

Original Research

Comparison of South Korean men and women admitted to emergency departments after attempting suicide: a retrospective study

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Abstract

Background: Suicide is a major health concern, especially in South Korea. The probability of dying by suicide and the fatality rate differ between men and women. The present study compared the suicide characteristics of women and men and analyzed the choice of suicide methods. **Methods:** This study retrospectively analyzed patients who visited the emergency department after a suicide attempt in the period from 2016 to 2018, which had been obtained from the National Emergency Department Information System. Variables included suicide methods, Korean Triage and Acuity Scale level, vital signs, and disposition following emergency care. **Results:** A total of 88,495 (54.7% women vs. 45.3% men) cases were investigated. Significant gender differences were observed in clinical outcomes. In total, 10.3% of the men (n = 3811) and 4.0% of the women (n = 1852) died in the hospital. Women were proportionately more likely to use poisoning (62.3% vs. 51.0% in men) and piercing and cutting (24.9% vs. 22.9% in men) compared with men, whereas men were more likely to use hanging (9.5% vs. 4.6% in women) and being struck (7.9% vs. 1.1% in women). **Conclusions:** Women chose less lethal suicide methods, whereas men chose more violent methods. The fatalities among men were higher, even when the same method was used. In establishing a suicide prevention policy, it is important to consider gender differences.

Keywords: Suicide; Gender; Suicide methods; Emergency department

1. Introduction

Suicide is a global phenomenon. It is the act of causing one's own death intentionally. According to the World Health Organization (WHO), over 700,000 people die by suicide annually, which is one person every 40 seconds. The ratio of suicide attempts to suicide deaths is estimated at 20 to 1 among adults [1]. Suicide attempts have been identified as the largest predictor of suicide-related deaths [2]. In South Korea, the rate of suicide-related death is 24.6 per 100,000 people, giving South Korea the highest suicide rate among the Organization for Economic Cooperation and Development (OECD) countries, where the average suicide rate is 11.0 per 100,000. In 2018, the number of patients admitted to the emergency department (ED) after a suicide attempt was 33,451, and the total number of deaths was 13,670 [3]. In this respect, suicide must be considered an important public health issue in South Korea.

Previous studies have reported that women attempt suicide more frequently than men, but suicide death rates are much higher for men [4–7]. In Korea, the rate of death by suicide in 2019 was 38.0 per 100,000 among men and 15.8 per 100,000 among women [8]. In contrast, the percentage of patients who visited the ED after attempting suicide was higher among women (55.7% vs. 44.3%) [9]. Many researchers have suggested that this gender gap in mortality rates is due to differences in the choice of sui-

cide methods [5,10–13]. In general, women attempt suicide using methods that are likely to be less lethal, such as drug poisoning. Therefore, they have a greater chance of being rescued or resuscitated. However, men select more violent methods that can cause irreversible damage, such as firearms or hanging. Some argue that gender socialization decreases the likelihood that women will own or be as familiar with firearms compared with men and these differences are reflected in the mortality gap [6,7,14,15]. However, the possession of firearms is illegal in South Korea. This is what makes South Korea different from other countries in terms of suicide methods. Therefore, this study aimed to analyze the differences among the methods of suicide and prognosis between men and women in South Korea.

2. Materials and methods

2.1 Setting and data collection

This descriptive study used retrospective anonymized routine data collected from the National Emergency Department Information System (NEDIS) from January 2016 to December 2018. There are 36 regional emergency medical centers (Level 1), 117 local emergency medical centers (Level 2), and 119 local emergency medical rooms (Level 3) in South Korea. Between 2016 and 2018, 399 out of 401 emergency medical institutions participated in the NEDIS



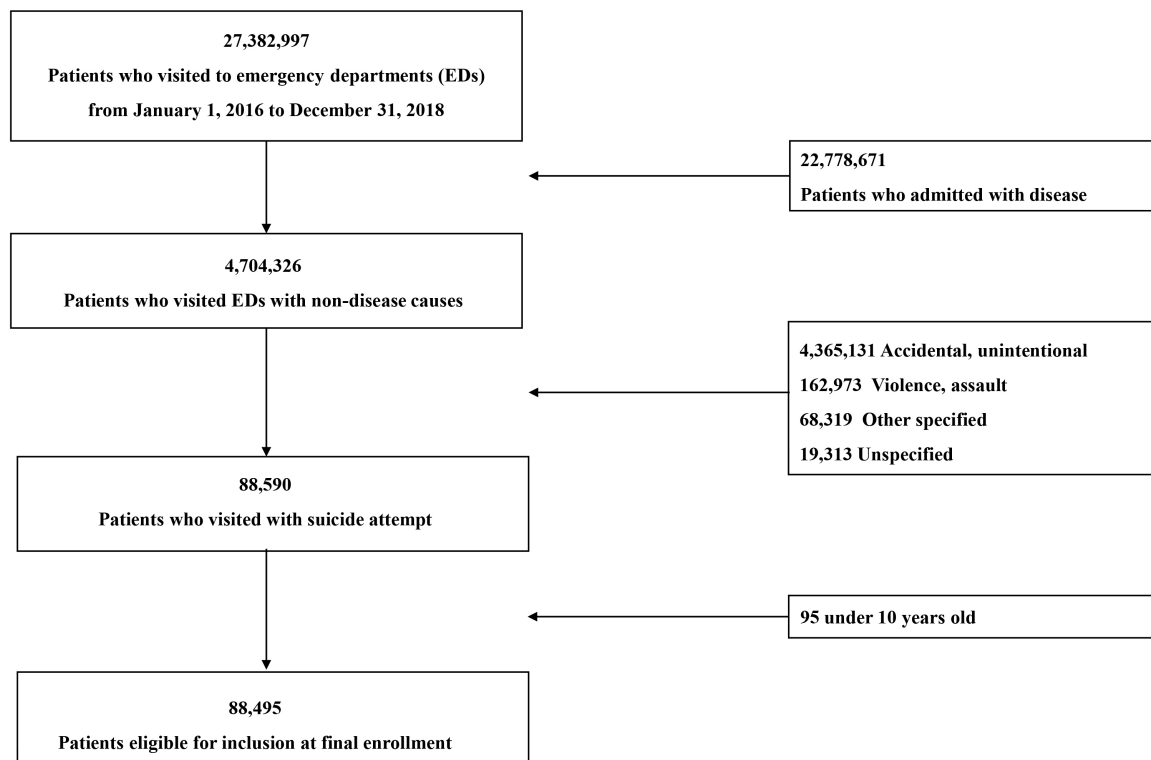


Fig. 1. Patient flow diagram.

data collection [9]. Information on patients who visited EDs was sent from each ED to the National Emergency Medical Center database in real-time.

This study included patients aged >10 years who were admitted to the ED after attempting suicide. The total attendance between January 1, 2016, and December 31, 2018, for all patients, was 27,382,997. A total of 22,778,671 patients who visited with disease were excluded. In addition, 4,615,736 patients with unintentional injuries (4,365,131 patients with injuries from unintentional accidents, 162,973 with injuries from violence, 68,319 with other specific injuries, and 19,131 with nonspecific injuries). Finally, 88,495 patients were included in this analysis (Fig. 1).

2.2 Variables and outcome measures

The NEDIS collects demographic and clinical data, including age, sex, area (urban or rural), ED visit date, insurance type, mode of arrival, intentionality, methods of injuries (poisoning, piercing or cutting, hanging, fall, slipping, struck by person or object, drowning, burn, traffic accidents, machine, and others), consciousness of patients in EDs, Korean Triage and Acuity Scale (KTAS) level, vital signs (systolic blood pressure, diastolic blood pressure, pulse rate, respiratory rate, saturation, and body temperature), and disposition after ED care (discharge, transfer to another hospital, admission to general ward (GW) or intensive care unit (ICU), ED deaths). For admitted patients, final medical results (death or discharge) on discharge were considered for the study.

2.3 Statistical analysis

Differences in epidemiological characteristics, clinical outcomes and suicide methods between genders were analyzed using the chi-squared test and Student's *t*-test. Categorical variables were analyzed using the chi-square test, and continuous variables were analyzed using an independent *t*-test. Factors affecting mortality were analyzed using a logistic regression model. Continuous variables are presented as mean \pm standard deviation, and categorical variables are presented as numbers with percentages. Statistical significance was set at $p < 0.05$. All statistical analyses were performed using the IBM® SPSS® Statistics version 26.0 (IBM Corporation, Armonk, NY, USA).

3. Results

3.1 Epidemiological characteristics of patients admitted to emergency departments after attempted suicide (Table 1, Fig. 2)

A total of 88,495 patients visited the EDs in South Korea after attempting suicide between January 2016 and December 2018. As shown in Table 1 and Fig. 2, there were more women (54.8%, $n = 48,648$) than men (45.2%, $n = 40,031$). The mean age of the men was 44.54 ± 19.05 years, and the mean age of women was 39.89 ± 17.98 years. There was a high proportion of patients aged <50 years (especially between the ages of 10 and 29 years) among the women, whereas there was a high proportion of patients aged >50 years among the men. There were more

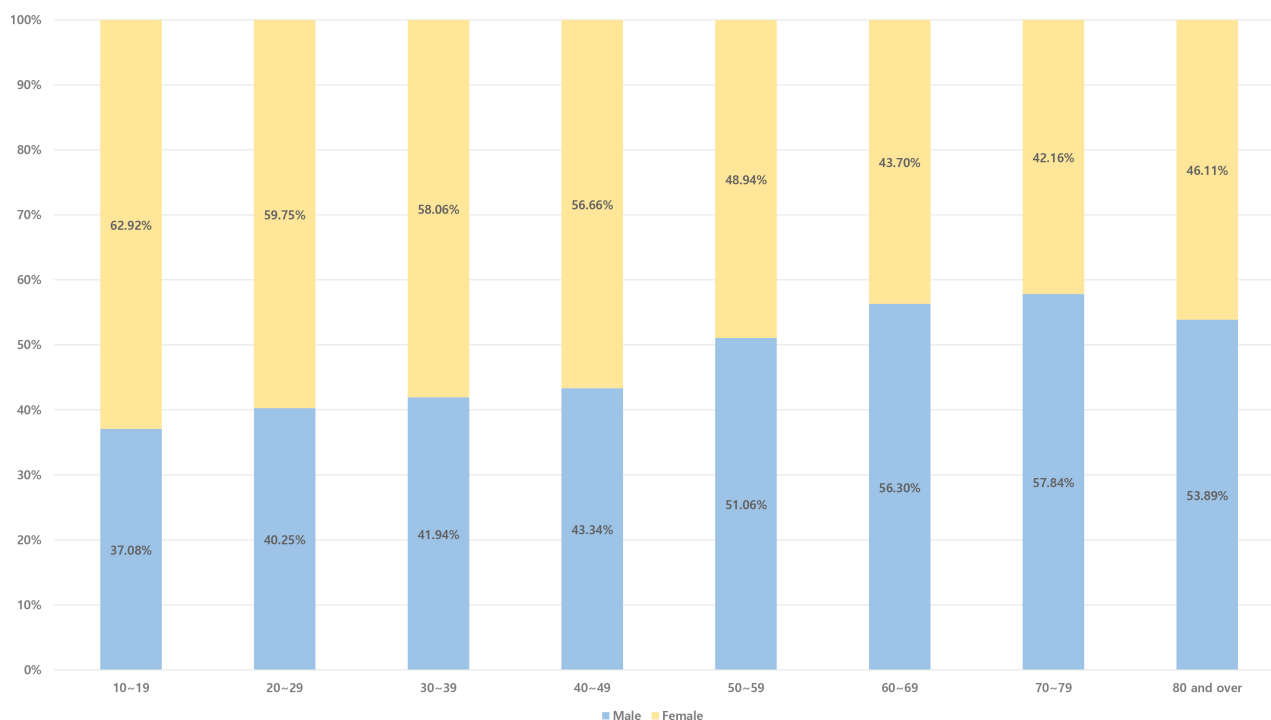


Fig. 2. Proportions of men and women in the study by age groups.

cases in rural areas among both men and women (women, 51.7%; men, 55.4%). The most common means of transportation to emergency medical institutions were 119 ambulances (62.7%).

3.2 Comparison of clinical characteristics and outcomes of men and women admitted to emergency departments after attempting suicide (Table 2)

The KTAS has been proven to be closely related to patient prognosis in various studies [16,17]. At the time of ED admission, 7.9% of all patients in the study were classified as KTAS level 1, with a higher proportion of men than women (10.9% among men vs. 5.3% among women, $p < 0.001$). The proportion of patients classified as KTAS level 2 was much higher among men (31%) than among women (29.1%). At the time of arrival to ED, 6.8% of the patients were unresponsive (9.7% of men and 4.4% of women) ($p < 0.001$). Significant gender differences were observed in the clinical outcomes. The ED death rates were 7.3% ($n = 2942$) in men and 2.9% in women ($n = 1384$). The percentage of hospitalized patients was 31.3% in women and 32.5% in men. The percentage of ICU hospitalizations was higher in men (19.2%) than in women (17.0%). The number of patients discharged from ED was 28,904 (59.6%) of women and 20,425 (51%) of men, indicating a better prognosis for women ($p < 0.001$).

Furthermore, 10.3% of men ($n = 3811$) and 4.0% of women ($n = 1852$) died in the hospital (in ED plus during hospitalization), showing statistically significant differences between genders ($p < 0.001$).

3.3 Comparison of methods of suicide of men and women admitted to emergency departments after attempting suicide (Table 3, Fig. 3)

Relevant descriptive information about suicide methods is presented in Table 3 and Fig. 3. In general, poisoning is the main method of suicide. For both genders combined, poisoning was used in over 57.2% of suicide attempts (62.3% of women, 51.0% of men). Piercing or cutting was the second most common method for women (24.9%) and men (22.9%). Only 6.8% of our sample attempted suicide by hanging. Being struck accounted for 4.2% of the total. Drowning and burning were the least likely of all methods. There were gender differences in the method of suicide, as shown in Table 3 ($p < 0.001$). Women were more likely to use poisoning (62.3% vs. 51.0% in men) and cutting (24.9% women vs. 22.9% men) than men, while men were more likely to use hanging (9.5% men vs. 4.6% women) and being struck (7.9% men vs. 1.1% women).

3.4 Method-specific mortality rate by gender (Fig. 4)

The fatalities of each suicide method tended to be similar between men and women, but the fatalities among men were higher even when the same method was used (Fig. 4). The fatality rates for hanging were found to be the highest overall and were significantly higher among men (56% for men and 44.1% for women). This trend has also been observed in other suicidal methods.

For falling, which had the second highest fatality rate, the percentage was 41.3% for men and 34.8% for women.

Table 1. Epidemiological characteristics of patients who were admitted emergency departments for suicide attempt.

	Women		Men		Total		<i>p</i> -value
	n	%	n	%	n	%	
Age (years)	39.89 ± 17.98		44.54 ± 19.05		41.96 ± 18.64		<0.001
Age group (years)							<0.001
10–19	5643	(11.6)	3325	(8.3)	8968	(10.1)	
20–64 years	37,735	(77.9)	30,063	(75.1)	67,798	(76.6)	
≥65 years	5086	(10.5)	6643	(16.6)	11,729	(13.3)	
Age (years)							<0.001
10–19	5643	(11.6)	3325	(8.3)	8968	(10.1)	
20–29	11,145	(23.0)	7508	(18.8)	18,653	(21.1)	
30–39	8954	(18.5)	6467	(16.2)	15,421	(17.4)	
40–49	9478	(19.6)	7249	(18.1)	16,727	(18.9)	
50~59	6463	(13.3)	6742	(16.8)	13,205	(14.9)	
60~69	2826	(5.8)	3641	(9.1)	6467	(7.3)	
70~79	2347	(4.8)	3220	(8.0)	5567	(6.3)	
≥80	1608	(3.3)	1879	(4.7)	3487	(3.9)	
Area							<0.001
Urban	23,420	(48.3)	17,850	(44.6)	41,270	(46.6)	
Rural	25,044	(51.7)	22,181	(55.4)	47,225	(53.4)	
Insurance							<0.001
National health insurance	37,886	(78.2)	30,261	(75.6)	68,147	(77.0)	
Medicaid	4277	(8.8)	4009	(10.0)	8286	(9.4)	
Self-paid	5947	(12.3)	5352	(13.4)	11,299	(12.8)	
Others	354	(0.7)	409	(1.0)	763	(0.9)	
ED visit season							0.008
Spring	11,995	(24.8)	10,311	(25.8)	22,306	(25.2)	
Summer	13,504	(27.9)	10,976	(27.4)	24,480	(27.7)	
Autumn	12,343	(25.5)	10,075	(25.2)	22,418	(25.3)	
Winter	10,622	(21.9)	8669	(21.7)	19,291	(21.8)	
Mode of arrival							<0.001
911	30,095	(62.1)	25,368	(63.4)	55,463	(62.7)	
Other ambulance	3599	(7.4)	4752	(11.9)	8351	(9.4)	
Car	14,592	(30.1)	9688	(24.2)	24,280	(27.4)	
Walk	111	(0.2)	75	(0.2)	186	(0.2)	
Others	67	(0.1)	148	(0.4)	215	(0.2)	

Categorical variables were analyzed using the chi-square test, and continuous variables were analyzed using an independent *t*-test.

This trend was observed in drowning (20.7% in men vs. 13.4% in women), poisoning (6.2% for men vs. 1.6% for women), and piercing or cutting (0.9% for men vs. 0.2% for women).

3.5 Multivariable logistic regression analysis for factors affecting mortality (Table 4)

This study focused on factors affecting mortality. Multivariate analysis was used to confirm the relationship between gender, age, region (urban vs. rural), consciousness of ED visits, and suicide method, which had statistically significant values in the univariate analysis. Men

were significantly more likely to die than women (odds ratio (OR) = 2.055, 95% confidence interval (CI) = 1.864–2.267). Additionally, mortality occurred more frequently among older age groups (OR = 1.043, 95% CI 1.040–1.046). ED in rural regions showed a higher mortality rate than urban centers (OR = 1.566, 95% CI 1.420–1.727). Patients with altered mental status during the initial ED visit had poor clinical outcomes. In particular, the odds of unresponsiveness were almost 208 times higher than the odds of alert mentality (OR = 208.7, 95% CI 183.4–437.4). Pain response mental status also showed 3.5 times higher mortality outcomes (OR = 3.51, 95% CI 3.027–4.09) and ver-

Table 2. Comparison of clinical characteristics and outcomes between women and men who visited EDs with deliberate self-harm.

	Women		Men		Total		<i>p</i> -value
	n	(%)	n	(%)	n	(%)	
KTAS							<0.001
Level 1	2586	(5.3)	4366	(10.9)	6952	(7.9)	
Level 2	14,120	(29.1)	12,413	(31.0)	26,533	(30.0)	
Level 3	18,761	(38.7)	12,519	(31.3)	31,280	(35.4)	
Level 4	11,802	(24.4)	9483	(23.7)	21,285	(24.1)	
Level 5	1158	(2.4)	1196	(3.0)	2354	(2.7)	
Consciousness							<0.001
Alert	31,968	(66.0)	26,512	(66.3)	58,480	(66.1)	
Verbal	9224	(19.0)	5645	(14.1)	14,869	(16.8)	
Pain response	5130	(10.6)	3981	(9.9)	9111	(10.3)	
Unresponsiveness	2142	(4.4)	3893	(9.7)	6035	(6.8)	
Vital signs							
Systolic blood pressure (mmHg)	121.76 ± 22.27		129.12 ± 23.67		124.99 ± 23.18		<0.001
Diastolic blood pressure (mmHg)	75.25 ± 15.04		78.83 ± 15.85		76.82 ± 15.50		<0.001
Pulse rate (beats/minute)	90.10 ± 18.51		91.12 ± 18.36		90.55 ± 18.46		<0.001
Respiratory rate (per minute)	19.55 ± 2.69		19.74 ± 2.89		19.63 ± 2.78		<0.001
Saturation (%)	97.43 ± 3.25		96.83 ± 3.99		97.17 ± 3.60		<0.001
Body temperature (°C)	36.60 ± 0.52		36.52 ± 0.56		36.56 ± 0.54		<0.001
ED results							<0.001
Discharge	28,904	(59.6)	20,425	(51.0)	49,329	(55.7)	
Admission	15,151	(31.3)	13,009	(32.5)	28,160	(31.9)	
General ward	6918	(14.3)	5342	(13.3)	12,260	(13.9)	
ICU	8233	(17.0)	7667	(19.2)	15,900	(18.0)	
ED death	1384	(2.9)	2942	(7.3)	4326	(4.9)	
Transferred	2583	(5.3)	3070	(7.7)	5653	(6.4)	
Others	442	(0.9)	585	(1.5)	1027	(1.2)	
Hospital mortality	1852	(4.0)	3811	(10.3)	5663	(6.8)	<0.001

Categorical variables were analyzed using the chi-square test, and continuous variables were analyzed using an independent *t*-test.

Table 3. Comparison of methods of suicide of men and women admitted to emergency departments after attempting suicide.

	Women		Men		Total		<i>p</i> -value
	n	(%)	n	(%)	n	(%)	
Methods							<0.001
Poisoning	30,203	(62.3)	20,432	(51.0)	50,635	(57.2)	<0.001
Piercing or cutting	12,065	(24.9)	9152	(22.9)	21,217	(24.0)	<0.001
Hanging	2222	(4.6)	3822	(9.5)	6044	(6.8)	<0.001
Fall	1154	(2.4)	1136	(2.8)	2290	(2.6)	<0.001
Slipping	110	(0.2)	106	(0.3)	216	(0.2)	0.274
Struck by person or object	538	(1.1)	3165	(7.9)	3703	(4.2)	<0.001
Drowning	425	(0.9)	499	(1.2)	924	(1.0)	<0.001
Burn	59	(0.1)	153	(0.4)	212	(0.2)	<0.001
Traffic accident	103	(0.2)	152	(0.4)	255	(0.3)	<0.001
Machine	12	(0.0)	9	(0.0)	21	(0.0)	0.997
Other specific methods and unknown	1573	(3.2)	1405	(3.5)	2978	(3.4)	<0.001

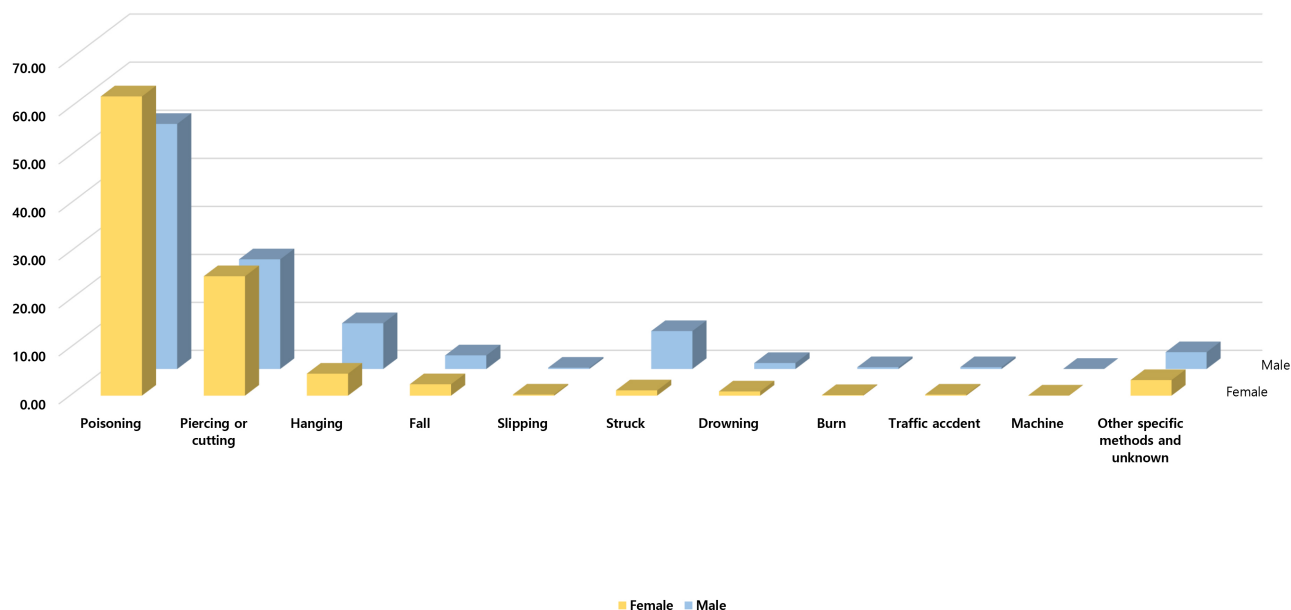


Fig. 3. Proportions of men and women in the study by each method of suicide.

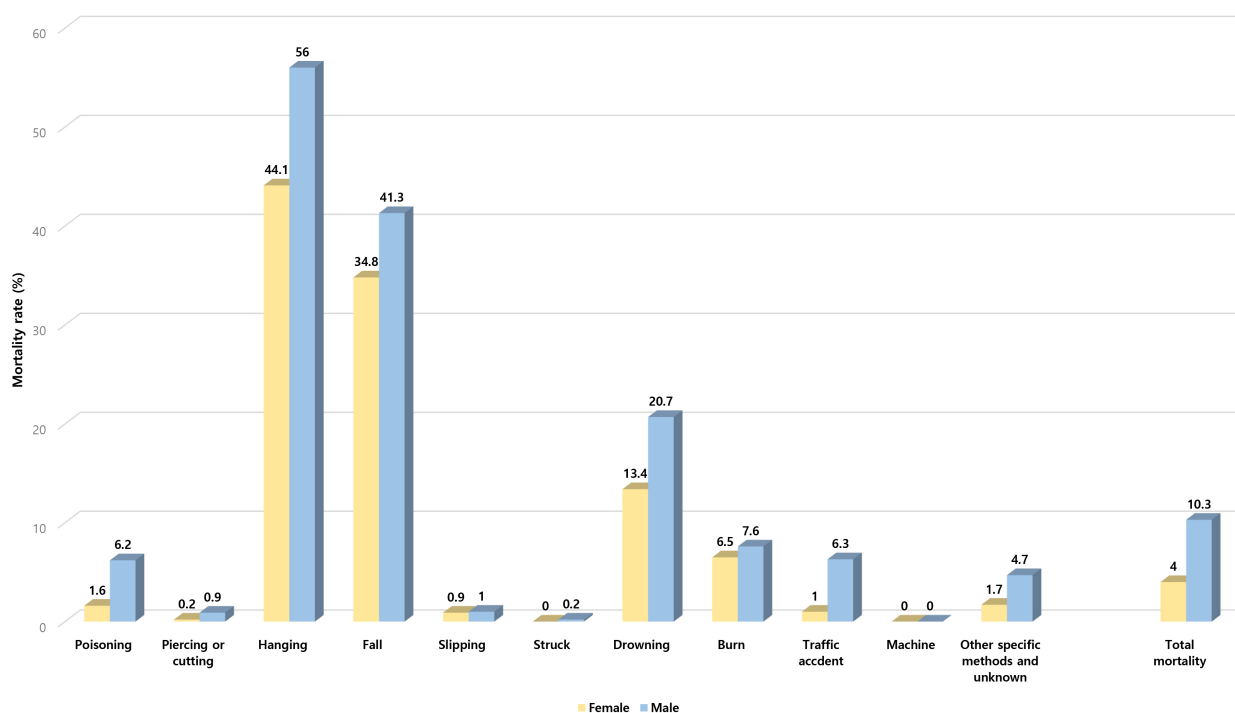


Fig. 4. Method-specific mortality rates by gender.

bal response had odds 2.03 higher than alert status. There were differences in mortality outcomes between the suicide methods. Poisoning, the most popular suicide method, had relatively good clinical outcomes. The odds of poisoning were 0.357 (95% CI 0.321–0.397). However, suicide methods such as hanging (odds ratio (OR) 2.549, 95% confidence interval (CI) 2.26–2.876), falling (OR 9.152, 95% CI

7.504–11.161), and drowning (OR 2.074, 95% CI 1.452–2.963) had higher mortality rates.

4. Discussion

This study aimed to analyze gender differences among patients who were admitted to ED after attempting suicide in South Korea nationwide (including suicide deaths). Sim-

Table 4. Multivariable logistic regression analysis of factors affecting mortality.

	Univariable			Multivariable		
	Adjusted OR	(95% CI)	<i>p</i> -value	Adjusted OR	(95% CI)	<i>p</i> -value
Sex	2.733	(2.581–2.894)	<0.001	2.055	(1.864–2.267)	<0.001
Age	1.040	(1.038–1.041)	<0.001	1.043	(1.040–1.046)	<0.001
Area	1.569	(1.484–1.659)	<0.001	1.566	(1.420–1.727)	<0.001
Consciousness						
Alert	Reference	Reference	Reference	Reference	Reference	Reference
Verbal	2.323	(1.992–2.710)	<0.001	2.030	(1.731–2.381)	<0.001
Pain response	5.190	(4.499–5.988)	<0.001	3.518	(3.027–4.090)	<0.001
Unresponsiveness	518.927	(463.073–581.518)	<0.001	208.690	(183.445–437.410)	<0.001
Methods	1.124	(1.11–1.135)	<0.001	0.991	(0.963–1.021)	0.568
Poisoning	0.279	(0.263–0.296)	<0.001	0.357	(0.321–0.397)	<0.001
Piercing or cutting	0.053	(0.043–0.064)	<0.001	0.341	(0.267–0.434)	<0.001
Hanging	28.782	(26.980–30.704)	<0.001	2.549	(2.260–2.876)	<0.001
Fall	9.554	(8.703–10.489)	<0.001	9.152	(7.504–11.161)	<0.001
Slipping	0.131	(0.102–0.526)	0.004	0.416	(0.083–2.088)	0.286
Struck by person or object	0.018	(0.007–0.043)	<0.001	0.114	(0.046–0.286)	<0.001
Drowning	2.899	(2.422–3.470)	<0.001	2.074	(1.452–2.963)	<0.001
Burn	1.071	(0.579–1.980)	0.827	1.848	(0.675–5.058)	0.232
Traffic accident	0.587	(0.311–1.106)	0.099	0.993	(0.340–2.879)	0.990
Machine	0.000	(0.000–0.000)	0.998	0.000	(0.000–0.000)	0.998

ilar to other countries, the overall number of suicide attempts in South Korea tends to be higher in women than in men. The number of suicide death was roughly twice as high among men compared with women, similar to global trends worldwide [4,5]. In other words, women tend to attempt suicide more than men, but they are also more likely to be survive or be rescued. This is referred to as the “gender paradox” in suicidal behavior [18,19].

We found that men showed more fatal conditions at the time of their first ED admission. We classified patients using the KTAS level system, initial mental status, and vital signs. As mentioned in the Results section, a higher KTAS level (Level 1 or 2) suggests a poor prognosis [16,17]. Therefore, we can assume that there are differences between men and women that affect ICU hospitalization rates and prognosis.

First, gender differences were observed considering age. In the younger age group, the majority of patients were women, whereas in the older adult group, the majority of patients were men. Some researchers have demonstrated a correlation between age increase and suicide death rate [20,21]. Of course, other factors also increase suicide mortality in old age, such as social isolation and poor physical or financial conditions [22]. However, the fact that the rate among men is higher than that among women seems to be linked to the higher suicide mortality rate in men. Some studies have suggested that there are urban-rural inequalities in suicide mortality [23] and that suicide attempts in women are seasonal [24]. However, we found that both

men and women showed no significant differences when considering different regions and seasons.

Second, men were more likely to choose high-risk methods with significantly higher mortality than women. In this study, drug poisoning was the most common suicide method in both genders. The percentage of participants who chose drug poisoning among women was higher than among men. The same was true for cutting. The fatalities of poisoning, piercing, and cutting were relatively less lethal methods than the other methods, as indicated by logistic regression. However, methods such as hanging, drowning, and falling were more common among men and have been shown to cause severe mortality outcomes. A recent study analyzed suicide methods based on the degree of fatality and found that firearms, hanging, and jumping from a height were associated with high fatalities, while drug poisoning, cutting, or piercing by sharp objects were associated with low fatalities [25].

Third, the lethality of each of the methods examined was higher for men than for women. This indicates that fatalities among men were higher than those among women, even when the same method was used. This finding was observed in the majority of cases. In addition to hanging, falling, and drowning, which are known to have high fatality rates, and poisoning and cutting by sharp objects, which are relatively less lethal methods, showed significantly higher fatality rates among men than women.

Possible reasons for this gender difference are still being explored. Some argue that women prefer less violent

methods because of the lower level of knowledge and technical skills needed for such methods [6,26], suggesting that the methods of suicide commonly employed by women are more available and accessible. The sociocultural environment may influence accessibility to different suicide methods, as well as technical skills. For example, firearms are readily available in many households and remain the most common method of suicide in the United States and other Western countries [10,13]. However, the possession and sale of firearms are legally prohibited in Korea, and the suicide rate by firearms is very low for both genders. Other studies suggest that women are more likely to use less lethal methods because they do not really want to kill themselves [5]. Studies show that major depression is a significant risk factor for both men and women, and there is evidence that depression is often diagnosed earlier and treated more appropriately among women than men [27]. Thus, in men, the willingness to attempt suicide may be masked without proper treatment and possibly released in the form of fatal attempts. Another study argues that the additional involvement of alcohol abuse is linked to the lethality of suicide attempts, especially in patients with mood disorders [28]. The high prevalence of alcohol dependence and abuse in men seems to be linked to high suicide mortality [29].

This study had several limitations. First, data analyses were conducted in only one county. Cultural characteristics may vary across various regions and countries, and these differences were not considered in this study. Second, there were no measures of socioeconomic status, such as income, occupation, or individual educational status. Third, we did not consider the effect of a patient's previous physical or mental health on suicide rates. Factors such as depression, anxiety, alcohol abuse, and prevalence rates of medical diseases may vary between men and women, and the effects of this on suicide fatality have not been identified. Finally, this study might have underestimated the number of deaths classified as "undetermined" or "undetermined hidden deaths" [30]. We retrospectively analyzed the nationwide ED admission data; therefore, cases of patients who were found too late and were not taken to the emergency room after a suicide attempt, or who died without regaining consciousness and whose intention was unclear, were not analyzed in the study.

5. Conclusions

Suicide is an important social issue that should never be dismissed as an individual issue. Its prevention requires both national and social attention and planning. In Korea, the suicide rate is globally among the highest, and more attention is needed for its reduction. In this study, we provide supporting evidence for the difference in suicide rates between genders. In a sample of ED patients from one country in South Korea, we found that women chose less lethal suicide methods, whereas men chose more violent ones. Moreover, among men were higher even when the same method

was used. In South Korea, public education on depressive symptoms for men and specialized programs to help depressed men are lacking. In establishing a suicide prevention policy, it is important to consider gender differences.

Abbreviations

ED, Emergency Department; WHO, World Health Organization; OECD, Organization for Economic Cooperation and Development; NEDIS, National Emergency Department Information System; KTAS, Korean Triage and Acuity Scale; GW, general ward; ICU, intensive care unit.

Author contributions

DHL and EK performed the analysis of the data authored, and prepared the tables. JIL, DHL and EK conceived and designed the research, analyzed data, and authored and reviewed the drafts of the paper. STS wrote the manuscript. EK and DHL contributed equally as corresponding authors. All the authors approved the final draft of the manuscript.

Ethics approval and consent to participate

This study was approved by the Institutional Review Board of Ewha Womans University Mok-dong Hospital (IRB No. 2021-08-012). Informed consent was waived by the institutional review board because this was a retrospective study. Patient information was anonymized before the analysis.

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Conflict of interest

The authors declare no conflict of interest.

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