Fatal Suicide and Modelling its Risk Factors in a Prevalent Area of Iran

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Abstract

Background and objectives: This paper aimed to study the epidemiology of suicide and causes related to fatal suicide in Ilam province, west of Iran.

Methods: All data related to attempted suicide and fatal suicide during 2011–2012 were extracted from the suicide registry of authorized directorates in Ilam Province, Iran. Risk factors for fatal suicide were evaluated using logistic regression modeling and discrimination of model assessed using ROC curve.

Results: A total of 1537 registered cases were analyzed, among which 130 were recorded as fatal suicides (1227 attempted suicides). Overall, 805 (52.4%) cases were female, 9.2% had a history of suicide, 59.3% were married and 63.3% of cases were aged under 24 years. The most common suicide method was overdose of medications (75.5%). In multivariable analysis, male gender (OR: 0.50; CI 95% 0.25 to 0.99) and higher education (OR: 0.36; CI 95% 0.20 to 0.65) were protective factors and application of physical methods (OR: 11.61; 95% CI 5.40 to 24.95) was a risk factor for fatal suicide.

Conclusions: Female gender, low education level and use of physical methods of suicide were revealed as risk factors of fatal suicide. We suggest population based case-control studies based on the suicide registry data for further assessing the risk factors of suicide in Ilam.

Keywords: Attempted suicide, fatal suicide, Iran, risk factor

Introduction

Suicide is the third cause of death among 15–44 years age group and the second cause of mortality among 15–19 year-old people.[1] In Asian countries, it is estimated that 1 million people commit suicide per year[2] and recent figures also show that 60% of the world's suicides occur in Asian countries.[3] However, the total rate of suicide among Eastern Mediterranean Region including Iran, compared to other countries, is lower. There is evidence to indicate an increasing trend of this problem in recent years.[4] The rate of suicide attempts is almost several times higher than fatal suicides in the world and this rate in Iran is about 4 times.[5]

Most recent studies performed in Iran showed that the mean age of suicide attempters as well as those with fatal suicide has been lowered and most of them were in the range of 20–25 years old.[4–6] The studies demonstrate that Ilam Province, located in western Iran, has the highest suicide mortality rate in the country (19.53 per 100000 population).[7] Given the rate of suicide in other parts of the world,[3] Ilam Province may be considered a high-rate area. Nevertheless, there are sparse analytical researches to assess the related determinants of this high mortality level and study whether fatal suicide attempt can be predicted by suicide related behaviors and sociodemographic factors.

According to the previous studies, different epidemiological patterns, risk factors and protective factors are considerably dissimilar among Asian countries compared to Western countries.[8,9] Studies showed that factors such as unemployment,[10,11] youth and history of suicide attempt,[11] gender,[12] family conflicts[13] and socioeconomic status (SES)[14] have been significantly related to fatal suicide.

The present study investigates the epidemiology of suicide and predictive factors related to fatal suicide in a prevalent area, Ilam Province, western Iran, during 2011–2012.

Materials and Methods

Data collection and registry

Through a descriptive-analytical study, data related to suicide and fatal suicide during 2011–2012 were extracted from the suicide registry of authorized directorates in Ilam Province, Iran. When a suicide attempt is referred to hospital, a comprehensive questionnaire is completed by health care personnel. In case of fatal suicide outside the hospital, the relevant death is confirmed and

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the questionnaire is completed by forensic medicine directorate. Because suicide attempts and fatal suicides respectively need treatment and legal permission for burial, the data related to almost all cases of suicide are recorded. Another system of data collection is death record system and the information related to suicide in hospital registry are finally linkages to those in the death record system and therefore data associated with suicide are rectified. All collected data were coded and entered into Excel version 2010 and necessary amendments were made on the data file.

Variables definitions

To evaluate the age variable in univariate analysis, the patients were categorized into age groups of five year intervals. Also, to measure adjusted odds ratio, by logistic regression model, on the basis of disposal information and according to the study by Malone et al.,[15] age variable was divided into two groups of less or equal to 24 and more than 24 years of age. Occupation status was categorized as employed and unemployed in which students and soldiers were considered as employed individuals. The variable education level was categorized into 6 different levels, from literacy to university levels, for univariate analysis and for logistic regression model was defined as dichotomous variable of under diploma and diploma or higher. Other variables are objectives and listed in Table 1. This study was approved by the Ilam University of Medical Sciences ethics committee.

Statistical analysis

The relationship between categorical variables and occupation status, measured by chi-square test, is reported as absolute and percentage values. If more than 20% of expected frequencies in n × n tables were less than 5, the exact test was applied. Also, for estimation of odds ratio of risk factors related to fatal suicides, binominal logistic regression (enter method) was applied. Likelihood ratio was used for estimation of 95% confidence interval of odds ratio. The goodness of fit of the three models was assessed using the Hosmer and Lemeshow Test, -2 log likelihood, Cox and Snell R square, and Negelkerke R square. Receiver operating characteristic (ROC) curves and area under the curves were estimated to assess the discrimination of each logistic model using the predicted probability of the models. For prevention of collinearity in the logistic model, using principal component analysis (PCA) (Varimax rotation and Bartlett method), the variable of socioeconomic status (SES) was built through relevant proxy variables including father's occupation, mother's occupation, father education levels and mother's education level. PCA is a widely used multivariable statistical technique for reduction of proxy variables. PCA creates uncorrelated components, where each component is a linear weighted combination of the original variables and the first component has the highest variance and so on. For classification of SES, we used commonly arbitrary cut-off points in which percentile 33 and lower were categorized as "low class", percentile 33 to 66 as "medium class" and higher than percentile 66 as "high class". P-values below 0.05 were considered as significant level for all tests and all analysis processes were performed using SPSS version 22.

Results

Characteristics description

This study included 1537 cases of suicide during 2011–2012 among which 1407 (91.5%) people attempted suicide and 130 (8.5%) cases were fatal suicides (Table 1). Totally, 805 (52.4%) patients were female and 9.2% of all cases had a history of suicide attempt, 59.3% of all cases were single and 63.3% were younger than 24 years of age. The majority of cases committed suicide at home (94.8%) and this figure was 3.7% and 1.5% for public places or at work, respectively. In our study, 51.8% of patients had diploma or higher education and 57.6% of all cases were identified as children living with their parents (Table 1). The most common method of suicide was medication overdose (75.5%) followed by different poisons (7.7%), petrol (6.0%), hanging or gunshot (3.9%), self-injury (2.1%) and 4.7% of methods were unknown. The reasons for suicide among 41.2% of cases were unknown and the known reasons, in decreasing order of frequency, were family conflict (27.4%), psychological disorders (26%) and unemployment (5.4%). Considering the kind of suicide, demographic, psychological and socioeconomic characteristics of patients are shown in Table 1.

Multiple logistic regression and goodness-of-fit test

Logistic models in Table 2 are presented as separate adjusted and unadjusted models for two categories of variables to calculate the OR and 95% CI for people with fatal suicide compared with non-fatal. Unadjusted logistic regression model showed that variables of age under 24 (OR: 1.43, $P = 0.05$), application of physical methods for suicide (OR: 8.40, $P < 0.001$) and history of attempted suicide (OR: 1.78, $P = 0.02$) increased the odds of fatal suicide. Also, variables of living with parents as children (OR: 0.58, $P = 0.003$), education higher than diploma (OR: 0.42, $P <0.001$), being single (OR: 0.62, $P = 0.009$) and committing suicide in house (OR: 0.31, $P < 0.001$) reduced the chance of suicide significantly.

In the multivariable model for prediction of fatal suicide, the base model (multivariable model 1 in Table 2) included the suicidal behaviors that are exhibited in Table 1. According to this adjusted model, physical methods of suicide had a remarkable significant association with an increased risk of fatal suicide (OR: 7.93, $P < 0.001$). The model was well fitted as indicated by nonsignificant Hosmer–Lemeshow goodness-of-fit tests ($P = 0.19$). But, according to the Cox and Snell R^2 as well as the Negelkerke R^2, 4% and 10% of the observed variance was explained by model 1. The results of model 2 indicated that age under 24 (OR: 1.79, $P = 0.04$) is a risk factor, while education higher than high school (OR: 0.34, $P < 0.001$) is protective factor for fatal suicide. The models were well fitted as indicated by non-significant Hosmer–Lemeshow goodness-of-fit tests ($P < 0.20$). Cox and Snell R^2 as well as Negelkerke R^2 showed that 5% and 11% of the observed variance was explained by the sociodemographic factors.

In model 3, putting all variables inside the multivariate regression model together, variables of male gender (OR: 0.50, $P = 0.04$), education higher than high school (OR: 0.36, $P = 0.001$) and application of physical methods for suicide (OR: 11.61, $P < 0.001$) remained significant. The details of odds ratio and 95% CI are indicated in Table 2. -2 Log likelihood for model 3 was 381.17 (Table 2), which shows that goodness of fit of model 3 is better than that of models 1 or 2. Figure 1 showed that the area under the curve for model 3 was higher than models 1 or 2; Cox and Snell R square = 0.11; Negelkerke R square = 0.23 in model 3 was higher than models 1 or 2 which shows goodness of fit of model 3 is better than that of models 1 or 2.

Table 1. Demographic characteristics and factors related to suicide among suicide attempters and fatal suicides in Ilam Province during 2011 – 2012.

Variables	Suicide		Total *	P
	Nonfatal	Fatal		
	N (%)	N (%)		
Age (yr)				
< 15	42 (91.3)	4 (8.7)	46 (3.0)	< 0.001
15 – 24	859 (92.7)	68 (7.3)	927 (60.3)	
25 – 34	420 (91.1)	41 (8.9)	461 (30.0)	
35 – 44	68 (89.5)	8 (10.5)	76 (4.9)	
> 45	18 (66.7)	9 (33.3)	27 (1.8)	
Gender				
Male	671 (91.7)	61 (8.3)	732 (47.6)	0.86
Female	736 (91.4)	69 (8.5)	805 (52.4)	
Education				
Uneducated	70 (81.4)	16 (18.6)	86 (6.0)	0.001<
Elementary	88 (80.7)	21 (19.3)	109 (7.6)	
Middle School	295 (90.2)	32 (9.8)	327 (22.7)	
High School	116 (94.3)	7 (5.7)	123 (8.5)	
Diploma	597 (94.2)	37 (5.8)	634 (44.0)	
University	156 (96.3)	6 (3.7)	162 (11.2)	
Employment Status				
Employed	183 (90.1)	20 (9.9)	203 (13.2)	0.44
Unemployed	1224 (91.8)	110 (8.2)	1334 (86.8)	
Marital status				
Single	848 (93.1)	63 (9.6)	911 (59.3)	0.009
Married	559 (89.3)	67 (10.7)	626 (40.7)	
Suicide location				
Public places	44 (77.2)	13 (8.22)	57 (3.7)	< 0.001 †
Work place	19 (82.6)	4 (17.4)	23 (1.5)	
Home	1344 (92.2)	113 (7.8)	1457 (94.8)	
Position in the household				
Headman	121 (84.0)	23 (16.0)	144 (9.4)	0.001<
Child	827 (93.3)	59 (6.7)	886 (57.6)	
Wife	405 (91.0)	40 (14.5)	445 (29.0)	
Unknown	54 (87.1)	8 (12.9)	62 (4.0)	
SES				
Low class	359 (94.0)	23 (6.0)	382 (48.0)	0.001
Middle class	124 (89.9)	14 (10.1)	138 (17.3)	
High class	236 (85.5)	40 (14.5)	276 (34.7)	
History of attempted suicide				
Yes	123 (86.6)	19 (13.4)	142 (9.2)	0.02
No	1284 (92.0)	111 (8.0)	1395 (90.8)	
Suicide method				
Medications	1145 (98.6)	16 (1.4)	1161 (75.5)	< 0.001
Poisons	109 (91.6)	10 (8.4)	119 (7.7)	
Self-injury	33 (100.0)	0 (0.0)	33 (2.1)	
Hanging or gunshot	26 (43.3)	34 (56.7)	60 (3.9)	
Petrol	30 (32.6)	62 (67.7)	92 (6.0)	
Unknown	64 (88.9)	8 (11.1)	72 (4.7)	

yr = year; *P* = *P*-value; SES = socioeconomic status; * Total is as column percent; † Calculated using exact test

Table 2. Adjusted and unadjusted odds ratios (OR) and 95% confidence intervals (95% CI) of fatal suicide for related risk factor based on three separate binary logistic regression models.

Variable	Unadjusted OR			Adjusted OR		
Models	OR	95% CI	P	OR	95% CI	P
Model 1 (suicidal behaviors)*						
History of attempted suicide (yes vs. no)				1.27	0.70 – 2.30	0.42
Suicide method (physical vs. chemical)				7.93	4.87 – 12.91	< 0.001
Suicide location (house vs. other places)				0.75	0.35 – 1.57	0.44
Model 2 (sociodemographic factors)†						
Gender (male vs. female)				0.99	0.56 – 1.73	0.97
Employment Status (unemployed vs. employed)				0.91	0.41 – 1.99	0.81
Education (≥ diploma vs. < diploma)				0.34	0.20 – 0.59	< 0.001
Age (< 24 yr vs. ≥ 24 yr)				1.79	1.02 – 3.13	0.04
Pos in hou (children vs. others)				0.95	0.35 – 2.54	0.92
Marital status (single vs. married)				0.76	0.28 – 2.05	0.59
Model 3 (all) §						
History of attempted suicide (yes vs. no)	1.78	1.06 – 3.00	0.02	1.47	0.62 – 3.52	0.37
Suicide method (physical vs. chemical)	8.40	5.23 – 13.50	< 0.001	11.61	5.40 – 24.95	< 0.001
Suicide location (house vs. other places)	0.31	0.17 – 0.55	< 0.001	0.59	0.16 – 2.16	0.43
Gender (male vs. female)	0.97	0.67 – 1.39	0.86	0.50	0.25 – 0.99	0.04
Employment Status (unemployed vs. employed)	0.82	0.49 – 1.35	0.44	0.69	0.29 – 1.59	0.38
Education (≥ diploma vs. < diploma)	0.42	0.29 – 0.63	< 0.001	0.36	0.20 – 0.65	0.001
Age (< 24 yr vs. ≥ 24 yr)	1.43	0.99 – 2.06	0.05	1.66	0.89 – 3.10	0.10
Pos in hou (children vs. others)	0.58	0.40 – 0.83	0.003	0.91	0.32 – 2.60	0.86
Marital status (single vs. married)	0.62	0.43 – 0.88	0.009	0.78	0.27 – 2.21	0.64

yr = years; SES = socioeconomic status; Ref = references category; diploma = high school diploma; Pos in hou = position in the household
*Hosmer and Lemeshow Test: Chi-square = 0.29, $P = 0.57$; -2 Log likelihood = 774.58; Cox and Snell R square = 0.04; Negelkerke R square = 0.10
†Hosmer and Lemeshow Test: Chi-square = 10.98, $P = 0.20$; -2 Log likelihood = 441.30; Cox and Snell R square = 0.05; Negelkerke R square = 0.11
§ Hosmer and Lemeshow Test: Chi-square = 5.03, $P = 0.75$; -2 Log likelihood = 381.17; Cox and Snell R square = 0.11; Negelkerke R square = 0.23
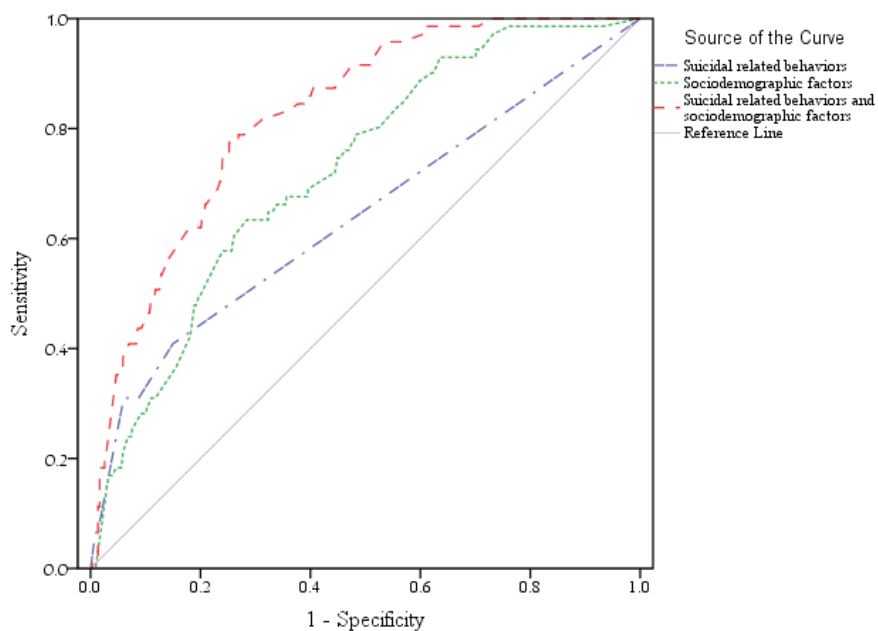
Models	Area under the curve	95% CI	P-value*
Model 1(suicidal related behaviors)	0.63	0.56 – 0.71	<0.001
Model 2 (sociodemographic factors)	0.72	0.66 – 0.78	<0.001
Model 3 (both)	0.82	0.78 – 0.86	<0.001

CI = 95% confidence intervals
* Null hypothesis: true area = 0.5

Figure 1. Receiver Operating Characteristic (ROC) curve analysis to assess discrimination for three binary logistic regression models.

The ROC curves and area under the curve for assessing the percentage of predicted probability that is explained by each model are exhibited in Figure 1. According to this figure, 63%, 72%, and 82% of the predicted probability was explained by Models 1, 2, and 3, respectively.

Discussion

The results of this study showed that about 63% of suicides in Ilam are committed by those under 24 years of age and the method of suicide among the majority of these (75.5%) is overdose of medications and also the most common cause of suicide is family conflict (26%). This finding is in agreement with recent meta-analysis findings which revealed drug poisoning as the most prevalent method for suicide[16] and family conflict as the most prevalent cause of suicide in Iran.[13] In the present study, the effects of environmental, social and psychological factors on the path that leads to fatal suicide were examined. This study found that application of physical methods for suicide is strongly associated with the risk of fatal suicide. The importance of this finding is that recent research revealed that the most frequent physical method of suicide in Iran is hanging.[17] On the other hand, male gender and high educational level are protective factors against fatal suicide. Although higher education was related to a higher rate of suicide attempts, it showed a negative relationship with fatal suicide. The results showed that the chance of fatal suicide among patients educated under diploma was 2.7 times higher than those with diploma or higher and this result was in accordance to other researches which showed that lethal methods of suicide are more frequently used by persons with lower educational status[18] and lower chance of fatal suicide in more educated individuals.[19] But, a possible explanation for the higher rate of suicide attempts in these people might be that highly educated people and college students are under great work-related pressure and are at a greater risk of depression. This justification is in agreement with our other study finding which showed a large proportion of college students in Ilam were suspected to have inappropriate general health status.[20]

A large number of studies have reported the history of previous suicide attempts as an independent risk factor for fatal suicide[11]; however, in multivariate regression analysis, in the current study, this variable was not identified as a significant risk factor for fatal suicide. This discrepancy may be related to the lower number of fatal suicides (case) with history of previous attempts in the regression model (19 fatal suicides). According to the power analysis, the statistical power of logistic model for this variable was 0.33, while the results of univariate analysis (Table 1) shows patients with history of suicide attempt, compared to those without history of suicide attempt, had higher fatal suicide with a significant difference.

There is controversy among different studies about the relationship between gender and fatal suicide. Some studies reported lack of difference between male and female,[21] while some others, such as Bradvick et al., reported a higher chance of fatal suicide among males compared to females and attributed this discrepancy to the selection of brutal methods for suicide among males compared to females.[22] In contrast with the two previous studies, our study showed that female gender significantly doubled the chance of fatal suicide and the proportion of fatal suicide among females was higher than that of males (52.3% vs. 57.7%).

Due to the specific cultural conditions and traditional culture in Ilam Province, women feel a high social pressure which inhibits their socio-economical independency and this phenomenon may be a reason for higher fatal suicide among females in this province. Also, due to the relationship between psychological disorders, as independent factors, and fatal suicide,[23,24] a screening study for identification of psychological disorders in this province is necessary.

From a geographical point of view, Ilam Province is among the warm provinces of Iran and located in the west of the country, bordering Iraq. In this province Mehran and Dehloran cities are among the warmest regions of Iran and other cities of the province are mountainous with mild temperature. Previous studies have shown a remarkable association between suicidal behavior and seasonal pattern in Iran.[13,25] It seems possible that the high rate of suicide in Ilam Province may be indirectly related to climate conditions in this province. The relationship between high levels of sun radiation and heat with increased risk of suicide reported from previous studies showed higher number of social tensions and peak of seasonal suicide in spring and summer.[25] However, more research on this issue needs to be undertaken before the association between suicide behavior and climate or environmental factors is more clearly understood in Ilam.

A foresighted finding of this study was identification of 11-folds chance of fatal suicide among victims who used physical methods for suicide. Even after adjustment in the model, this variable remained highly significant. Physical methods for committing suicide such as hanging, self-injury, gunshot and falling are among the most common and deadliest methods of fatal suicide among almost all societies and using less dangerous methods such as chemical substances for committing suicide among different countries showed high variety.[26] Due to the particular characteristics of physical methods of suicide, there is small chance for the victim to survive. The results of the current study showed that the most common method of committing suicide in Ilam Province was overdose of drugs, particularly among those under 24 years of age and this method, compared to physical methods, gives a better chance of survival; however, its increasing prevalence rate in Iran is considerable.[27]

There were some limitations in this study: a) due to the high variety of methods for committing suicide methods among males and females and low sample size, we could not analyze this variable among males and females, separately; b) as age variable is usually an important confounding factor in the suicide research, in our study age was entered into the model as a dummy variable and this method of analysis may increase the effects of residual confounding; and c) temporal relationships cannot be assessed because of the cross-sectional nature.

In conclusion, according to the results of this study, the most common method of suicide in Ilam Province was overdose of medications and more than half of suicides in Ilam were committed among those under 24 years of age. Meanwhile, female gender, low education level and use of physical methods of suicide were revealed as related risk factors for fatal suicide.

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