



Trend Analysis of Suicide Mortality and Years of Life Lost from 2016 to 2021 in Southern Iran

Iman Shakibkhah¹, Habibollah Azarbaksh², Mahmoudreza Peyravi¹,
*Milad Ahmadi Marzaleh¹, Mitra Rafiei Boldaji³

1. Department of Health in Disasters and Emergencies, School of Health Management and Information Sciences, Shiraz University of Medical Sciences, Shiraz, Iran
2. Department of Epidemiology, Faculty of Health, Abvaz Jundishapur University of Medical Sciences, Abvaz, Iran
3. Clinical Education Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

*Corresponding Author: Email: miladahmadimarzaleh@yahoo.com

(Received 17 Apr 2023; accepted 10 Jul 2023)

Abstract

Background: Suicide as the commonest psychiatric emergency imposes a heavy burden on communities. We aimed to evaluate the years of life lost (YLLs) due to premature death from suicide in Kohgiluyeh and Boyer-Ahmad Province, Iran.

Methods: Data regarding suicidal deaths were extracted from the Forensic Medicine Organization. The YLL of each year were calculated among gender and age groups. The YLL calculation was performed using the 2015 WHO excel calendars template. The Join Point Regression method was used to examine the trend of the crude mortality rate, the standardized mortality rate, and the YLL rate.

Results: Overall, 572 people died by suicide between 2016 and 2021 (63.5% in males and 36.5% in females). The main method of death in most cases was hanging (52.8%). The total YLL due to premature death in the 6-year period was 9248 (4.2 per 1000 persons) in males, 5602 (2.6 per 1000 persons) in females. Hanging (7909) compromised the largest YLL category between different methods of suicide. According to the joinpoint regression analysis, the 6-year trend of YLL rate due to premature mortality was increasing in males: the annual percent change (APC) was 4.8% (95% CI 1.0 to 8.7, $P=0.024$) and stable trend for females.

Conclusion: The YLL was higher in men than in women. Effective training interventions should be designed and implemented to reduce the incidence of suicide.

Keywords: Years of life lost; Suicide; Iran; Trend; Mortality rate; Joinpoint regression

Introduction

According to the WHO, suicide attempt is defined as the act of intentionally hurting oneself without the aid of other persons (1, 2). Besides, approximately 850,000 suicide deaths occurred in 2000 worldwide, with suicide attempt rate of

more than 10-20 times higher than suicide mortality rate. The incidence of suicide attempts has increased by 60% in the past 45 years, and it is predicted that, approximately 153,000 people will die from suicide by 2020 (1,2). A meta-analysis



estimated the incidence of suicide attempts as 91.65 per 1000 persons in Iran (3). The rates of suicide differ among societies. After China and India, Iran is the third country in which the female suicide rate has shown an increasing trend, and is surpassing the male suicide rate (4).

Suicide is a multifactorial phenomenon with a multitude of patterns at even local level of a country (5). There causes of suicide attempt are various and can be classified into three categories: mental illness, social issues and physical problems (6). Factors such as emotional failure, mental disorders, academic failure, illicit drug use, history of suicide in mental domain, family problems, unemployment and poverty, marital status, prison history, and divorce in social domain, and physical illnesses in the physical domain are associated with suicide attempt (7). This phenomenon, in addition to personal and family loss, also imposes heavy costs on the communities (8). As such, in rich countries, men are three times more likely than women to die due to suicide, while in low- and middle-income countries, the female to male ratio of suicide mortality rate was 1.5 (9). Moreover, in Muslim countries, the incidence of suicide was shown to be lower with an increasing trend (10).

Aggressive suicide methods include hanging, self-immolation, drowning, falls, firearms injuries, sharp force injuries, suicide by train, and strangulation (11).

Suicide is one of the most important psychiatric emergencies, committed in different ways for a wide range of reasons in all societies, thus comprehensive knowledge about the methods and causes of suicide in the province will help to effectively design and establish interventions aimed at reducing the prevalence of this phenomenon.

It is necessary to investigate different aspects of suicide in Iran. Suicide is a costly event for our health care system and not congruent with our country's cultural and value criteria. During the last years, suicide rate has revealed an increasing trend in Iran, which affects both the subjects and their families negatively (12). Kohgiluyeh and Boyer Ahmad Province was one of the 4 prov-

inces of Iran with the highest suicide rate during the years 2006-2016 (13).

Therefore, we aimed to evaluate the years of life lost (YLL) and mortality rate due to premature death from suicide in different age groups and genders, to identify effective strategies for identification of high-risk individuals to prevent suicide attempt in Kohgiluyeh and Boyer-Ahmad Province (Southwest of Iran), Iran.

Methods

Data collection

We collected suicide death information (572 deaths) committed in Kohgiluyeh and Boyer-Ahmad Province, from the province forensic medicine department, regarded as a golden standard for suicide data. Under Iranian regulations, the death certificate of every suspicious or unnatural case of death must be examined at forensic centers of each city and province. Accordingly, suicide is an example of suspicious cases of death, thus all suicide cases should be reported and filed to the LMO (legal medical organization).

The study data were collected during a 6-year period from 2016 to 2021. The main variables filed in the FMO (Forensic Medicine Organization) for each death case were age, gender, and marital status, year of death and method of suicide.

In the present study, International Classification of Diseases, Tenth Edition (ICD-10), codes X60-84 were assigned to suicidal deaths as an external cause of death. We used the following ICD-10 codes to classify different types of suicides: X70 for hanging, X76-77 for self-harm, X60-64 for drug poisoning, X68-69 for chemical poisoning, X71 for drowning, X72-74 for firearms, X75 for explosives, X78-79 for sharp force injuries, and X80-81 for falls (14).

One-year YLL for each year was calculated based on age/gender group as well as suicide method. After data cleaning, the YLLs were computed using the 2015 WHO excel template.

Statistical analysis

Descriptive analyzes included mean and standard deviation of age at death, number of deaths and sex ratio of deaths. Then gender-specific mortality was calculated.

Crude rates were first calculated, then, for comparison, age-standardized rates were used using the 2013 standard population for low- and middle-income countries. Afterwards, the YLLs due to premature death from suicide were calculated separately by age/gender group, year of suicide and suicide method.

The YLL for a given cause, age, or gender was calculated by the following equation (15).

$$YLL = N C e^{(na)} / (\beta+r)^2 [e^{(\beta+r)(L+a)} [-(\beta+r)(L+a)-1] - e^{-(\beta+r)a} [-(\beta+r)a-1]]$$

Where, N equals the number of suicide deaths for a specific age and gender, L as the standardized life expectancy at age of death for a specific age and gender, r represents discount rate (e.g., r=0.03), β is the age weighting constant (e.g. β =0.04), C equals adjustment constant for age-weights (e.g. C= 0.1658), and e is a constant and equal to 2.71828.

Since suicide occurs rarely in children under the age of ten, the age groups were first divided into 5-year-old age and gender groups according to the classification proposed by the WHO. Then,

the age groups of 5-14, 15-29, 30-44, 45-59, 60-69, 70-79 and equal and older than 80 yr were reported (14).

The analysis of YLL due to premature death from suicide was performed using the YLL template 2015 developed in Excel spreadsheet (Microsoft Corp., 2007). Descriptive analysis was performed using SPSS, ver. 22.0 (IBM Corp., Armonk, NY, USA).

The protocol of this study was reviewed and approved by the ethics committee of Shiraz University

Of Medical Sciences: IR.SUMS.NUMIMG.REC.1402.052. All aspects of the study were conducted following the University Code of Ethics.

Results

In 2016-2021, the LMO recorded 572 deaths due to suicide (63.5% in males and 36.5% in females) (sex ratio: 1.7, male/female). The mean age at the time of death was 29.23 ± 11.39 in males, 26.30 ± 11.39 in females and 28.16 ± 12.31 in both genders. The most frequent marital status was single (61.0%). The main method of death in most cases was hanging (52.8%) (Table 1).

Table 1: Absolute and Relative Frequency of suicide death in the Kohgiluyeh and Boyer-Ahmad Province, Iran during 2016–2021

Variables	Number	%
Marital Status		
Single	349	61.0
Married	201	35.1
Divorce or widow	22	3.9
Methods		
Hanging	302	52.8
Overdose	39	6.8
Opium	48	8.4
Toxic agent	85	14.9
Warm weapon	60	10.5
Cold Weapon	1	0.2
Self-immolation	22	3.8
Drowning	1	0.2
Fall	5	0.9
Others	9	1.5
Total	572	100.0

Mortality rate due to suicide

During the study years, the crude and standardized mortality rates are increasing trend in male and stable trend in female (Table 2).

YLL due to suicide

The total years of life lost due to premature death in the 6 year– period was 9248 (4.2 per 1000 per-

sons) in males, 5602 (2.6 per 1000 persons) in females and 14850 (3.4 per 1000 persons) in both genders (Table 2). Among all age- groups, suicide had the largest years of life lost due to premature death in persons aged 15- 29 yr (Fig. 1). Hanging (7909) compromised the largest YLL category between different methods of suicide (Table 3).

Table 2: Crude and age-standardized mortality rate (per 100,000 population) and years of life lost due to suicide by gender and year in Kohgiluyeh and Boyer-Ahmad Province during 2016-2021

Year	No. death		Crude mortality rate		ASR (95%CI)		YLL			
	Male	Female	Male	Female	Male	Female	No.		(Per 1000)	
							Male	Female	Male	Female
2016	52	29	14.4	8.2	13.2 (9.3-17.1)	8.1 (5.1-11.1)	1363	760	3.8	2.2
2017	57	33	15.6	9.3	14.3 (10.2-18.3)	8.9 (5.8-12.1)	1465	902	4.0	2.5
2018	55	24	14.9	6.7	13.5 (9.5-17.4)	6.6 (4.0-9.2)	1395	625	3.8	1.7
2019	66	35	17.7	9.7	15.3 (11.0-19.6)	9.6 (6.4-12.8)	1675	956	4.5	2.6
2020	62	47	16.5	12.8	16.0 (11.9-20.1)	12.5 (8.8-16.1)	1572	1241	4.2	3.4
2021	71	41	18.7	11.1	17.5 (13.1-21.8)	10.1 (6.7-13.5)	1778	1118	4.7	3.0
Total	363	209	16.3	9.7	15.0 (13.3-16.7)	9.3 (8.0-10.6)	9248	5602	4.2	2.6
P-value	-	-	0.024	0.146	0.007	0.189	-	-	0.024	0.172

Table 3: Years of life lost (YLL) count and rate per 1000 persons by external causes of death (methods) of suicide and gender, Kohgiluyeh and Boyer-Ahmad Province (2016-2021)

External causes of death	YLL (years)			YLL rate (per 1000 persons)		
	Male	Female	Total	Male	Female	Total
Hanging	5102	2807	7909	2.3	1.3	1.8
opium overdose	814	459	1273	0.4	0.2	0.3
Toxic agent	574	444	1018	0.3	0.2	0.2
Warm weapon	1115	1019	2134	0.5	0.5	0.5
Self-immolation	1310	228	1538	0.6	0.1	0.4
Fall	70	489	559	0.1	0.2	0.1
Other	108	28	136	0.1	0.0	0.1
Total	155	128	283	0.1	0.1	0.1
Total	9248	5602	14850	4.2	2.6	3.4

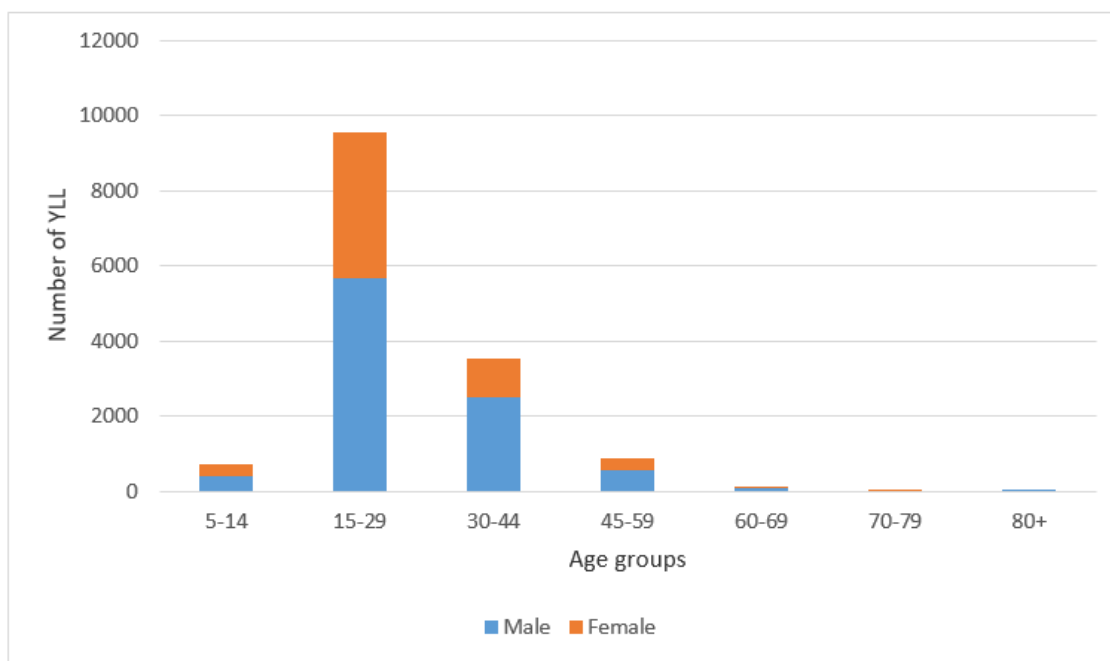


Fig. 1: Years of life lost due to suicide by gender and age groups

According to the Join Point regression analysis, the 6-year trend of YLL rate due to premature mortality was increasing in males: the annual percent change (APC) was 4.8% (95% CI 1.0 to 8.7, $P=0.024$), stable trend for females and both sexes: APC was 8.6% (95% CI -5.4

to 24.8, $P=0.172$) and 5.8% (95% CI -3 to 12.3, $P=0.057$) respectively. The model did not show any join point; hence, the AAPC (Average Annual Percent Change) is the same as APC (Figs. 2-3).

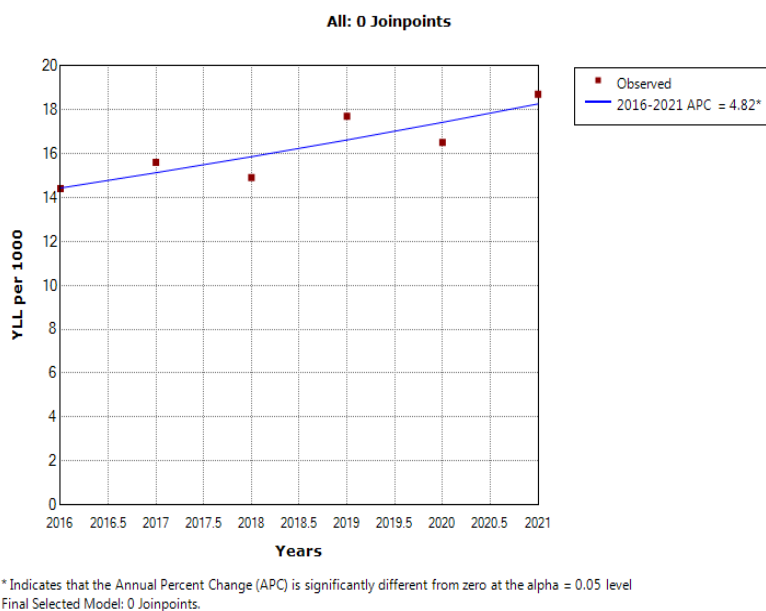


Fig. 2: The trend of years of life lost due to suicide in male during 2016-2021

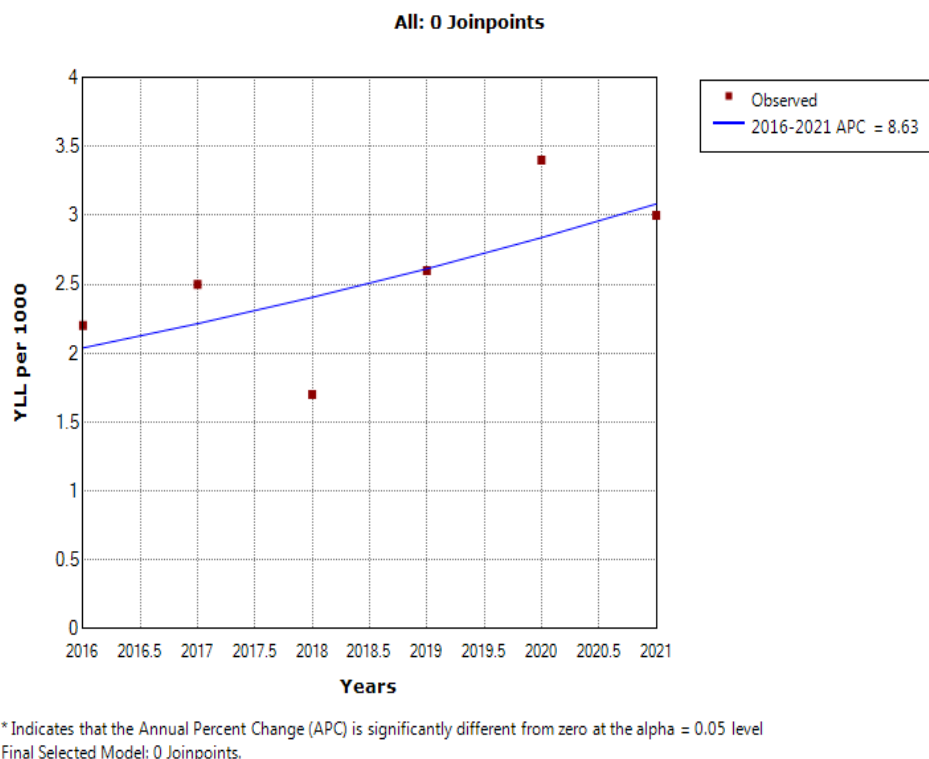


Fig. 3: The trend of years of life lost due to suicide in female during 2016-2021

Discussion

We aimed to investigate the mortality rate of and years of life lost due to suicide in Kohgiluyeh and Boyer-Ahmad Province. Suicide is not a disease, but can be caused by a large number of diseases and social problems. Therefore, in this study, the burden of suicide did not include the underlying factors and causes of suicide. In addition, the burden related to the time between the suicide attempt and the moment of death was not calculated. During a six-year period, the rate of death due to suicide was shown to increase from 14.4 per 100,000 in 2016 to 18.7 per 100,000 in 2021 among men and from 8.2 per 100,000 to 11.1 per 100,000 among women. The results of previous studies showed that, men had higher YLL due to suicide and subsequently higher rate of suicide in all age groups during the study period (16-18). The reason for this result is age and gender dif-

ferences in patterns and attitudes about suicide. Lethal suicide attempts with the different pattern for suicide and maladaptive attitudes about suicide are more common in males and are generally more among individuals 15–29 years.

In 2000 Global Burden of disease study, the YLL was estimated as 119174 thousand years, of which 69.2% was related to unintentional injuries and 30.8% was related to intentional injuries. Both intentional and unintentional injuries, were more prevalent among men than in women. As such, in intentional injuries, mainly related to suicide, the YLL was two times higher in males than in females (70.5% in males vs. 29.5% in females), which was consistent with the results of our study. The burden of injury was estimated to be less in women compared to men (36.92% in females vs. 63.08% in males) (9).

In Iran, suicide attempts are more common amongst young adults aged 11-30 years in recent

years, while in some developed countries, suicide at an older age is considered as a health concern (8). The highest rate of YLL between 2016 and 2021 in both men and women was observed in the age group of 15-29 years. In a number of studies, the highest value of YLL was reported in the age groups of 20-29 and 10-19 years, accounting for 41% and 31% of the total YLL, respectively, supported by results of our study (11, 19). Some specific characteristics and conditions of this age group, such as puberty, identity crisis and mood and emotional characteristics, may be associated with higher prevalence of suicide among these individuals (20).

In the present study, the most common method of suicide either in men or women was hanging. The highest YLLs in men were respectively related to hanging (2.3 per 1000), warm weapon (0.6 per 1000) and toxic agent (0.5 per 1000), while the highest YLLs in women were related to hanging (1.3 per 1000), toxic agent (0.5 per 1000) and self-immolation (0.2 per 1000) respectively. According to a meta-analysis on causes and methods of suicide attempt in Iran during 2001-2014, drug poisoning was the most prevalent method of suicide, whereas hanging was the least common method of suicide (3). In Tehran, the most prevalent method of suicide was 87% by using pills and drugs, 3.10% by consuming plant toxins and detergents, and 2.7% by taking opium and its derivatives, which were inconsistent with the present study (21). In addition, the most common method of suicide in men was self-harm (21%) followed by hanging (22). In Iran, among the methods of suicide, drug poisoning displayed the highest frequency (3).

In the United States, the most common method of suicide is firearms in men and drugs poisoning in women (23). In Austria from 2000 to 2010, the most common method of suicide was hanging, as 49.1% in men and 35% in women (24). Skinner et al., Suffocation (hanging and suffocation) was the most common method and the main method of suicide was drug poisoning among Canadians (46.9%) (19). In the United States, about one in four suicide attempts in 2014 was committed by suffocation, including hanging and suffocation,

and drug poisoning was the most common type of suicide amongst women (17).

The most important method of suicide is various across countries, which can be due to differences in access to suicidal tools as well as cultural, behavioral and socio-economic factors (25). However, there may be some unknown factors associated with suicidal behavior. Accordingly, personal factors may also play a role in the occurrence of suicide, but this anomaly as a social harm is the result of deviations and social realities (11).

In the present study, single individuals displayed highest rate of suicide (64.4%). Hassan and colleagues stated that marriage provides significant security against suicide. As such, divorce and widowhood provided the least protection against suicide (26). The findings of this study supported Durkheim's theory. Married people over the age of 20 either male or female with high social cohesion are much less likely to commit suicide (27), while married people (66%) have the highest rate of successful hanging in India (28). The highest rate of completed self-immolation was reported among married individuals (29), which was inconsistent with the results of our study.

In the present study, the trend of the YLL rate due to suicide increased in men and remained constant in women. In Iran (14), the ten-year (2006-2015) trend of the YLL rate due to suicide was increasing in both sexes. Longer study time and different sample size are possible reasons for this difference in women.

The contradiction between results of different studies can be attributed to different cultural, socio-economic conditions, beliefs and lifestyles in various regions. Lack of generalizability of samples to the study population due to selection bias in selecting individuals or collecting information, as well as inadequate sample size in determining the relationship between variables can possibly lead to contradictory results. The strengths of this study are first, long time interval, second, calculation of YLL was performed based on different suicide methods.

Conclusion

The findings revealed higher YLL due to suicide among males than in females. Since the majority of suicide deaths are preventable, effective interventions at national and provincial level may contribute to reduction of suicide mortality rates, resulting in lowered YLL due to suicide.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Acknowledgements

We would like to acknowledge the Health Vice-chancellor, Yasuj University of medical sciences.

Conflict of interest

The authors declare that there is no conflict of interests.

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