorders. 2012; 140: 168–175.
[28] Call JB, Shafer K. Gendered Manifestations of Depression and Help Seeking among Men. American Journal of Men's Health. 2018; 12: 41–51.
[29] Abdel Moneim WM, Yassa HA, George SM. Suicide rate: Trends and implications in Upper Egypt. Egyptian Journal of Forensic Sciences. 2011; 1: 48–52.
[30] Snowdon J, Mehdi Saberi S, Moazen-Zadeh E. A comparison between the age patterns and rates of suicide in the Islamic Republic of Iran and Australia. Eastern Mediterranean Health Journal. 2020; 26: 748–754.
[31] Burns RA. Sex and age trends in Australia's suicide rate over the last decade: something is still seriously wrong with men in middle and late life. Psychiatry Research. 2016; 245: 224–229.
[32] Varin M, Orpana HM, Palladino E, Pollock NJ, Baker MM. Trends in Suicide Mortality in Canada by Sex and Age Group, 1981 to 2017: a Population-Based Time Series Analysis: Tendances de la mortalité par suicide au Canada selon le sexe et le groupe d'âge, 1981–2017: Une analyse de séries chronologiques dans la population. The Canadian Journal of Psychiatry. 2021; 66: 170–178.
[33] Yoon JH, Jung SJ, Choi J, Kang MY. Suicide Trends over Time by Occupation in Korea and Their Relationship to Economic Downturns. International Journal of Environmental Research and Public Health. 2019; 16: 2007.
[34] Chang YH, Gunnell D, Hsu CY, Chang SS, Cheng AT. Gender difference in suicide in Taiwan over a century: a time trend analysis in 1905–1940 and 1959–2012. Journal of Epidemiology and Community Health. 2020; 74: 898–906.
[35] Tanaka T, Okamoto S. Increase in suicide following an initial decline during the COVID-19 pandemic in Japan. Nature Human Behaviour. 2021; 5: 229–238.
[36] Somjai D. Impacts of Socio-economic Factors on Provicial Suicide Trends in Thailand. Journal of Health Science. 2012; 21: 251–262.
[37] Supasaek Virojanapa, Taneepanichskul N. Suicidal Idea among The Elderly. Journal of Public Health and Development. 2020; 18: 102–109.
[38] Yilmaz N, Karaca SN. Dissatisfaction with life and absence of leisure time activity: clues to overt depression and occult suicide risk in elderly individuals without significant disabling disease. Psychogeriatrics. 2020; 20: 337–344.
[39] Dhungel B, Sugai MK, Gilmour S. Trends in Suicide Mortality by Method from 1979 to 2016 in Japan. International Journal of Environmental Research and Public Health. 2019; 16: 1794.
[40] Lim M, Lee SU, Park J. Difference in suicide methods used between suicide attempters and suicide completers. International Journal of Mental Health Systems. 2014; 8: 54.
[41] Lin J, Chang S, Lu T. The leading methods of suicide in Taiwan, 2002–2008. BMC Public Health. 2010; 10: 480.
[42] Wu KC, Chen YY, Yip PS. Suicide Methods in Asia: Implications in Suicide Prevention. International Journal of Environmental Research and Public Health. 2012; 9: 1135–1158.
[43] Rane A, Nadkarni A. Suicide in India: a systematic review. Shanghai Archives of Psychiatry. 2014; 26: 69–80.
[44] Nurdiyanto FA, Jaroah S. The Characteristics of Suicide in Gunungkidul Indonesia. Disease Prevention and Public Health Journal. 2020; 14: 69–75.
[45] Yoshioka E, Hanley SJ, Kawanishi Y, Saijo Y. Time trends in method-specific suicide rates in Japan, 1990–2011. Epidemiology and Psychiatric Sciences. 2014; 25: 58–68.
[46] World Health Organization. Suicide. 2021. Available at: https://www.who.int/news-room/fact-sheets/detail/suicide (Accessed: 7 January 2022).
[47] Denning DG, Conwell Y, King D, Cox C. Method choice, intent, and gender in completed suicide. Suicide & Life-Threatening Behavior. 2000; 30: 282–288.
[48] Mergl R, Koburger N, Heinrichs K, Székely A, Tóth MD, Coyne J, *et al*. What are Reasons for the Large Gender Differences in the Lethality of Suicidal Acts? An Epidemiological Analysis in Four European Countries. PLoS ONE. 2015; 10: e0129062.
[49] Callanan VJ, Davis MS. Gender differences in suicide methods. Social Psychiatry and Psychiatric Epidemiology. 2012; 47: 857–869.
[50] Tsirigotis K, Gruszczynski W, Tsirigotis M. Gender differentiation in methods of suicide attempts. Medical Science Monitor. 2011; 17: PH65–PH70.
[51] Kanchan T, Menon A, Menezes RG. Methods of choice in completed suicides: gender differences and review of literature. Journal of Forensic Sciences. 2009; 54: 938–942.
[52] Xu X, Zhang J, Zhou Q, Sun L. Gender Characteristics in Methods of Chinese Rural Young Suicides. International Journal of Mental Health and Addiction. 2021; 19: 438–446.
[53] Thailand's Department of Mental Health. National Suicide Prevention Strategy 2021–2022. Department of Mental Health, Ministry of Public Health: Nonthaburi, Thailand. 2020.