

# Silent Change of Suicide in the West of Iran (Kermanshah): Joinpoint Regression Analysis

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## Abstract

**Background:** Suicide in Iran is more or less the problem of the western region of the country. Although previous studies have described the features of suicide, they didn't study the trends through reliable methodology.

**Objectives:** We study changes in temporal trends of suicide mortality in the west of Iran using joinpoint regression analysis.

**Methods:** This is a cross-sectional study. Data for all registered suicide cases in western province of Kermanshah in Iran during 2003 - 2014 was retrieved from the death registry of Iranian legal medicine organization. After direct standardization of the rates, we analyzed data by joinpoint regression analysis to discover the main changes of the trends.

**Results:** Overall suicide mortality has increased from 10.6 per 100,000 in 2003 to 12.4 in 2014, which equals to 1.5% (+0.1-+2.8) annual percentage change (APC). Increase in suicide rate for women was remarkably higher than men (APC = 4.5 for women and 0.5 for men (P value < 0.001)). Majority of increase belonged to age group 20 - 29 in women and 30-39 in men. Old men have an increasing trend during the last decade. Hanging constantly increased in both genders with APC of 4.2 (+1.9 - + 6.5) while self-burning decreased after 2006 in women with APC of -5.9 (-12.6 - + 1.2) and poisoning increased in 2011 in men with APC of 17.0 (-4.0 - + 42.5). The number of suicide death in married couples has increased for both genders while for single women decreased in 2007. For women, suicide in low educated or illiterate decreased and in high educated increased, while in men it increased in both educational levels.

**Conclusions:** Suicide in the west of Iran has increased slightly during 2003 - 2014 with remarkable differences for men and women. Suicide in old men and women has increased profoundly and may be due to losing their familial and social support in modern life. Pattern of suicide in women has changed dramatically from most rural, uneducated, and self-burned to most urban, high educated, and hanging use form.

**Keywords:** Iran, Suicide, Time Trend, Self-Burning, Joinpoint Regression

## 1. Background

World health organization named suicide as an upcoming youth concern and estimated that it will cause more than 2% of the global burden of disease by the year 2020 (1). Suicide as a fatalistic act increases burden of disease in the society by increasing the rate of mortality and morbidity (2). Regardless the immense negative on family, it also affected society through mass media (3, 4). Integrity between members of society or social support protected people from depression and suicide (5, 6). Some writers called suicide as a modern obsession or major feature of modern life (7). The term suicide emerged after the 1650s as a new modern concept, which has changed from religious prohibited crime to expression of miserable madness (8). It seems that big historical change in minor societies or global scope lead to an increase in the rate of such a painful act by rational creature like human beings.

Although Islamic countries in Middle East have the lowest rate of suicide mortality in comparison to other high risk countries, new studies showed change in trends

toward increase in countries (9). Due to the wide-ranging diversity in the incidence of suicide across geographical areas (10), overall reported suicide mortality rate doesn't show the real figure of the problem. For vast geographical lands such as Iran, with its own diversity in terms of ethnicity, culture, and social development, the overall rate of suicide could be confusing and didn't show real magnitude and characteristics of suicide for different parts of the country. Therefore, to explore the actual aspects of the problem in the study of suicide, it is essential to go into the restricted geographical area with similar ethnicity and level of social development.

West of Iran, predominantly inhabited by Kurds and Lors, is the riskiest region of suicide in the country. A recent study on suicide between 2006 - 2010 showed two provinces of Ilam and Kermanshah having the highest suicide mortality rate across the country (10). This region is well known for tragic images of self-burning suicides among young women in rural parts with low levels of education. Adjustment disorder has been stated as one of

the major relevant factor of self-burning (11). Searching for historical root of this unique type of suicide, some writers claim that its origin come from the Indian culture and through their translated literature in Iran during the 16th century (12). As the biggest province in the west, Kermanshah is a heterogeneous province with diverse distribution of suicide. Eastern regions of the province have the lowest rate of suicide predominantly in men while western parts have the highest rate mainly in young women (13). Increasing trend of psychological disturbance and suicide related experience among Iranian Kurds reported as an effective factor on attitude towards suicide (14). It seems that suicide is a main problem for Kurdish communities in other neighboring countries such as Iraq (15) and Turkey (16-18). War in this region of the world could be one of the dominant determinants for chronic psychological disorder, which leads to suicide attempt. Durable war causes post-traumatic stress disorder (PTSD) and its psychological pain increases the risk of suicide (19, 20). Some studies showed the relationship between PTSD and suicide related thoughts among Kurds in the west of Iran (21). In women, its mainly caused by cultural change and suicide used as a helping tool or cry for help in hard emotional situations (22).

Majority of previous studies deal with demographic characteristics of the suicide cases and didn't use correct time trend analysis to show the trends (23, 24). In the absence of reliable researches on suicide trend in the west of Iran, limited evidence about its changes in recent decades and upcoming situation is available. Although few studies dealt with the temporal trend of suicide in Iran, the majority didn't use accurate statistical analysis (25-28), some study seasonal pattern (29), and in a recent one which temporal trend in provinces level across the country trends assessed by developed method, the time span of study was so short that validity of the analysis is uncertain (10). In the present study, for the first time we analyzed the temporal trend of suicide in the most dangerous region of Iran for a time span more than a decade (12 years) using an advanced statistical method (joinpoint regression analysis) in order to present the latest evidence on suicide mortality changes in this region.

## 2. Methods

This is a cross-sectional study, which reviewed recorded data retrospectively. Without sampling and by census, data for all registered suicide cases in western province of Kermanshah in Iran during 2003 - 2014 was retrieved from the death registry of Iranian legal medicine organization. Suicide cases in Kermanshah province including: age, gender, methods used for suicide, and occupation of subjects

during 2003 - 2014 were retrieved from the death registry of Iranian legal medicine organization.

Source of the data: As an independent organization the legal medicine organization works under control of the head of Judiciary System by experts, capable personnel, and modern equipment. Kermanshah has 12 branches around the city and responds to all relevant judicial demands. All suicide cases have to be investigated by legal medicine organization centers in 12 cities following a death certificate, which allows for burial. Regarding obligation of all cases to be investigated by this organization, the level of coverage is almost complete. There is an under reporting of cases in some small tribal regions due to the social stigma of suicide, however, since extension of legal medicine centers in marginal cities, the proportion of these cases are diminishing.

Inclusion/exclusion criteria: All registered deaths in the Kermanshah legal medicine organization, which have been reported as a suicide, were included in the analysis. Suicide cases belonged to other provinces like Ilam and Lorestan, were excluded from the analysis to have an accurate rate.

Age-Standardized Rates: We obtained population data from 2 national population and housing census of Iran in 2005 and 2011, available on the website of Iranian statistical center (11). Based on the 2 national census and the growth rate, population for other years was estimated for men and women separately. Suicide rates were age standardized using the world standard population as reference population for genders and methods of suicide separately. Data for time of suicide, age, and gender was complete however, for marital status, level of education had a small ratio of missing. Therefore, we have calculated ASR according to age-groups and genders but use count data for marital status, method of suicide, and level of education

Statistical Analysis: To detect significant changes in ASRs of suicide during the time of the study, we do joinpoint regression analysis using the Joinpoint trend analysis software version 4.2.0.2 provided by the surveillance research program of USA national cancer institute. The joinpoint regression model was used to describe changes in trend data. This is a form of non-linear regression, which was also called a piecewise regression, segmented regression, broken line regression, or multi-phase regression. We use log scale of data in analysis based on poisson distribution assumption for suicide rates. The first step it fits the simplest model to the data (e.g. suicide rates) on a log scale [ $\ln(\text{age-adjusted suicide rate}) = a + b \times x$ , where  $b$  represents the year of suicide]. The analysis starts with the least number of joinpoint (e.g. 0 joinpoints, a straight line) and checks whether more joinpoints are fitted to the data. Monte Carlo Permutation test was used to select the opti-

mal number of joinpoints, which are statistically significant (2). Our analysis was also based on constant variance (Homoscedasticity) assumption during the time.

An annual percentage change (APC) in ASRs for each segment of the trend line was estimated with 95% confidence. Based on intercept of the earlier log-linear regression, APC was computed as:  $APC = (e^b - 1) \times 100$ . APC is statistically significant if its confidence interval didn't contain zero value (0% annual change).

The APC is tested to find out the difference from the null hypothesis that the annual percent change is 0%. To quantify the size of change in linear trends by period, the estimated annual percent change (APC) with 95% confidence interval was computed for each of those segments by fitting a linear regression model to each one (in natural logarithmic scale). Time period (years of study) was used as an independent variable in the model. The number of joinpoints, which the software allowed to fit to the data, is based on the number of time points. Since our study includes 12 years, we allowed only 2 points as a maximum number for analysis. Unlike gender and method of suicide, which we used ASR as a dependent variable, for marital status and educational level, the total number of suicides was used as a count variable in joinpoint analysis. For those time points, which the count values were zero, software changed them with a minimum numerical value of 0.5 in order to overcome a mathematical limit during the analysis.

To compare the mean of overall change between 2 genders during the study, we used the t-test calculator option of STATA13.

Ethical considerations: The personal identity of all suicide cases remains secret by the legal medicine organization itself, which we only had access to demographic information of the cases. We reviewed the recorded data very thoroughly and did not get any data directly from the cases.

### 3. Results

During the 13 year study, 3105 suicide cases have been reported from the legal medicine organization. For male cases, there was an increase from 162 in 2003 to 202 in 2014 and in females it increased from 69 in 2003 to 116 in 2014. Suicide mortality rate has increased from 10.6 per 100,000 in 2003 to 12.4 in 2014 equals to 1.5% (95% CI: +0.1 - +2.8) annual percentage change (APC).

Overall and gender-specific ASR: Overall, the suicide mortality rate has increased slightly between 2003 and 2014 in the west of Iran. Although suicide mortality increased in both genders, women by an annual percentage change of 4.5 has higher and more fluctuated rate change

than men with an annual percentage change of 0.8 (P value < 0.001). The average increase suicide rate in women was 6 times higher than men. The direction of mortality trend at the beginning of the observation for men was decreasing, while for women it was moving toward a sharp increase. However, it changed for men in 2006 and for women in 2008 to the opposite route. After 2006, the increasing trend of suicide in men is stable meanwhile women increased again in 2011. The overall average annual percentage change (AAPC) of suicide was 1.5% (95% CI: +0.1 - +2.8).

By comparing the suicide Mortality rate in men and women, we saw a different trend in quantity and quality of changes. In average, from 2003 to 2014, the mortality rate of suicide in men increased slightly by 0.8% in APC (95% CI: -1.7 - +3.5) and in women it increased more sharply by 4.5% (95% CI: -3.4 - +13.1). At the start point of the study (2003), the suicide rate in men is much higher than women (ASR = 14.6 in men and 6.2 in women). The two trend line converged and they reached the nearest point in 2008 (ASR = 13.8 per 100,000 in men and 12.7 per 100 000 women) and then diverged again (Table 1).

**Table 1.** Demographic Characteristics of Suicide Cases in Kermanshah During 2003 - 2014

		Values <sup>a</sup>	Missing
<b>Gender</b>	Male	1909 (61.5)	0
	Female	1196 (38.5)	
<b>Marital status</b>	Single	1507 (48.5)	23 (0.7)
	Married	1408 (45.3)	
	Others	167 (6.2)	
<b>Education</b>	Illiterate-Primary	1219 (39.3)	258 (8.3)
	Middle-high School	1111 (35.8)	
	Diploma and higher	501 (16.2)	
<b>Method of Suicide</b>	Hanging	1243 (40)	14 (0.5)
	Self-Burning	760 (24.5)	
	Poisoning	659 (21.3)	
	Others	429 (13.9)	
<b>Age</b>	Male	33.58 ± 15.88	< 0.001
	Female	30.22 ± 14.76	
	P value		

<sup>a</sup>Values are expressed as mean ± SD or No. (%).

In men, (ASR) of suicide declined by -6.8% (95% CI: -15.5 - +2.9) from 2003 to 2008 and then increased by 3.9% (95% CI: +1.7 - +6.1) annually until 2014. In women, joinpoint regression breaks the suicide trend into the 3 segments.

From 2003 to 2008 there was an increase by 14.0% (+5.5 - +23.2), then decreased by 17% from 2008 to 2011, and after 2011 the suicide mortality rate in women again increased by 13.8% (Figure 1 and Table 2).

### 3.1. Crude Rate in Age Groups

Regardless the segments fitted to the trend by the joinpoint regression, in average, the suicide mortality rate was more or less stable in age groups 10 - 19, 20 - 29, 40 - 49, and 50 - 59 years. There was a rising in trends in the age groups 30 - 39, 60 - 69, and > 70 years. The average annual percentage change (AAPC) varied between 0.1% APC (95 % CI: -1.9 - +2.1) in 20-29 years and 8.5% (95% CI: -7.7 - +27.5) in > 70 years. The rising trend, only in age group 30-39 years, was statistically significant by a 4.1% increase annually (95% CI: +1.7 - +6.6). Considering that joinpoints showed a different pattern of change in some age groups. Although age group 20-50 year has decreased by 4.8% between 2003 and 2012, in last 2 years it increased by 40.7% (95% CI: -12.5 - +126.2). The age group > 70 years also increased by 90.1% between 2003 and 2005 (95% CI: -29.5 - +412.7) and then decreased by 4.2% (95% CI: -12.5 - +4.9) (Figure 2).

In men, the rising trend of suicide was seen in age groups 30-39, 60-79, and > 79 years while the decrease rate was seen in age groups 20 - 29 years. Opposite to the women trend, there is no joinpoint in men for all age groups and software fitted only linear line for all. Increase rate of suicide in age group 29 - 30 years was statistically significant by 5.3% APC (95% CI: +1.3 - +9.5).

In women, ASR of suicide fluctuated dramatically as it goes beyond the rate of men in age groups 20-29 years in 2008 and > 70 years in 2006 and then decreased. In age group 20 - 29-years, the suicide rate increased by 5.7% in average (95% CI: +0.3 - +11.4) with 23.4% (95% CI: +17.2 - +29.9) increase during 2003 - 2008 and 21.1% (95% CI: -37.3 - +0.8) decrease during 2008 - 2011. In age group 10 - 19-years, suicide rate for women was always higher than men during the whole period of observation. The highest rising rate was seen in age group > 70 years by 58.2% increase in average (95% CI: +31.7 - +89.9) (Figure 2).

### 3.2. Method-Specific Standardized Suicide Rate

Generally hanging, self-burning, and poisoning are the most prevalent methods of suicide in west Iran. On average, during the period of observation (2003 - 2014), age specific standardized rate (ASR) of suicide was 4.7 per 100,000 for hanging, 2.7 per 100,000 for self-burning and 2.4 per 100,000 for poisoning. Over the past 12-years, suicide by hanging, which is predominantly used by men, increased significantly with an average annual percentage change (AAPC) of 4.2% (95% CI: +1.9 - +6.5). Regarding hanging,

men and women have a difference that the rising trend was stronger in women than men as their AAPC was 6.8% (95% CI: 2.8 to 11.5) while in men it was 3.5% (95% CI: +0.7 - +6.3). Self-burning is a widespread method for suicide among women and its ASR increased by 38.1% (95% CI: +1.9 - +87.3) during 2003-2006 then declined by 7.9% (-13.9 - -1.6) in last 6 years between 2006 and 2014. In men, the result also showed a significant increase of self-immolation by 9.2% (95% CI: +0.9 - +18.3) (Figure 3). Poisoning in men declined during the first 7 years of observation (2003 - 2010) by 15.4% (95% CI: (-26.2 - -3.0) and rising again by 28% (95% CI: -7.2 - +76.9). Overall, poisoning in men and women has a decreased during 2003 - 2014.

### 3.3. Count Data

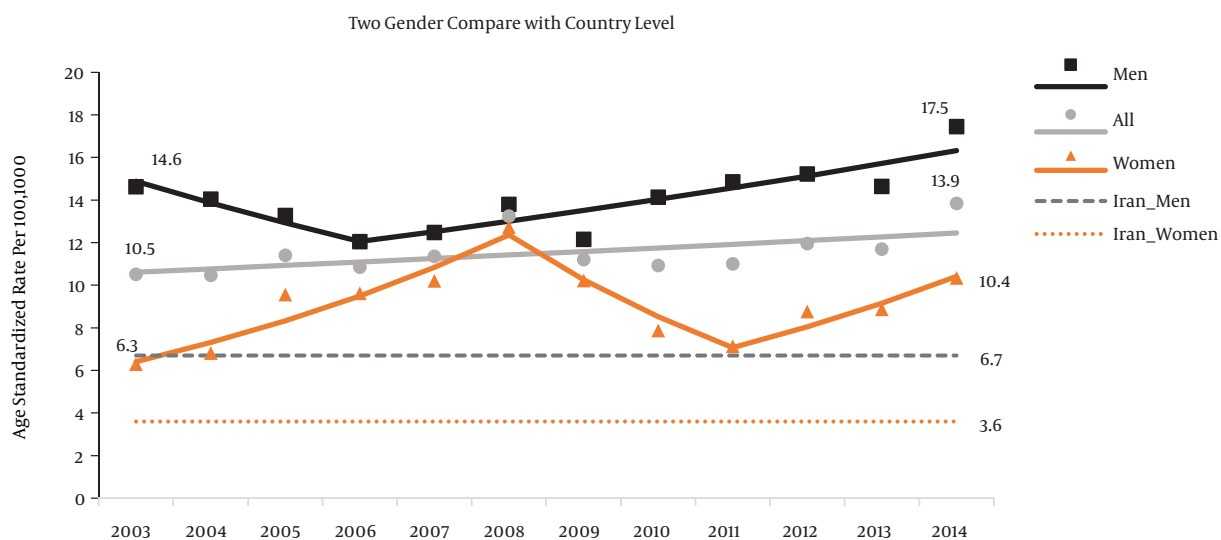
For marital status and educational level, we put the number of suicide cases as a count data in the model. Overall trend of suicide in both single and married couples slightly moved towards an increase until 2008. After 2008, marriage suicide increases faster and goes beyond the singles.

Figure 4 presents the trends in number of suicide death from 2003 to 2014 According to marital status and level of education by 2 genders (data markers represent observed rates; lines have been drawn according to the joinpoint results).

Single men have stable trends throughout the study period while married men, after decreasing trend from 2003 to 2006, get a steep rising trend until it reached the level of singles in 2014. Opposite to men, single and married women breaks down in 2008 until 2012, which then marrying again gets an increasing trend (Figure 4). Regarding educational level in men, suicide increased among illiterates, primary school, and high educated, however, in women, illiterate or primary school decreased and in over diploma it has increased.

## 4. Discussion

We used a particular software developed for time trend analysis to explore temporal changes of suicide in the west of Iran. Unlike the typical approach by fitting only 1 constant regression line to the entire sequential data, joinpoint regression considers data as a nonlinear model for subtle changes, break it down into the different segments. With this approach, data could be explained in more detail and exhibited a precise image of suicide mortality changes. From the evaluation of all findings, we explore that suicide feature in the west of Iran has been changed from old image to a new emerging one.



**Figure 1.** Suicide Age-Adjusted Mortality Rates by Gender in Compare to Average Country Rate in Kermanshah 2003 - 2014

Suicide rate for both genders in this region was considerably higher than the country average rate and this distance has an increasing trend. As previous studies showed, the west of Iran is the high risk region for suicide (1, 2). While the overall rate (13.9 per 100,000) is higher than the country mean rate (6.3 per 100,000) reported to WHO (1), the pattern has been changed profoundly.

**Decline in women self-burning:** By going to different layers of age groups, we saw that although during the whole time period of the study, men have a higher rate of suicide than women, however in age group 10 - 19, women have a higher position in comparison to men and have also sharper increasing trend. The age group 20 - 29 years is crucial for women because its shape of trend is almost similar to the overall trend in women. This means that the majority of changes in women belonged to this age group. By putting graphs of suicide methods in women aside this finding, we came to this inference that change in using self-burning, as an old and routine method of suicide in the women, could explained the shape of radical decrease in 2008. Sharp decrease in rate of suicide by self-burning in 2008 is a radical change in the pattern of suicide among women. Self-immolation or self-burning in the past was the prevalent suicide method among women in the west of Iran and almost used by rural illiterate or low literate women (3, 4). In Figure 4 we saw that suicide among illiterate or primary women has decreased while high-educated women have increasing rate. Sharp decrease in number of suicide cases among single women in 2007 is a remarkable finding. We also see age groups 60 - 69 years and over 70 years having sharp changes. Especially in age group > 70

years, the rising rate from 2003 to 2005 was notable. Year 2007 is a pivotal point for women.

For the first time our result show that self-burning among women has decreased. In the west of Iran, self-burning is a predominantly common method of suicide used by young illiterate women or those with low levels of education (4). These young women mostly belong to old-fashioned families who live in outlying villages in the western provinces (12, 13). One of the key reason behind choosing this method for suicide by rural women is its availability and being aware if its complications (30). The main argument concerning education in females is quantitative growth of female access to schools and higher education. The number of girls in school continues to grow: 48% in 2010 compared to 38% in 1978 (14). In the past decades, seeing a new style of life faraway in the cities without force of patriarchy, choice in marriage and educational opportunity in universities causes quarrel between this young generation and their families. For those who reached to disappointment with their family members the only way to show their objection to others and in some cases free from dark life was self-burning (15). Being at the age of reproduction, the majority of these women who committed suicide (31) have a high burden on family and society. Kurds, as a major resident of the region, have a restricted interaction between family members.

In recent the culture has changed in some aspects including: rising level of education in rural girls, attenuate of patriarchy in the families made by Urbanization and decreasing in attitude toward stigma in the society. Another reason behind this decline in self-burning suicide among

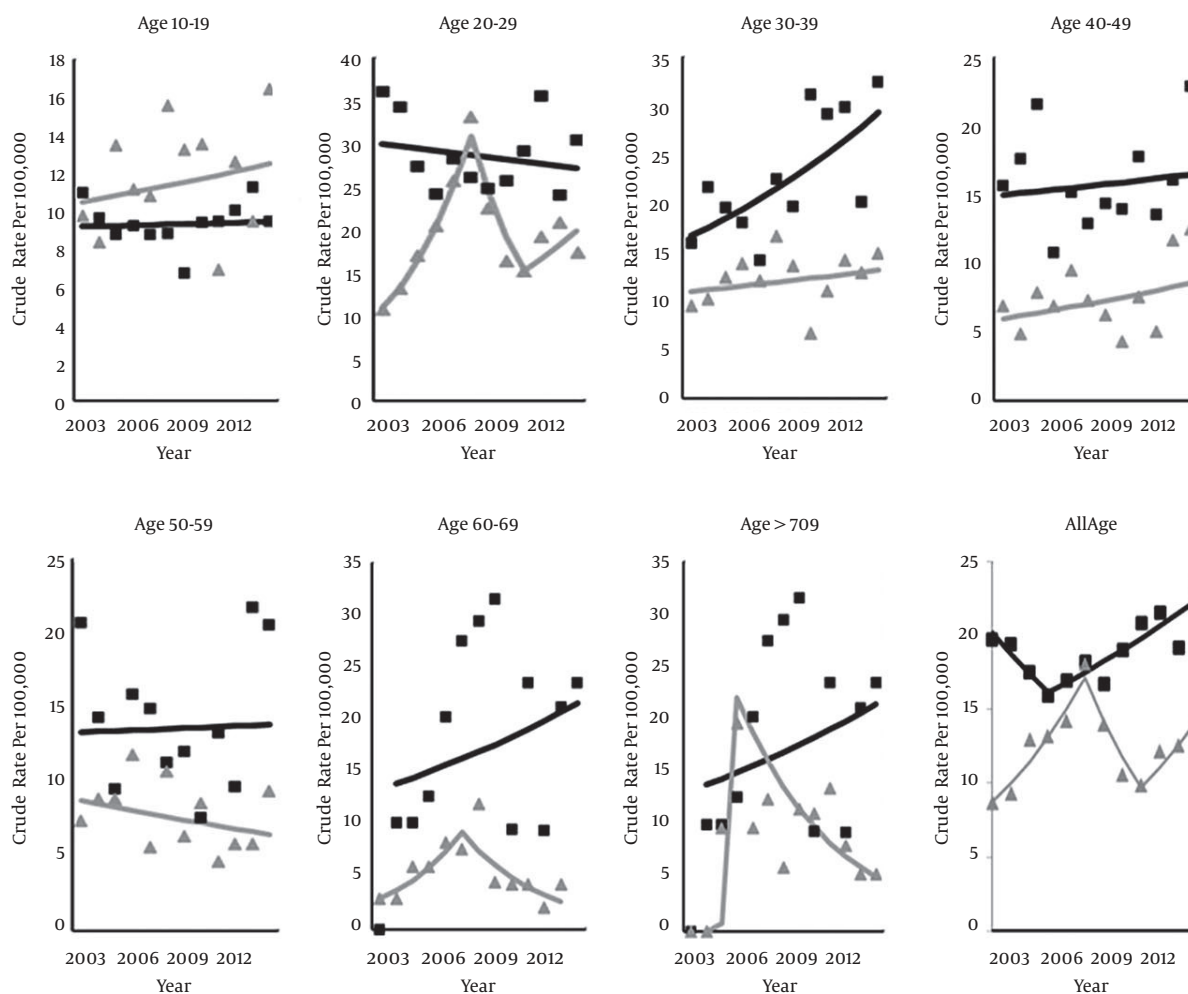


**Table 2.** Joinpoint Analysis for Crude and Age-Adjusted Suicide rate in Men and Women by Age groups and Method Used, 2003 - 2014

	Overall		Women		Men			
	Time	AP (CI)	Time Period	AP (CI)	Time	AP (CI)		
Age groups	10 - 19	2003 - 2014	2003 - 2014	1.1 (-1.3 - +3.5)	2003 - 2014	1.6 (-3.2 - +6.7)	2003 - 2014	0.3 (-2.2 - +2.8)
			2003 - 2008	23.4 (+17.2 - +29.9)*				
			2008 - 2011	-21.1 (-37.3 - +0.8)*				
	20 - 29	2003 - 2014	2003 - 2014	0.1 (-1.9 - +2.1)	2011 - 2014	9.5 (-2.3 - +22.9)	2003 - 2014	-0.9 (-3.7 - +2.0)
			Average	5.7 (+0.3 - +11.4)*				
	30 - 39	2003 - 2014	4.1 (+1.7 - +6.6)*	2003 - 2014	1.7 (-3.0 - +6.5)	2003 - 2014	5.3 (+1.3 - +9.5)*	
	40 - 49	2003 - 2014	2003 - 2014	1.6 (-2.4 - +5.7)	2003 - 2014	3.3 (-2.8 - +9.7)	2003 - 2014	0.9 (-3.2 - +5.1)
			2003 - 2012	-4.8 (-8.8 - -0.6)*				
	50 - 59	2012 - 2014	2012 - 2014	40.7 (-12.5 - 26.2)	2003 - 2014	-2.7 (-7.7 - +2.6)	2003 - 2014	0.3 (-6.0 - +7.1)
			Average	2.2 (-5.4 - +10.4)				
60 - 69	2003 - 2014	2003 - 2014	5.9 (-0.0 - +12.2)	2003 - 2008	25.7 (-3.0 - + 62.8)	2003 - 2014	8.2 (-0.8 - +17.9)	
		2008 - 2014	-18.6 (-33.1 - -1.0)*					
		Average	-0.8 (-13.1 - +13.1)					
70 >	2003 - 2005	2003 - 2005	90.1 (-29.5 - +412.7)	2003 - 2005	2465.1 (734.0 - +7789.7)*			
		2005 - 2014	-4.2 (-12.5 - +4.9)	2005 - 2014	-14.8 (-23.1 - -5.6)*	2003 - 2014	4.1 (-4.8 - +13.7)	
		Average	8.5 (-7.7 - +27.5)	Average	58.2 (+31.7 - +89.9)*			
Hanging	2003 - 2014	2003 - 2014	4.2 (+1.9 - +6.5)*	2003 - 2014	6.8 (+2.4 - +11.5)*	2003 - 2014	3.5 (+0.7 - +6.3)*	
		2003 - 2006	38.5 (-1.0 - +93.9)	2003 - 2006	38.1 (+1.9 - +87.3)*			
		2006 - 2014	-5.9 (-12.6 - +1.2)	2006 - 2014	-7.9 (-13.9 - -1.6)*	2003 - 2014	9.2 (+0.9 - +18.3)*	
Self-immolation	2003 - 2010	2003 - 2010	-16 (-27.7 - -2.5)*			2003 - 2010	-15.4 (-26.2 - -3.0)*	
		2010 - 2014	17.0 (-4.0 - +42.5)	2003 - 2014	-1.2 (-7.5 - +5.5)	2010 - 2014	28.1 (-7.2 - +76.9)	
		Average	-2.4 (-11.7 - +7.9)			Average	-1.6 (-12.8 - +11.0)	
Poisoning	2003 - 2006	2003 - 2006		2003 - 2008	14.4 (+6.8 - +22.5)*	2003 - 2006	-7.2 (-17.0 - +3.8)	
		2008 - 2011		2008 - 2011	-17.2 (-39 - +12.5)	2006 - 2014	4.2 (+1.7 - +6.7)*	
		2001 - 2014		2001 - 2014	13.6 (-2.6 - +32.4)	Average	0.9 (-2.0 - +3.9)	
Crude Mortality Rate	2003 - 2014	2003 - 2014	1.6 (+0.3 - +2.9)*	Average	4.5 (-2.5 - +12.1)			
		2003 - 2008		2003 - 2008	14.0 (+5.5 - +23.2)*	2003 - 2006	-6.8 (-15.5 - +2.9)	
		2008 - 2011		2008 - 2011	-17.0 (-41.3 - +17.5)	2006 - 2014	3.9 (+1.7 - +6.1)*	
Mortality	ASR	2003 - 2014	2003 - 2014	1.5 (+0.1 - +2.8)*	2001 - 2014	13.8 (-4.3 - +35.4)	Average	0.8 (-1.7 - +3.5)
			2001 - 2014		Average	4.5 (-3.4 - +13.1)		

women is shift from traditional arranged marriages to more freedom in choosing in the new generation. Compulsory marriage is one of the main causes of attempting suicide (16, 17). For young Iranian women in the west of Iran,

this is almost the only available threatening tool to object against their parent's decisions (18). Today, this tradition has changed gradually and parents provide more freedom in choosing for the young girl. The stigma linked with di-



**Figure 2.** Trends in Age-Standardized Suicide Rates from 2003 to 2014 in Age Groups by Two Genders (Data Markers Represent Observed Rates; Lines Have Been Drawn According to the Joinpoint Results)

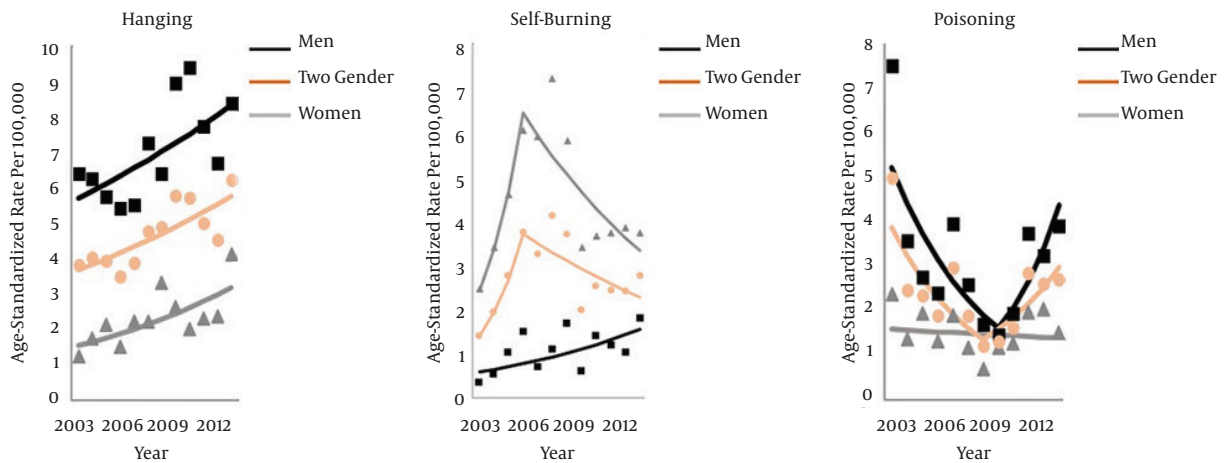
orce has declined such that women choose divorce as an alternative of committing suicide to escape from bad marriages and show itself as an increase in the divorce rate (17).

After this point, image of suicide among women has changed from old to its new features, from self-immolation to hanging, from majority rural to majority urban, from illiterate to high literate, and more importantly from single to married. We interpret this time point and change in pattern of age and method as an emerging new feature of suicide in the west of Iran.

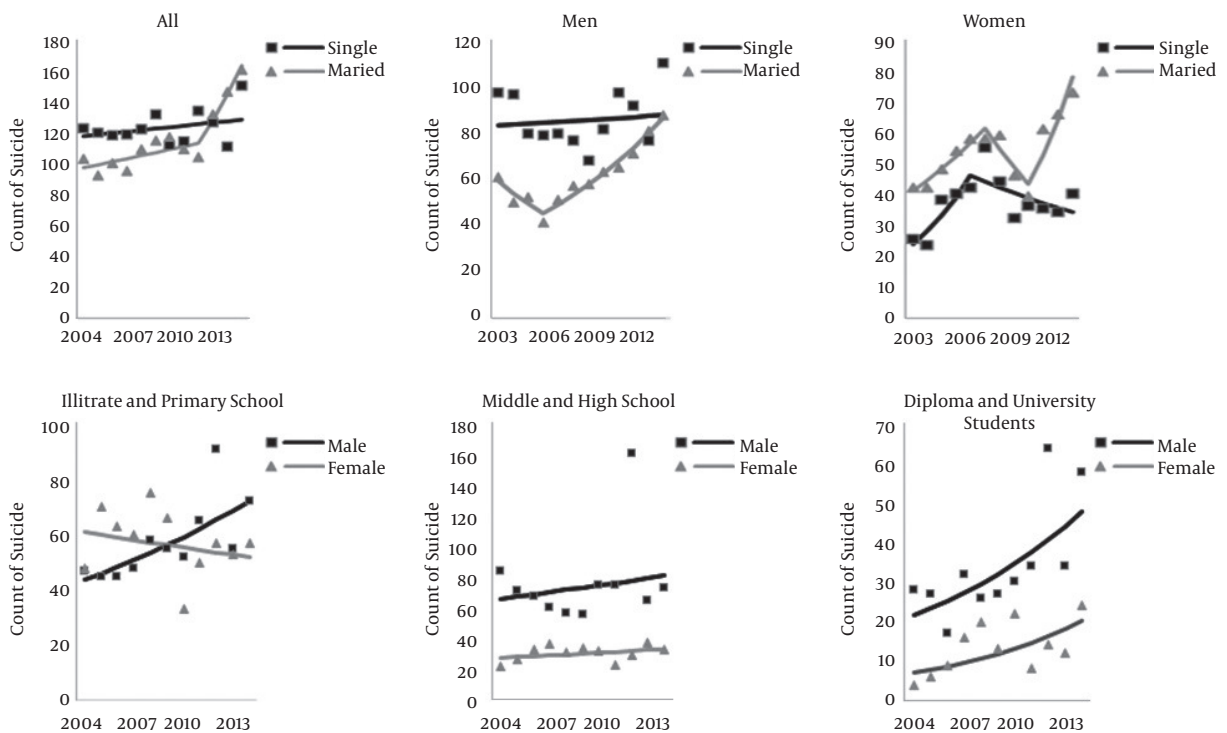
Decline in social support and economic crisis for men: After a sharp decrease of suicide in men from 2003 it increased again in 2006. The decline from 2003 to 2006 belonged mostly to a decrease of suicide rate in age group 20 - 29 and its increase after 2006 is explained to a sharp increase in age group 30 - 39 year. As age group 20 - 29 ex-

plained the majority of changes of suicide rate in women, age group 30 - 39 played a pivotal role in change of suicide trend among men. The first decrease between 2003 - 2006 belonged to the decrease in age group 20 - 29 because this is the only age group that has a decrease rate of suicide during the study period.

The decrease of suicide rate in age group 29 - 30 is consistent with other finding of the study. Among men, the suicide number in married has increased after 2006 and reached the level of singles in 2014. Also, suicide among highly educated rises. By increasing the average age of men to get married, the peak of suicide rate moves from age group 20 - 29 to 30 - 39 years. Along with this, in the recent decade, proportion of young people who goes to a university increased in Iran and the majority of students are looking for the job after graduation is almost concur-



**Figure 3.** Trends in Age-Standardized Suicide Rates from 2003 to 2014 According to Different Methods of Suicide by 2 Genders (Data Markers Represent Observed Rates; Lines Have Been Drawn According to the Joinpoint Results)



**Figure 4.** Trends in Count Numbers of Suicide from 2003 to 2014 According To Different Level of Education in 2 Genders and Their Marital Status (Data Markers Represent Observed Rates; Lines Have Been Drawn According to the Joinpoint Results).

rent with ages between 30 - 39 years (5).

In age groups over 60 years for men and slightly for women, suicide rate increased. This rising trend in old ages could be explained by a decrease in their familial and social support during previous decades. Social integrity and

social support from the first study of Durkheim on etiology of suicide (6) has been known as a main determinant of mental health and suicide (7, 8). In coordinate with the rise of modern life style and emerging the era of technology, old people can't adapt with the new radical change in their



life (9) therefore this conflict between old age and new age show himself as a discrepancy and conflict between family members, which is one of the prevalent conditions among suicide cases in Iran (1, 10). There is an inverse correlation between level of social capital and suicide rate (32). The increase in level of globalization is related with the level of suicide rate in Asia (11) as well as increase in level of population (12). Suicide is seen as an individual act or decision but it rooted deeply in the context of the families (33), therefore families have a pivotal role in this issue. Numbers of change in the structure of Iranian family and much more in the western part of the country have created this situation.

We found that married people have a higher risk of suicide than men. This is the vital change in epidemiology of suicide in this region. Protective effect of being married against suicide is well known (13) and reverse consequence of it in recent years demands special assessment. In women, always married have a higher percentage. Economic crisis is one of the main determinants of suicide as in the 2008 European and American crisis. The rate of suicide in men aged 15 - 24 (European) and 45 - 64 (American) has increased (19); the countries have higher rate of job loss (19).

Study on suicide rates between 1983 - 2012 showed a rise in total suicides by 35.7% after new austerity (12). Unemployment has a strong correlation with suicide mortality, particularly among working age men (13). In recent decades' young Iranian people have experienced many economical crises. Some of the problems belong to durable war with Iraq and some caused by sanctions imposing against Iran by western powers. This effect could be explained by an increase in unemployment and immense economic pressure on the society, especially young married men with no stable job and social opportunity. However, this period of time is also concurrent with time for getting married and job for generation belong to birth cohort of war between Iran and Iraq which fertility rate was in its highest level after Islamic revolution.

Another explanation is that the low level of emotional health, leads to unemployment (11). Economic crisis affected people differently based on their conditions. Neurotic persons affected more by the economic crisis than others (15). Our new young generation suffered from low level of social support and in the best condition their social relationship is very low. For example, students in Tehran University of Medical Sciences have the best opportunity for job and social respect in their future but they also suffer from low social relation (20).

Weak and strong points: Between the 2 categories of suicide and para-suicide, our conclusion is generalizable only to suicide mortality because legal medicine's data is

restricted to this group. Majority of suicide attempts is a cry for help and they don't really want to die like suicide cases. Although there is similarity between the 2 types, in terms of intention and demographic characteristics, dissimilarities also should be regarded. Since there is a stigma on suicide in tribal based regions, we have under estimation and perfect actual rate is slightly higher than the observed rates, in recent decade with increase of knowledge toward psychological problem. Time trend analysis needs data for several decades to be more accurate and reliable. Registry system of suicide in Iran has begun lately in comparison to western countries. Therefore, we will have more accurate analysis on data in the next decades.

Novelty: Among studies on suicide in Iran, our study followed the longest time trend (13 years) and used the most accurate approach to analyze the data. For the first time we explored the falling trend in old image of suicide in the west of Iran and increasing trend of new feature.

Conclusion: feature of suicide in high-risk region of Iran is changing from earlier ones to new emerging model. Self-burning in young women from rural areas with low level of education is declining and self-poisoning among educated urban is increasing. Mean age of suicide for men has increased mostly among married men with high level of education.

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## Footnote

**Conflict of Interest:** The authors proclaim no conflict of interest in this study.

## References

1. WHO . Preventing suicide; a global imperative 2013. Available from: <http://www.who.int/mentalhealth/suicide-prevention>.
2. Ferrari AJ, Norman RE, Freedman G, Baxter AJ, Pirkis JE, Harris MG, et al. The burden attributable to mental and substance use disorders as risk factors for suicide: findings from the Global Burden of Disease Study 2010. *PLoS One*. 2014;9(4):e91936. doi: 10.1371/journal.pone.0091936. [PubMed: 24694747].
3. Niederkrotenthaler T, Voracek M, Herberth A, Till B, Strauss M, Etzersdorfer E, et al. Role of media reports in completed and prevented suicide: Werther v. Papageno effects. *Br J Psychiatry*. 2010;197(3):234-43. doi: 10.1192/bjp.bp.109.074633. [PubMed: 20807970].

4. Schmidtke A, Schaller S. The role of mass media in suicide prevention. The international handbook of suicide and attempted suicide. ;2000.
5. Kleiman EM, Liu RT. Social support as a protective factor in suicide: findings from two nationally representative samples. *J Affect Disord*. 2013;**150**(2):540-5. doi: [10.1016/j.jad.2013.01.033](https://doi.org/10.1016/j.jad.2013.01.033). [PubMed: [23466401](https://pubmed.ncbi.nlm.nih.gov/23466401/)].
6. Huoliang G, Miaomiao S. Impact of Social Support and Self-compassion on Suicide Ideation. *J Baoding Univ*. 2015;**1**:021.
7. Beattie D, Devitt P. Suicide: a modern Obsession. Liberties Press; 2015.
8. Bahr A. Between "Self-Murder" and "Suicide": The Modern Etymology of Self-Killing. *J Soc History*. 2013;**46**(3):620-32. doi: [10.1093/jsh/shst119](https://doi.org/10.1093/jsh/shst119).
9. Pritchard C, Amanullah S. An analysis of suicide and undetermined deaths in 17 predominantly Islamic countries contrasted with the UK. *Psychol Med*. 2007;**37**(3):421-30. doi: [10.1017/S0033291706009159](https://doi.org/10.1017/S0033291706009159). [PubMed: [17176500](https://pubmed.ncbi.nlm.nih.gov/17176500/)].
10. Kiadaliri AA, Saadat S, Shahnavazi H, Haghparast-Bidgoli H. Overall, gender and social inequalities in suicide mortality in Iran, 2006-2010: a time trend province-level study. *BMJ Open*. 2014;**4**(8):e005227. doi: [10.1136/bmjopen-2014-005227](https://doi.org/10.1136/bmjopen-2014-005227). [PubMed: [25138804](https://pubmed.ncbi.nlm.nih.gov/25138804/)].
11. Ahmadi A, Mohammadi R, Almasi A, Amini-Saman J, Sadeghi-Bazargani H, Bazargan-Hejazi S, et al. A case-control study of psychosocial risk and protective factors of self-immolation in Iran. *Burns*. 2015;**41**(2):386-93. doi: [10.1016/j.burns.2014.07.025](https://doi.org/10.1016/j.burns.2014.07.025). [PubMed: [25406886](https://pubmed.ncbi.nlm.nih.gov/25406886/)].
12. Rezaeian M. Self-Immolation: The Literacy History Between India and Iran. *Iran J Psychiatry Behav Sci*. 2015;**9**(4):ee1581. doi: [10.17795/ijpbs-1581](https://doi.org/10.17795/ijpbs-1581). [PubMed: [26834797](https://pubmed.ncbi.nlm.nih.gov/26834797/)].
13. Rostami M, Jalilian A, Ghasemi S, Kamali A. Suicide Mortality Risk in Kermanshah Province, Iran: A County-level Spatial Analysis. *Epidemiology, Biostatistics and Public Health*. 2016;**13**(3).
14. Mofidi N, Ghazinour M, Araste M, Jacobsson L, Richter J. General mental health, quality of life and suicide-related attitudes among Kurdish people in Iran. *Int J Soc Psychiatry*. 2008;**54**(5):457-68. doi: [10.1177/0020764008091663](https://doi.org/10.1177/0020764008091663). [PubMed: [18786907](https://pubmed.ncbi.nlm.nih.gov/18786907/)].
15. Othman N. Suicide by self-burning in Iraqi Kurdistan: description and risk factors. *Arch Suicide Res*. 2011;**15**(3):238-49. doi: [10.1080/13811118.2011.589717](https://doi.org/10.1080/13811118.2011.589717). [PubMed: [21827313](https://pubmed.ncbi.nlm.nih.gov/21827313/)].
16. Dogan N, Toprak D. Trends in Suicide Mortality Rates for Turkey from 1987 to 2011: A Joinpoint Regression Analysis. *Arch Iran Med*. 2015;**18**(6):355-61. [PubMed: [26058930](https://pubmed.ncbi.nlm.nih.gov/26058930/)].
17. Hekimoglu Y, Esen Melez I, Canturk N, Erkol ZZ, Dizdar MG, Canturk G, et al. A descriptive study of female suicide deaths from 2005 to 2011 in Van city, Turkey. *BMC Womens Health*. 2016;**16**:20. doi: [10.1186/s12905-016-0299-1](https://doi.org/10.1186/s12905-016-0299-1). [PubMed: [27107719](https://pubmed.ncbi.nlm.nih.gov/27107719/)].
18. Kir MZ, Gunduz E, Gullu MN, Uysal C, Korkmaz M, Icer M, et al. Recurrent suicide attempt cases in Diyarbakir, Turkey. *Eur J Forensic Sci*. 2014;**1**(1):9.
19. Davis MT. DSM-5 PTSD and Passive Suicidal Ideation: An Application of the Interpersonal-Psychological Theory of Suicide. Auburn University; 2016.
20. Ramsawh HJ, Fullerton CS, Mash HB, Ng TH, Kessler RC, Stein MB, et al. Risk for suicidal behaviors associated with PTSD, depression, and their comorbidity in the U.S. Army. *J Affect Disord*. 2014;**161**:116-22. doi: [10.1016/j.jad.2014.03.016](https://doi.org/10.1016/j.jad.2014.03.016). [PubMed: [24751318](https://pubmed.ncbi.nlm.nih.gov/24751318/)].
21. Mofidi N, Ghazinour M, Richter J. How about the relationships between PTSD, depressivity and suicide related thoughts in Iranian Kurds? ; 2009.
22. Safari R, Khanjani N, Najafi F. Self-immolation causes and preventive strategies from the viewpoint of healthcare providers: A qualitative study. *J School Public Health Inst Public Health Res*. 2015;**12**(3):37-51.
23. Shojaei A, Moradi S, Alaeddini F, Khodadoost M, Barzegar A, Khademi A. Association between suicide method, and gender, age, and education level in Iran over 2006-2010. *Asia Pac Psychiatry*. 2014;**6**(1):18-22. doi: [10.1111/appy.12097](https://doi.org/10.1111/appy.12097). [PubMed: [24038892](https://pubmed.ncbi.nlm.nih.gov/24038892/)].
24. Nazarzadeh M, Bidel Z, Ayubi E, Asadollahi K, Carson KV, Sayehmiri K. Determination of the social related factors of suicide in Iran: a systematic review and meta-analysis. *BMC Public Health*. 2013;**13**:4. doi: [10.1186/1471-2458-13-4](https://doi.org/10.1186/1471-2458-13-4). [PubMed: [23289631](https://pubmed.ncbi.nlm.nih.gov/23289631/)].
25. Shirazi HR, Hosseini M, Zoladl M, Malekzadeh M, Momeninejad M, Noorian K, et al. Suicide in the Islamic Republic of Iran: an integrated analysis from 1981 to 2007. *East Mediterr Health J*. 2012;**18**(6):607-13. [PubMed: [22888617](https://pubmed.ncbi.nlm.nih.gov/22888617/)].
26. Saberi-Zafaghbandi MB, Hajebi A, Eskandarieh S, Ahmadzad-Asl M. Epidemiology of suicide and attempted suicide derived from the health system database in the Islamic Republic of Iran: 2001-2007. *East Mediterr Health J*. 2012;**18**(8):836-41. [PubMed: [23057372](https://pubmed.ncbi.nlm.nih.gov/23057372/)].
27. Najafi F, Hasanzadeh J, Moradinazar M, Faramarzi H, Nematollahi A. An epidemiological survey of the suicide incidence trends in the southwest iran: 2004-2009. *Int J Health Policy Manag*. 2013;**1**(3):219-22. doi: [10.15171/ijhpm.2013.40](https://doi.org/10.15171/ijhpm.2013.40). [PubMed: [24596868](https://pubmed.ncbi.nlm.nih.gov/24596868/)].
28. Mirhashemi S, Motamedi MH, Mirhashemi AH, Taghipour H, Darnial Z. Suicide in Iran. *Lancet*. 2016;**387**(10013):29. doi: [10.1016/S0140-6736\(15\)01296-9](https://doi.org/10.1016/S0140-6736(15)01296-9). [PubMed: [26766345](https://pubmed.ncbi.nlm.nih.gov/26766345/)].
29. Chaman R, Khosravi A, Sajedinejad S, Nazemi S, Fereidoon Mohasseli K, Valizade B, et al. Smoking and Its Related Factors Among Iranian High School Students. *Iran J Psychiatry Behav Sci*. 2015;**9**(4):ee1583. doi: [10.17795/ijpbs-1583](https://doi.org/10.17795/ijpbs-1583). [PubMed: [26834798](https://pubmed.ncbi.nlm.nih.gov/26834798/)].
30. Karim H, Schwebel DC, Bazargan-Hejazi S, Mohammadi R, Choubsaz M, Heidari Zadi Z, et al. What factors play a role in preventing self-immolation? Results from a case-control study in Iran. *J Inj Violence Res*. 2015;**7**(2):59-63. doi: [10.5249/ijvr.v7i2.550](https://doi.org/10.5249/ijvr.v7i2.550). [PubMed: [26081518](https://pubmed.ncbi.nlm.nih.gov/26081518/)].
31. Fardiazar Z, Sadeghi-Bazargani H, Mohammadi R. Domestic injuries and suicide among women of reproductive age in Iran. *Int J Gen Med*. 2012;**5**:547-52. doi: [10.2147/IJGM.S31429](https://doi.org/10.2147/IJGM.S31429). [PubMed: [22807643](https://pubmed.ncbi.nlm.nih.gov/22807643/)].
32. Recker NL, Moore MD. Durkheim, social capital, and suicide rates across US counties. *Health Soc Rev*. 2015;**25**(1):78-91. doi: [10.1080/14461242.2015.1101703](https://doi.org/10.1080/14461242.2015.1101703).
33. Frey LM, Cerel J. Risk for Suicide and the Role of Family. *J Fam Issues*. 2015;**36**(6):716-36. doi: [10.1177/0192513X13515885](https://doi.org/10.1177/0192513X13515885).