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Original Research

Investigation of suicide deaths in Turkey between 2015 and 2019

Emrah Emiral[1,*], Gulsum Ozturk Emiral[2], Zehra Arslan Cevik[1], Nergis Canturk[3], Gurol Canturk[1]

[1]Department of Forensic Medicine, Ankara University, School of Medicine, 06620 Ankara, Turkey
[2]Cankaya District Health Directorate, 06230 Ankara, Turkey
[3]Department of Criminalistics, Ankara University Institute of Forensic Sciences, 06620 Ankara, Turkey

***Correspondence:** emiral@ankara.edu.tr (Emrah Emiral)

Abstract

Background and objectives: Although suicide is the act of an individual, it is an important public health problem that affects the individual's environment and also society. Approximately 800,000 people die by suicide each year. In this study, we aimed to evaluate the socio-demographic characteristics of fatal suicides in Turkey between 2015 and 2019.

Materials and methods: This observational-analytical study was conducted by examining retrospective records in the period 2015–2019. The study was conducted by secondary analysis based on data from the Turkish Statistical Institute.

Results: During the study period, the suicide rate (per 100,000) varied in the range 3.94–4.15 and the mean (standard deviation, SD) was 4.07 (0.09). The mean (SD) suicide rate was 6.14 (0.13) in males and 1.99 (0.18) in females; it was higher in males (z = 2.611; p = 0.008). Considering age groups, there was no difference between sex in terms of suicide rate among those aged $<$19 years (z = 1.617; p = 0.446), whereas the suicide rate was higher in males and in those aged $\geq$20 years ($p < 0.05$ for each). During the study period, the most common suicide mean in both men and women was "by hanging". The incidence of suicide using chemical substances and by jumping from a height was higher in women than in men, whereas the rate of suicide using firearms was high in men (p = 0.000). When the female/male suicide rate was compared according to marital status, the suicide rate was observed to be higher in men regardless of marital status, and this difference was more striking in men who were divorced or whose spouse had died.

Conclusion: Between 2015 and 2019, the suicide rate was higher especially in older men and in those who had lost a spouse. Therefore, socio-demographic characteristics should be considered in planning interventions to prevent suicides and guiding rehabilitation programs following a suicide attempt.

Keywords

Suicide; Sex; Turkey; TURKSTAT; Marital status; Education; Economic problems

1. Introduction

Suicide is an important public health problem with social, emotional and economic effects. The World Health Organization (WHO) divided suicides into two categories depending on whether they resulted in death or not. While all voluntary attempts that did not result in death were considered as suicides, suicide, on the other hand, was defined as the action of a person toward oneself that resulted in death [1]. It was determined that the annual number of suicides resulting in death worldwide was approximately 800,000 and 1–4% of total deaths were due to suicide. Worldwide data for 2016

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showed that the age-standardized suicide rate was between 10.4 and 11.2 per 100,000 [2]. Moreover, it was found that there was a relationship between suicidal action and many other factors. Psychiatric diseases and psychological characteristics (panic disorder, agoraphobia, post-traumatic stress disorder, generalized anxiety disorder, major depression), consumption and addiction of alcohol and drugs, physical ailments, cultural and social factors (marital status, concept of honor, perception of religion, political conditions) and economic situation (insufficient social support, unemployment, low income, poor access to health services) were defined as risk factors that might lead to suicide or non-fatal suicide attempts in individuals [3, 4].

Characteristics such as suicide rates, causes of suicidal action, means used and age group may differ between sexes [2, 4]. A review of the distribution of suicide-related mortality rates according to sex among age groups around the world indicates that the mortality rate due to suicide was higher in men in all age groups other than the 15–19 years group, whereas the said difference between men and women in some parts of China and India was determined to be lower than that seen in other parts of the world [2, 5–9]. This suggests the need to evaluate the dynamics of the region under study as well as individual variables. Suicide-related death rates vary among age groups. It was found that mortality due to suicide increased in the elderly population with an increase in life expectancy in general. Additionally, it was observed that there were regions where this increase was higher in young adults [1, 2, 10, 11]. Despite the increase in mortality due to suicide in the elderly population, death due to suicide was not among the top ten causes of death at the age of $\geq$70 years, and death due to suicide between the age of 10 and 24 years was among the top five causes of death [2].

It is important to define age- and sex-specific suicide means in order to support measures against suicide and restrict access to lethal means [12, 13]. Suicide by means of hanging, intoxication and firearms stand out as the most commonly used means worldwide [1]. It was also found that suicide means differed over time according to the country. For example, in Finland, poisonous substance intake was found to be the most frequently used mean in 2000, but this was replaced by hanging in 2015. While firearms and explosives were the most common means used in Colombia and South Africa in 2000, these were replaced by hanging in 2015 [13]. In a relevant study, it was found that the most frequently used suicide means in Turkey were hanging and firearm use, and a review of the change in suicide means used between 1990 and 2010 indicated that the rates of suicide by firearm use increased in both men and women [14].

Therefore, there is more than one reason that causes this important public health problem, which is seen globally and at any stage of human life and can thereby be called a "silent epidemic". Global and national prevention studies should be supported by determining the factors that lead to suicide and examining the distribution of suicide means according to age and sex. Owing to its geographical location, Turkey maintains many common features of the East and the West in terms of social, cultural and economic aspects. As a result, studies on suicide rates specific to Turkey are important for the purpose of evaluating other national and international studies. In the present study, we aimed to evaluate the socio-demographic characteristics of suicide deaths in Turkey between 2015 and 2019.

2. Materials and methods

This is an observational-analytical study that was conducted by examining the retrospective records of the time period between 2015 and 2019. The study was conducted using secondary analysis based on data from the Turkish Statistical Institute (TURKSTAT).

In this study, suicide statistics published in the TURKSTAT database between 2015 and 2019 were evaluated on the basis of socio-demographic characteristics [15, 16]. TURKSTAT is the official institution in Turkey that compiles data and information and produces, publishes and distributes the necessary statistics in the fields required by the country. The institution collects data from individuals, households and workplaces through surveys and censuses [17]. The necessary data for the relevant time period were obtained from the official website (www.tuik.gov.tr) with the title "Suicide Statistics". As the data were published publicly, no other permission or ethics committee approval was required.

In Turkey, death notifications are made electronically via the "Death Notification System" with forms filled out by health professionals. TURKSTAT analyzes death statistics over these notifications and publishes them as open access. As TURKSTAT is an official institution that collects data systematically and regularly, the data quality is considered to be high. The TURKSTAT database presents suicide statistics according to variables such as age (15–75 years), sex and means of suicide (hanging, firearm use, etc.).

The data obtained in our study were evaluated using SPSS software (version 20.0) (IBM corp, NY, USA). The Kolmogorov–Smirnov test was used to check for normality and the data were found not to have a normal distribution. In addition, Mann–Whitney U and Kruskal–Wallis tests were used for analyzing the data. A p value of <0.05 was considered to be statistically significant.

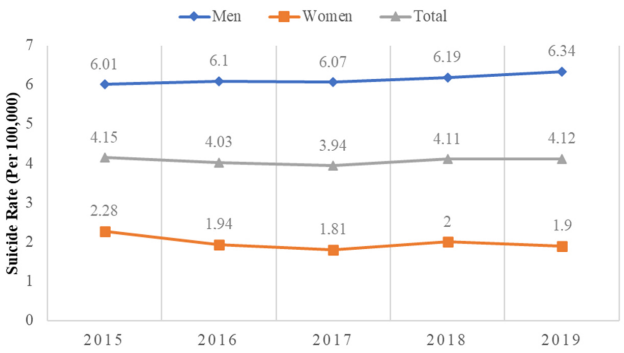

FIG. 1. Suicide rates according to year and sex.

3. Results

During the 2015–2019 study period, the suicide rate varied within the range 3.94–4.15 and the mean (standard deviation, SD) was 4.07 (0.09) (Fig. 1).

The mean (SD) suicide rate was 6.14 (0.13) in men and 1.99 (0.18) in women; it was higher in men (z = 0.008; p = 0.008). The ratio of suicide rates between men and women ranged between 2.64 and 3.35, with a mean (SD) of 3.11 (0.29) (Fig. 2). In this study, there was no statistically significant difference in suicide rates between sexes during the study period by year ($p > 0.05$ for each). A comparison of the suicide rates obtained in the study according to sex is given in Table 1.

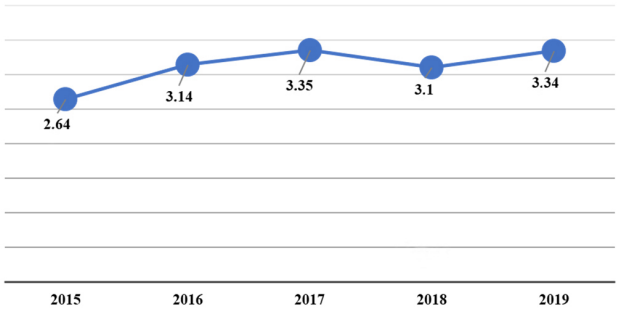

FIG. 2. Ratio of male/female suicide rates according to year.

TABLE 1. Comparison of suicide rates according to sex.

Sex	Suicide rate		Statistical analysis
	Mean (SD)	Median (Q1–Q3)*	z (p)**
Male	6.14 (0.13)	6.10 (6.07–6.19)	2.611 (0.008)
Female	1.99 (0.18)	1.94 (1.90–2.00)	

*Q1: 25th quartile; Q3: 75th quartile. **Exact significance is displayed.

In this study, the suicide rate was generally higher in the 20–29 years age group compared to the ≤19 and 30–69 years age groups, and there was no difference between the 20–29 and ≥70 years age groups (K_w = 24.501; p = 0.000). With regard to age group, there was no difference according to sex in terms of the suicide rate for those under 19 years of age (z = 1.617; p = 0.446), whereas the suicide rate was higher for men in all age groups of 20 years and older ($p < 0.05$ for each). In men, the suicide rate for the ≤19 years age group was lower than that of the other age groups, whereas the suicide rate was higher for women in the 20–29 years age group than that in the 40–69 years age group ($p < 0.05$ for each). The distribution of suicide rates according to age group and sex is given in Table 2.

It was found that the most common suicide means in both men and women was "by hanging" during the study period. The incidence of suicide using chemical substances and by jumping from a height was higher in females compared to that in males, whereas the suicide rate by using firearms was higher in men (p = <0.001). A comparison of suicide means by sex is given in Table 3.

In our study, the suicide rate was found to be generally lower in those who were married compared to those who never married and those who were divorced. In addition, the suicide rate was lower in those who never married compared to those who were divorced (17.979, $p < 0.001$). The suicide rate was lower in both men and women who were married ($p < 0.05$ for each). A comparison of the suicide rate according to sex and marital status indicated that it was higher in men regardless of marital status and this difference became even more pronounced in men who were divorced or whose spouse had died. The distribution of suicide rates according to marital status and sex is given in Table 4.

In this study, the suicide rate was high in men at all education levels ($p < 0.05$ for each). While the suicide rate was lower in university graduates in women, there was no such difference in men. The distribution of suicide rates according to education level and sex is given in Table 5.

An examination of the suicide rate according to the reason for suicide indicated that the frequency of suicide due to economic problems/commercial failure in men was higher than that in women. Moreover, in women, the rate of suicide due to illness and educational failure was higher than that in men (chi-square analysis: 362.238; p = <0.001). The distribution of the reason for suicide according to sex is given in Table 6.

4. Discussion

Worldwide, about 700,000 people die each year (1 death every 40 seconds) due to suicide. Among the causes of death, suicides are ranked seventeenth in general (1.3% of all deaths) and fourth in the 15–29 years age group [18]. On examining the WHO data, it is seen that the crude suicide rate between 2015 and 2019 was 12.8 (0.16) for men, 5.7 (0.09) (M/F = 2.2) for women and 9.3 (0.12) in general. According to WHO's country-based data, the total suicide rate and the suicide rates in men and women in 2019 were 16.1, 25.0 and 7.5 in the USA, 14.7, 19.9 and 9.5 in Sweden, 5.1, 8.4 and 1.9 in Greece, 12.3, 18.6 and 6.2 in Germany, 4.1, 6.6 and 1.6 in Azerbaijan, 5.2, 7.7, and 2.8 in Iran, 6.0, 8.9 and 2.0 in Saudi Arabia and 2.4, 3.6 and 1.2 in Turkey, respectively [19]. The TURKSTAT and WHO reports on Turkey are not consistent. In Turkey, suicide statistics are obtained only from TURKSTAT. It is likely that the said difference is due to the different databases that WHO uses for Turkey. Turkey is a country where most of the people are Muslim. Although this may protect people against suicide, it suggests that there may be deficiencies in reporting as it may cause stigmatization. For this reason, it is thought that WHO can make projections in line with the data obtained from similar countries. If the databases used by WHO could be accessed, the reasons for the differences could be understood.

Examination of all these results suggests that the suicide rates in Turkey are lower than in Western countries and similar to countries where a Muslim majority lives. People with high religious and spiritual values may find more reasons to live, which can protect individuals against suicide.

TABLE 2. Distribution of suicide rates according to age group and sex.

Age group (years)	Study group	Men	Women	Statistical analysis (*p*)
	Mean (SD)	Mean (SD)	Mean (SD)	
	Median (Q1–Q3)*	Median (Q1–Q3)*	Median (Q1–Q3)*	
≤19	2.89 (2.28)	3.16 (2.57)	2.60 (2.00)	1.617 (0.446)
	2.89 (0.70–5.07)	3.09 (0.70–5.57)	2.47 (0.75–4.53)	
20–29	5.85 (0.35)	8.81 (0.48)	2.78 (0.58)	25.812 (<0.001)
	5.79 (5.64–5.88)	8.88 (8.72–9.17)	2.72 (2.34–3.39)	
30–39	4.88 (0.44)	7.51 (0.59)	2.20 (0.43)	25.818 (<0.001)
	4.81 (4.55–5.07)	7.29 (7.11–8.04)	2.21 (1.91–2.47)	
40–49	4.99 (0.32)	8.02 (0.67)	1.91 (0.27)	25.812 (<0.001)
	4.98 (4.66–5.27)	7.82 (7.53–8.46)	1.87 (1.65–2.11)	
50–59	5.02 (0.45)	8.14 (1.02)	1.90 (0.36)	25.806 (<0.001)
	4.90 (4.75–5.42)	8.0 (7.55–8.65)	1.89 (1.71–2.15)	
60–69	4.83 (0.49)	8.01 (0.91)	1.87 (0.45)	25.818 (<0.001)
	4.69 (4.42–5.18)	7.93 (7.23–8.82)	1.82 (1.52–2.01)	
≥70	5.81 (1.17)	10.32 (2.38)	2.54 (0.71)	25.061 (<0.001)
	5.79 (4.62–6.84)	10.51 (8.01–12.09)	2.44 (2.18–3.02)	
Statistical analysis (*p*)	24.501 (<0.001)	38.533 (<0.001)	14.918 (0.021)	

*Q1: 25th quartile; Q3: 75th quartile.

TABLE 3. Distribution of suicide means according to sex.

Means of suicide	Study group	Sex		Statistical analysis (*p*)
		Men	Women	
	n (%)*	*n* (%)*	*n* (%)*	
By hanging	7732 (47.2)	5828 (47.1)	1904 (47.9)	876.261 (<0.001)
Using firearms	4597 (28.1)	4026 (32.5)	571 (14.4)	
Jumping from a height	1917 (11.7)	1100 (8.9)	817 (20.6)	
Using chemicals/natural gas/liquefied petroleum gas, etc.**	867 (5.3)	501 (4.0)	366 (9.2)	
By drowning	241 (1.5)	167 (1.3)	74 (1.9)	
Using a sharp instrument	221 (1.4)	188 (1.5)	33 (0.8)	
By burning	62 (0.4)	49 (0.4)	13 (0.3)	
Jumping off a train or other motorized vehicle	61 (0.4)	50 (0.4)	11 (0.3)	
Other	657 (4.0)	475 (3.8)	182 (4.6)	
Total	16355 (100.0)	12384 (75.7)	3971 (24.3)	

*The column percentage is provided. **High doses of drugs, stimulants and psychoactive substances belonging to other classes; intake of corrosive substances; pesticide ingestion; carbon monoxide inhalation; etc.

TABLE 4. Distribution of suicide rates by marital status and sex.

Legal marital status	Study group	Men	Women	Statistical analysis (*p*)
	Mean (SD)	Mean (SD)	Mean (SD)	
	Median (Q1–Q3)*	Median (Q1–Q3)*	Median (Q1–Q3)*	
Never married	7.26 (0.22)	9.42 (0.33)	4.36 (0.59)	12.590 (0.002)
	7.30 (7.30–7.30)	9.30 (9.20–9.60)	4.20 (4.00–4.50)	
Married	4.20 (0.07)	6.64 (0.09)	1.72 (0.11)	12.774 (0.002)
	4.20 (4.20–4.20)	6.70 (6.60–6.70)	1.70 (1.70–1.70)	
Divorced	11.68 (0.77)	19.78 (2.15)	5.60 (1.27)	12.500 (0.002)
	11.90 (11.20–12.30)	19.70 (18.90–20.70)	5.20 (4.50–6.90)	
Widowed	4.84 (0.29)	17.68 (2.44)	2.68 (0.55)	12.522 (0.002)
	4.70 (4.60–5.10)	18.70 (16.70–19.00)	2.60 (2.30–2.70)	
Statistical analysis (*p*)	17.979 (<0.001)	16.604 (0.001)	16.866 (0.001)	

*Q1: 25th quartile; Q3: 75th quartile.

Abrahamic religions (Judaism, Christianity and Islam) disapprove of suicidal behavior. Although there are practical differences arising from the sect and ethnic differences of each Islamic country, suicide is prohibited in the Holy Book of the Islamic religion [And do not kill yourself. Indeed, Allah is very merciful to you. (Quranic Verse Nisa: 4:29)]

TABLE 5. Distribution of suicide rates by education level and sex.

Education level	Study group	Men	Women	Statistical analysis (p)
	Mean (SD)	Mean (SD)	Mean (SD)	
	Median (Q1–Q3)*	Median (Q1–Q3)*	Median (Q1–Q3)*	
Illiterate	3.96 (0.67)	9.12 (2.88)	3.06 (0.62)	11.301 (0.004)
	4.00 (3.40–4.40)	8.30 (8.30–8.30)	3.10 (2.60–3.20)	
Literate without diploma	2.38 (0.53)	3.28 (0.68)	1.72 (0.38)	9.293 (0.010)
	2.20 (2.10–2.30)	3.10 (2.80–3.40)	1.60 (1.50–1.60)	
Primary school	4.00 (0.19)	6.62 (0.41)	1.94 (0.09)	12.635 (0.002)
	3.90 (3.90–4.20)	6.50 (6.30–7.00)	2.00 (1.90–2.00)	
Junior high school	6.30 (2.58)	8.72 (4.01)	3.07 (0.74)	18.858 (0.000)
	5.95 (4.30–7.30)	8.20 (5.50–10.30)	2.85 (2.70–3.50)	
High school	5.00 (0.23)	7.30 (0.27)	2.06 (0.23)	12.613 (0.002)
	5.10 (4.80–5.20)	7.30 (7.10–7.40)	1.90 (1.90–2.20)	
University	3.92 (0.16)	5.78 (0.29)	1.66 (0.23)	12.590 (0.002)
	3.90 (3.80–3.90)	5.70 (5.70–5.90)	1.60 (1.50–1.90)	
Statistical analysis (p)	23.838 (<0.001)	20.079 (0.001)	25.935 (<0.001)	

*Q1: 25th quartile; Q3: 75th quartile.

TABLE 6. Comparison of the reasons for suicide by sex.

Reason for suicide	Study group	Sex		Statistical analysis (p)
		Men	Female	
	n (%)*	n (%)*	n (%)*	
Illness	3707 (22.7)	2607 (21.0)	1100 (27.7)	
Economic problems/Commercial failure	1404 (8.6)	1337 (10.8)	67 (1.7)	
Family incompatibility/Emotional relationship and not marrying to the desired person	1183 (7.2)	865 (7.0)	318 (8.0)	
Educational failure	28 (0.2)	15 (0.1)	13 (0.3)	362.238 (<0.001)
Other	2682 (16.4)	2009 (16.2)	673 (16.9)	
Unknown	7351 (44.9)	5551 (44.8)	1800 (45.3)	
Total	16355 (100.0)	12384 (75.7)	3971 (24.3)	

[20, 21]. Muslim and non-Muslim Israelis were compared in a study conducted by Gal *et al.* [22] and no difference was reported between the rates of suicidal ideation and planning between Muslims and non-Muslims, although suicide deaths were lower in Muslims. This may be based on both the effect of the Quran and the social reasons in the process of reporting suicide incidents [22]. In a study conducted by Eskin using WHO data from Mediterranean countries, it was reported that suicide rates in Muslim Mediterranean countries were lower than those in non-Muslim countries and that the percentage of people who said religion was insignificant in daily life was associated with the increase in suicide rates [23]. In light of the above information, it is obvious that religious and spiritual values play a protective role against suicide. In addition, methodological differences between countries in processes such as diagnosing, recording and reporting suicide incidents may have contributed to this situation.

Although the relationship between sex and suicides is not clearly elucidated, sex is one of the important predictive factors for suicide deaths [24]. Similar to world data, the suicide rate was higher for men in our study. In a study conducted by Clarke *et al.* [25] in Ireland, it was reported that the suicide rate in men was six times higher than that in women. In the same study, the religiosity of men and women was evaluated and it was suggested that women were more religious and therefore their suicide rate might be lower [25]. Many psychosocial factors, such as substance use, unemployment, suicide mean, psychiatric comorbidity (especially depression), family ties, stressful life events and sexual harassment, may contribute to the relationship between sex and suicide. In a study conducted in Norway, it was reported that alcohol use was associated with the suicide rate in men, but this relationship could not be demonstrated for the suicide rate in women [26]. A study by Qin *et al.* [24] reported that having a child was a protective factor for females against suicide. In many studies, it has been shown that the number of suicidal thoughts and non-fatal suicide attempts is higher in women but that more men die due to suicide, which is a sex paradox. This can be explained by referring to the chosen means of suicide, and it has been suggested that men would choose more lethal means [23, 27, 28]. In a study conducted by Denning *et al.* [28], suicide means were classified as violent and non-violent, and it was reported that men more frequently preferred "violent" means. In a meta-analysis by Arsenault-Lapierre *et al.* [29], it was reported that approximately 90% of those who commit suicide had a mental health issue and hospitalization due to mental health

was a risk factor for suicidal behavior. Considering the strong relationship between suicidal behaviors and psychiatric disorders, it is quite possible that the differences in suicidal behavior between men and women are associated with sex differences in psychopathology. In addition, the lower rates of suicide in females may be due to the earlier and more frequent use of healthcare providers and treatment of diseases that lead to suicide [29, 30]. Although all these reasons might contribute to the difference in suicide rates between men and women, it is obvious that more comprehensive epidemiological studies are needed to clarify the issue.

Suicidal behavior can be seen at any age. Among the causes of death in the USA, suicides rank second in the 10–34 years age group and fourth in the 35–54 years age group. The WHO reported that suicide ranked fourth among the causes of death in the 15–29 years age group [18, 31]. In the present study, the suicide rate was high in the 20–29 years age group, both in the general population and in females; however, there was no difference in men among the >20 years age group. In a study conducted by Moneim *et al.* [32] in Egypt, it was reported that suicide cases were most frequent in the 20–30 years age group. Additionally, it was shown in a study conducted by Elhak *et al.* [33] that suicides were generally common in the 20–30 years age group, similar among men, and the highest frequency was observed in the 30–40 years age group in women. In a study conducted in Canada, the 45–64 years age group was reported to have the highest suicide rate for both men and women, whereas in another study conducted in the UK the highest suicide rate was reported in the 45–49 years age group [34, 35]. In studies conducted in Denmark and Brazil, the ≥65 years age group was reported to have the highest suicide rate [36, 37]. In a study by Snowdon *et al.* [38] that compared suicide rates in Iran and Australia, the highest suicide rate was reported for Iranian men aged 20–24 years during 2006–2010 and for Iranian women aged 15–19 years during 2011–2015. In the same study, it was found that the suicide rate showed a bimodal distribution in Australian men, the first peak being in the 35–44 years age group and the second in those over 65 years of age (highest in the ≥85 years age group); on the other hand, females had a peak in the 35–59 years age group [38]. Anxiety about finding/losing a job, lack of social support, intense sense of responsibility towards family/environment and comorbid conditions such as alcohol–substance addiction in the young–productive age group can be included in the reasons that lead to suicide. Later years of life are characterized by improved well-being, the ability to manage emotions better and an added meaning to life. Nevertheless, in many countries, the suicide rate in older ages is quite high. Although the reason for this discrepancy is not fully elucidated, the presence of physical ailments (cancer, disability, etc.) and associated symptoms such as pain, the choice of more deadly suicide means compared to young people and difficulties in diagnosing psychiatric disorders such as depression can be included in the underlying causes. Furthermore, factors such as globalization, change in the family structure, isolation and cultural change may contribute to the process leading to suicide by causing deterioration of the traditional values and norms of elderly people [39, 40].

In the present study, hanging was the most preferred mean among both men and women. It was found that the rate of suicide using chemicals and jumping from a height was more common in women, whereas the use of firearms and sharp objects was more common in men. It was reported in a study conducted by Yoshioka *et al.* [41] that the most preferred mean of suicide among both men and women was hanging, whereas among men it was using natural gas or liquefied petroleum gas; jumping off a height ranked second among females. A study on fatal suicides conducted by Moneim *et al.* [32] in Egypt reported that 29% of men used chemicals or toxins, 28% chose hanging, 70% of females used toxins (especially organophosphates) and 12% chose self-burning. The WHO reported that 20% of all suicides were by ingesting pesticides and this was mostly seen in low–middle income countries. The WHO also reported that hanging and firearms were the most commonly used means [42]. The legal regulations of the countries may affect individuals' accessibility to the means and thereby their choices. For example, in Turkey, people cannot use many pesticides and they are not allowed to buy them [43]. The suicide rate due to toxins, therefore, may be low. Hanging is a deadly suicidal mean with fatality varying between 60% and 85% [44]. In studies conducted on suicide deaths, the fact that people who really wanted to die chose a more violent/lethal means may have contributed to this result.

Marriage is an institution that provides social, economic and emotional support and prevents family members from being alone by creating social integration opportunities. Spouses can encourage each other to adopt healthy lifestyle behaviors and when there is a health problem they can guide the correct health behavior during both the diagnosis and treatment process. The aforementioned reasons can be considered an example of the protective effect of marriage against suicidal behavior. In addition, the effect of marital status on suicidal behavior can be attributed to "matrimonial selection bias". Although the reason is not exactly known, people who get married and remain married may be different from other people. For example, they may be healthier than divorced people [45, 46]. In our study, the suicide rate was found to be lower in married females compared to those who never married and those who were divorced, whereas there was no difference in the suicide rate between married females and those whose spouses died. In men, the suicide rate was lower in those who were married compared to those whose spouses died and who were divorced, but there was no difference among those who never married. The protective effect of marriage is more pronounced in men and the difference in suicide rate becomes clear in those who are unmarried. It was shown in a study conducted by Masocco *et al.* [47] that spouse death and/or separation from the spouse/partner between the ages of 25 and 64 years were risk factors for suicide in both men and women; furthermore, death of the spouse at the age of ≥65 years was found not to be a risk factor for women but for men the risk of suicide

was approximately doubled.

Similar results were found in different studies conducted by Martiello *et al.* in Italy, Zhang *et al.* in China and Duberstein *et al.* in the USA [48–50]. In this study, consistent with the literature, the suicide rate for both men and women was lower in those who were married.

It is known that good school performance is protective against suicide at general society level [51]. In our study, although the suicide rate was low among female university graduates, there was no difference between suicide rate and education level among men. Similarly, in a study conducted by Zhang *et al.* [49] in China, it was reported that those with a low level of education had a higher risk of suicide. In a cohort study conducted by Alaraisanen *et al.* [51] in Finland it was reported that, in general society, good success in school was a protective factor against suicide; however, in individuals with psychoses, success in school was related to a higher risk of suicide [51]. In the study by Lorant *et al.* [52] conducted in ten European countries it was shown that low education level, especially in men, was a risk factor for suicide in eight countries. Low education level can be associated with suspect resources (or lack of resources) and socio-economic status. In addition, low education level can be associated with poor problem-solving ability [53]. When people cannot find a solution to their problems, they may believe that everything would be solved by sacrificing themselves and punishing their loved ones by leaving their loved ones "without them". In addition, reasons such as the inability to comprehend the consequences that may occur in behavior such as non-fatal suicide attempts may be the reason that leads people to suicide when facing problems. It was reported in a study conducted by Shojaei *et al.* [54] in Iran that people with a low education level choose suicide by hanging and self-burning, whereas people with a high education level choose suicide by poisoning. In addition, it was suggested that individuals with a low education level who choose more lethal/violent means might contribute to the relationship between education level and suicide rates.

TURKSTAT collects the statistics of suicide cases from death documents filled out for individuals. Data on the reasons for suicide may be insufficient because the relatives of suicide victims cannot be interviewed. Therefore, in the present study, the cause of approximately half of the suicide cases that occurred between 2015 and 2019 could not be elucidated. Among the identifiable causes of suicide, it was determined that the frequency of suicide due to economic problems/commercial failure was higher in men than in women but that the frequency of suicide rate due to illness and educational failure was higher in women than in men. Similar to our study, Rocchi *et al.* [55] reported that the frequency of suicides due to economic reasons was high in men and that the frequency of suicides due to psychiatric illness was high in women. It was reported in a study by Amiri *et al.* [56] that the most common causes of non-fatal suicide attempts were familial and psychiatric problems and that the most common causes of fatal suicides were unemployment and poverty. It was shown in a study of Kim *et al.* [57] that the two most common reasons for non-fatal suicide attempts were interpersonal relationships and socio-economic reasons. The fact that there is a sizable group in our study under the "other causes of suicide" category can be considered as a factor preventing us from ascertaining the clear causes of suicide.

5. Conclusions

Suicide is a global public health problem with psychosocial and economic effects on individuals, families and communities. Although the suicide rate is lower in Turkey compared to Western countries, it remains important among the preventable causes of death. In Turkey, a suicide action plan is being prepared on a provincial basis. For this reason, there is a need for preventive action plans, intervention programs and evaluation of the effectiveness of the interventions. Therefore, determining the characteristics of risk groups for suicide will shed light on the intervention programs to be devised and will guide policymakers.

In conclusion, in our study, the suicide rate was found to be higher in men, especially in the older age groups and in those who had lost their spouse. The suicide rate was found to be lower in people who were married and in university graduates. Different socio-demographic and clinical characteristics underlie the non-fatal suicide attempts. Intervention studies should be formulated by considering the aforementioned socio-demographic characteristics for planning the prevention of suicide and guiding rehabilitation programs following non-fatal suicide attempts.

The strengths of our study are that suicides, which are an important public health problem, were studied not on a local basis but on a country basis, in all age groups, without being specific to any group. There are, however, some limitations of the present study; analysis was carried out with a limited number of socio-demographic variables because there were no individual data; and there were insufficient records on the reasons leading to suicide, personality traits and life events.

Abbreviations

SD, standard deviation; TURKSTAT, Turkish Statistical Institute; WHO, World Health Organization

Author contributions

All authors contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity. Concept or design: NC, GC. Acquisition of data: EE, GOE, ZAC. Analysis or interpretation of data: EE, GOE. Drafting of the manuscript: EE, GOE, ZAC, Critical revision for important intellectual content: NC, GC.

Ethics approval and consent to participate

Since TURKSTAT data is publicly published, permission or ethics committee approval was not obtained.

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Conflict of interest

The authors declare no conflict of interest.

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