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Original Article

Suicide Reattempt Risk Factors: A Cross-Sectional Study Using Mashhad's Population-Based Registry, 2019-2022

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Abstract

Background: Suicide is a serious global public health issue, which is the fourth-leading cause of death for young people between the ages of 15 and 29. This study aimed to be conducted to investigate the factors affecting suicide reattempts.

Methods: This cross-sectional study used data from the Sina Electronic Health Registration System and the HIS of Mashhad University of Medical Sciences, Mashhad, Iran covering around 90% of suicide attempts in Mashhad's government hospitals (2019–2022). The study population included all Mashhad residents with documented suicide attempts in this period. Descriptive analysis was followed by a Poisson multivariable regression to identify factors affecting suicide attempt frequency, with analyses conducted in Stata version 14 and significance set at $P<0.05$.

Results: Among 5,737 participants, 3,157 (55.0%) were men. The overall rate of suicide reattempt was 10.1% (n=580). Suicide reattempts were more prevalent among men (55.5% of reattempts, n=322), individuals with mental disorders (16.0%, n=93), substance users (7.8%, n=45), single persons (66.6%, n=386), those with high school education (47.6%, n=276), and self-employed individuals (45.7%, n=265). Poisson regression analysis revealed that substance users had a 43% higher likelihood of reattempting suicide compared to non-users (IRR=1.43, 95% CI: 1.27-1.61, p<0.001), after adjusting for other variables.

Conclusion: Identifying risk factors for suicide reattempt, such as drug abuse, may be effective in identifying high-risk groups and preventing suicide reattempts.

Keywords: Suicide; Suicide reattempt; Risk factors; Iran; Poisson multivariate

Introduction

Suicide, as the second leading cause of death among young people aged 15 to 29 yr, is a serious global public health issue (1). According to the WHO, suicide accounts for about 703,000 deaths annually, and the number of attempted suicides is estimated to be more than twenty times higher

than complete suicides worldwide. Suicide was the cause of about 1.3% of fatalities in 2019 (2). According to reports, Iran has a suicide death rate of 5.3 per 100,000 persons, which is twice as high for men as it is for women (3). In addition, suicide attempts prevalence is very different in Iran, which is depending on the geographical region, so this rate is estimated at 16.8 in the Hamadan and Kermanshah province and 117.8 in the Golestan Province per hundred thousand people (4).

The wide range of data on suicide rates in the world from 2 to 80 per hundred thousand people, shows that these deaths occur at diverse rates, follow distinct patterns, and have different root reasons in various nations (2, 5). In reality, several interconnected biological, psychological, socioeconomic, and cultural factors contribute to suicide, and their complex interactions can fuel the occurrence of suicide attempts in people (6, 7). Mental disorders like depression, schizophrenia, alcohol and drug abuse, personality disorders, and chronic obstructive pulmonary disease (COPD), in addition to physical conditions like hemodialysis, cancer, AIDS, malignancies, multiple sclerosis, severe body burns, paralysis of a limb, and congestive heart failure are some of the individual and psychological factors that can contribute to suicide attempt and reattempt (8-10). Studies investigating factors affecting suicide reattempts in various societies have identified several risk factors. These include low income, low educational attainment, unemployment, financial problems, insufficient social support, stressful life events, substance abuse (including drugs and alcohol), and mental disorders. All of these factors have been associated with an increased risk of repeated suicide attempts (11, 12).

The results of studies conducted in Iran indicate that most cases of suicide attempts occurred in young people, married individuals, those with secondary education, low-income groups, and pregnant women (13, 14). A systematic review examining seven climatically distinct regions of Iran revealed that suicide rates and completed suicides are significantly influenced by various climatic and associated factors (15). Geographical factors such as altitude and latitude affected suicide rates, with higher-altitude regions (>1000m) showing 1.5 times higher rates. Atmospheric changes, including temperature extremes and high humidity, were associated with increased suicide attempts. Cultural factors played a role, with areas of stronger traditional family structures reporting 25% lower suicide rates. Economic conditions also had an impact, as provinces with above-average unemployment experienced 30% higher suicide attempt rates. Additionally, limited access to mental health services correlated with higher rates of completed suicides.

In today's society, the increasing prevalence of various types of social anomalies is a warning for society and individuals (16). Among these anomalies, suicide has become a crisis in the country due to its complex and multi-causal nature as well as its growing occurrence (17). Therefore, it is crucial to understand the factors contributing to suicide reattempts. In 2019, Mashhad University of Medical Sciences launched a comprehensive suicide attempt registration in Hospital Information System (HIS) for the first time. This system, is directly linked with the existing electronic health record system at the primary health care level, called SinaEHR. The HIS captures detailed information on each suicide attempt, including demographic data, method used, underlying mental health conditions, and previous attempts. This information is then integrated with the individual's broader health record in SinaEHR, providing a holistic view of their health status and history. The system covers all government hospitals and health centers, ensuring a wide data collection network. Furthermore, the SinaEHR system incorporates standardized reporting protocols based on the WHO guidelines, enhancing data consistency and comparability across different regions of the country (18). This integration of systems allows for longitudinal tracking of individuals, enabling researchers to study patterns and risk factors for suicide reattempts over time. The comprehensive nature of this new registration system has opened up unprecedented opportunities for conducting extensive and detailed research in the field of suicidol-

ogy in Iran. It allows for more accurate prevalence estimates, identification of high-risk groups, and evaluation of intervention strategies. Given that our knowledge about the risk factors associated with the possibility of someone reattempting suicide is incomplete, the present study leverages this new data infrastructure to investigate the factors affecting suicide reattempts.

Materials and Methods

Study Setting

This research was a cross-sectional study that utilizes information from two sources: the Sina Electronic Health Registration System (SinaEHR) database and the Hospital Information System (HIS), both operating under the supervision of Mashhad University of Medical Sciences, Mashhad, Iarn. These sources provided comprehensive information about individuals referring to Mashhad's government hospitals for suicide attempts.

Mashhad University of Medical Sciences, has 55 hospitals. Of these, 33 are government hospitals fully covered by our study, while 20 are private hospitals not included in our data collection. The 33 government hospitals account for approximately 70% of all hospital admissions. These two systems (SinaEHR and HIS) communicated with one another using the national code as a unique identifier for each individual.

This study used a census approach to include all eligible cases, defined by documented suicide attempts between Jan 1, 2019, and Dec 31, 2022, among residents covered by Mashhad University of Medical Sciences. Cases were excluded if documentation was incomplete or inconsistent, the attempt occurred outside the designated timeframe, or if non-residents were admitted to Mashhad hospitals. We excluded fewer than 5% of total cases of suicide attempts based on these criteria.

Study Procedure

In this study, suicide reattempt was the primary outcome variable. We defined a suicide reattempt as any subsequent suicide attempt after the initial recorded attempt within our study period. The number of attempts per individual ranged from 1 to 9 in our database.

Independent variables included:

- Demographic factors: gender, age, place of residence, marital status, occupation, education
- Clinical factors: underlying diseases (focusing on high blood pressure and diabetes), substance abuse, mental disorders
- Contextual factors: domestic violence, suicide methods, receiving counseling after attempting suicide

We categorized these variables as either risk factors or protective factors based on existing literature. Potential confounding variables, such as socioeconomic status, were adjusted for in our multivariate analysis.

The Hurt, Insult, Threaten, Scream (HITS) domestic violence screening tool was employed to assess experiences of domestic violence. HITS comprises four items rated on a five-point Likerttype scale, with scores ranging from 1 to 5. Total HITS scores range from 4 to 20, with scores of 10 or higher implying a risk of domestic violence, a tool validated for research among Shiraz families (19).

Information on substance abuse was recorded based on medical assessments conducted during hospital admission. Psychological Disorder including depression (ICD-10: F32, F33), anxiety disorders (F41, F43), bipolar disorders ([F30, F31], F34), psychosis (F20, F22, F23, F25), mental retardation (F70-F73), drug use disorders (F10-F19), obsessive-compulsive disorder (F42), and other disorders (F44, F45, F50, F52, F40, F95, F84, F90, F91, G40, G41, T40, T51, F53).

We used the International Classification of Diseases (ICD-10) codes registered in both the Sina and HIS systems to identify suicide attempts (X60-X84), completed suicides (X70-X84), high blood pressure (I10, I15), and diabetes (E10, E11).

Suicide attempt cases were classified according to the ICD-10 classification from codes X60 to X80. The codes X60 to X69 were classified as

nonviolent, and codes X70 to X84 were classified as violent methods.

While our study focused on high blood pressure and diabetes due to their high prevalence and established links to suicide risk in previous literature, we acknowledge this as a limitation and suggest future studies include a broader range of underlying diseases.

To provide a more comprehensive picture of suicide-related behaviors, we also collected data on completed suicides using ICD-10 codes X70-X84. However, our primary analyses focused on suicide attempts and reattempts.

Statistical Analysis

For the analysis, we conducted a descriptive examination of the data to outline participant characteristics. Following this, Poisson multivariable regression was applied to investigate the factors influencing the frequency of suicide reattempts, with adjustments made for other covariates. Variables that showed a *P*-value of less than 0.25 in the univariate analysis were included in the multivariable model. In the Poisson regression model, results are expressed as Incidence Rate Ratios (IRRs). The IRR quantifies the relative change in the rate of suicide reattempts for each unit change in predictor variables, with other covariates held constant. All analyses were conducted using Stata software version 14, and *P*-values less than 0.05 were considered statistically significant.

Ethics approval

All procedures were in accordance with the ethical standards of the Mashhad University of Medical Sciences. In addition, the research was reviewed by the Ethics Committee of the Mashhad University of Medical Sciences with IR.MUMS.FHMPM.REC.1401.110 ethics code.

Results

Our study encompassed 5,737 individuals, with 3,157 (55.0%) men and 2,580 (45.0%) women. We identified 580 cases of suicide reattempts, yielding an overall reattempt rate of 10.1%, consistent with the distribution of attempt frequencies in the interval data. Specifically, 89.89% (5,157) of cases fell within a single attempt, while the remaining 10.11% comprised individuals with multiple attempts distributed across subsequent intervals. In detail, 7.58% of cases (435 individuals) fell into the second interval, followed by 1.48% (85 cases) in the third, with decreasing frequencies across intervals up to nine attempts (0.02%, 1 individual).

The mean age for reattempt cases (28.7 ± 12.7 yr) was comparable to single attempt cases (28.95 ± 12.6 yr). Among those who reattempted suicide, 322 (11.65%) were men, 386 (11.74%) were single, and 276 (9.38%) had high school education. Substance use was significantly more prevalent in reattempt cases (45, 25.43%) compared to single attempt cases (132, 74.57%; $P<0.001$). Similarly, mental disorders were more common in reattempt cases (93, 15.48%) versus single attempt cases (508, 84.52%; $P<0.001$).

The majority of reattempt cases (499, 10.38%) employed non-violent methods. Post-attempt counseling was received by 148 (10.91%) of reattempt cases, slightly higher than the 89.09% of single attempt cases. Regarding employment, 265 (10.60%) of reattempt cases were self-employed, followed by students (211, 12.68%) and housewives (67, 6.98%) (Table 1).

Table 2 shows the results of univariate and multivariate analysis using Poisson regression for suicide reattempts in the study. The remaining variables in the final model included gender, education, mental disorders, drug use, and marital status. The adjusted rate ratio for gender was estimated to be 0.94, which indicates that the incidence rate in men is 6% higher than in women. (95% CI: 0.89-1), which is not statistically significant. Compared to the illiterate group as the base group, the highest occurrence of suicide reattempts is in people with primary education (IRR=1.11), high school education (IRR=1.06), and university education (IRR=1.05). The rate of suicide reattempts was reported to be 2% higher in single people than in married people (IRR=1.02, 95% CI: 0.96-1.09).

Table 1: Demographic and Clinical Characteristics of Participants by Single Suicide Attempt vs. Reattempt Status

Variable		Suicide attempt		Suicide re-attempt		P-value
		Frequency	Percentage	Frequency	Percentage	
Gender	Female	2715	91.32	258	8.68	<0.001
	Male	2442	88.35	322	11.65	
Marital Status	Married	2254	92.07	194	7.93	<0.001
	Single	2903	88.26	386	11.74	
Resident	Metropolitan	2801	89.80	316	10.20	0.93
	suburban	2356	89.92	264	10.08	
Education	illiterate	92	95.80	4	4.20	<0.001
	Primary school	970	86.91	146	13.09	
	High school	2668	90.62	276	9.38	
	Academic education	1427	90.25	154	9.75	
Job	housewife	893	93.02	67	6.98	<0.001
	student	1458	87.32	211	12.68	
	unemployed	145	94.15	9	5.85	
	employee	181	91.87	16	8.13	
	worker/ farmer	144	92.30	12	7.70	
	self-employed	2236	89.40	265	10.60	
Psychological Disorder	No	4649	90.51	487	9.49	0.47
	Yes	508	84.52	93	15.48	
High Blood Pressure	No	5084	89.82	576	10.18	0.15
	Yes	73	94.80	4	5.20	
Diabetes	No	5107	89.89	574	10.11	0.88
	Yes	50	89.28	6	10.72	
Suicide Methods	Violent Suicide	847	91.27	81	8.73	0.127
	Non-Violent Suicide	4310	89.62	499	10.38	
Substance Abuse	No	5025	90.37	535	9.63	<0.001
	Yes	132	74.57	45	25.43	
Domestic Violence	No	5103	89.90	573	10.10	0.72
	Yes	54	88.52	7	11.48	
Psychological Counseling After Suicide	No	3948	90.13	432	9.87	0.26
	Yes	1209	89.09	148	10.91	

The occurrence of suicide reattempts in people with mental disorders is 1% higher, which is not statistically significant. In addition, a statistically significant relationship was observed between drug use and suicide reattempt, and the adjusted rate ratio in drug users was 1.43 times higher than those who did not use any drugs (95% CI: 1.27-1.61).

Table 2: Crude and Adjusted Incidence Rate Ratios for Factors Associated with Suicide Reattempt

Variable		Crude Rate Ratio			Adjusted Rate Ratio		
		Incidence Rate Ratio	*P*-value	Confidence Interval	Incidence Rate Ratio	*P*-value	Confidence Interval
Gender	Male	Reference	-	-	-	-	-
	Female	0.74	0.001	(0.63-0.87)	0.94	0.056	(0.89-1.00)
Age		0.99	0.97	(0.99-1.00)	-	-	-
Marital Status	Married	Reference	-	-	-	-	-
	Single	1.03	0.12	(0.98-1.09)	1.02	0.35	(0.96-1.09)
Resident	Metropolitan	Reference	-	-	-	-	-
	Suburban	1.07	0.77	(0.95-105)	-	-	-
Education	Illiterate	Reference	-	-	-	-	-
	Primary school	1.13	0.21	(0.92-1.39)	1.11	0.30	(0.90-1.36)
	High school	1.07	0.45	(0.88-1.31)	1.06	0.53	(0.87-1.30)
	Academic Education	1.07	0.45	(0.88-1.31)	1.05	0.59	(0.86-1.29)
Job	Housewife	Reference	-	-	-	-	-
	Student	1.07	0.054	(0.99-1.16)	1.02	0.56	(0.93-1.12)
	Unemployed	0.97	0.78	(0.82-1.15)	0.94	0.48	(0.79-1.11)
	Employee	1.00	0.93	(0.86-1.16)	0.97	0.74	(0.83-1.13)
	Worker/ Farmer	0.99	0.94	(0.84-1.16)	0.92	0.34	(0.77-1.09)
	Self-Employed	1.06	0.075	(0.99-1.14)	1.01	0.64	(0.93-1.10)
Psychological Disorder	No	Reference	-	-	-	-	-
	Yes	1.12	0.002	(1.04-1.21)	1.01	0.51	(0.96-1.07)
High Blood Pressure	No	Reference	-	-	-	-	-
	Yes	0.91	0.43	(0.73-1.14)	-	-	-
Diabetes	No	Reference	-	-	-	-	-
	Yes	0.98	0.88	(0.76-1.25)	-	-	-
Suicide Methods	Non-Violent Suicide	Reference	-	-	-	-	-
	Violent Suicide	0.96	0.29	(0.90-1.03)	-	-	-
Substance Abuse	No	Reference	-	-	-	-	-
	Yes	1.43	0.001	(1.27-1.61)	1.43	<0.001	(1.27-1.61)
Domestic Violence	No	Reference	-	-	-	-	-
	Yes	0.97	0.81	(0.76-1.23)	-	-	-
Psychological Counseling After Suicide	No	Reference	-	-	-	-	-
	Yes	0.99	0.75	(0.93-1.04)	-	-	-

Discussion

This study leverages data from the first comprehensive suicide attempt registry in Iran, integrating Hospital Information Systems (HIS) with the Sina Electronic Health Registration System (SinaEHR). Our analysis revealed several key factors associated with suicide reattempts, with substance abuse emerging as the most significant predictor.

Our findings indicated that men had a 6% higher rate of suicide reattempts compared to women, though this difference was not statistically significant. This slight gender disparity aligns with recent research that found while women attempt suicide more frequently, men have a higher rate

of completed suicides and reattempts (20). The traditional Durkheimian theory suggesting women's lower suicide rates stem from less social participation may not fully apply in contemporary societies. Modern research points to complex interactions between gender, societal roles, and mental health factors in suicide risk (21). For instance, gender differences in suicide rates vary across countries and are influenced by socioeconomic factors (22).

Our study found that single individuals had a 2% higher rate of suicide reattempts compared to married individuals. This modest difference is consistent with recent findings that observed marriage continues to offer a protective effect against suicide, albeit less pronounced than in previous decades (23). The protective effect of marriage may be attributed to increased social support and shared responsibilities, factors that can buffer against suicidal behaviors (24). However, the quality of the marital relationship is crucial, as marital discord can increase suicide risk (25).

Education level showed varying effects on suicide reattempt rates in our study, with primary education associated with the highest risk (11% increase) compared to illiteracy. This nuanced relationship between education and suicide risk is reflected in recent literature. The protective effect of education against suicide attempts varies across racial and ethnic groups, highlighting the complex interplay between education, socioeconomic factors, and suicide risk (26). The relationship between education and suicide risk may be mediated by employment opportunities and social integration (27).

The most significant finding of our study was the strong association between substance abuse and suicide reattempts. Individuals with substance use issues had a 43% higher rate of reattempts compared to non-users. This substantial increase aligns with recent research, that identified substance abuse as a critical risk factor for repeated suicide attempts, often interacting with mental health disorders and social support deficits (28). The relationship between substance abuse and suicide is likely bidirectional, with substance use potentially exacerbating mental health issues and social problems, thereby increasing suicide risk (29). Esang and Ahmed emphasize the need for integrated treatment approaches addressing both substance use disorders and suicidal behaviors (30).

Our study found a slight increase (1%) in reattempt rates among individuals with mental disorders, though this was not statistically significant. While this finding seems to diverge from some previous studies that identified mental disorders as a strong predictor of suicide reattempts (31), it may reflect improvements in mental health care or indicate that other factors, such as substance abuse, play a more prominent role in our study population. However, the complex relationship between mental disorders and suicide risk warrants further investigation, particularly in the context of Iran's healthcare system. The impact of mental disorders on suicide risk may vary depending on the specific diagnosis and comorbidities (32).

Our study also examined other factors such as place of residence, occupation, and method of suicide attempt. While these factors did not show statistically significant associations with reattempt rates in our multivariate analysis, they may still play important roles in the complex dynamics of suicidal behavior. For instance, occupational factors can influence suicide risk, particularly in high-stress professions (33).

This study has several limitations that should be addressed in future research. Our data were limited to government hospitals, potentially underestimating suicide attempt rates. We did not differentiate between types of substances or patterns of use in our analysis of substance abuse as a risk factor. The cross-sectional nature of our study limits causal inferences. We also lacked detailed information on psychosocial factors and specific psychiatric diagnoses, and did not extensively explore cultural and religious influences on suicidal behavior. Future studies should aim to incorporate data from private hospitals and community sources, explore nuances in substance use, conduct longitudinal research, include more psychosocial factors, and consider cultural and religious

contexts in Iran to provide a more comprehensive understanding of suicide risk and develop targeted intervention strategies.

Conclusion

The findings underscore the critical role of substance abuse in suicide reattempt risk, while also highlighting the complex interplay of demographic, social, and clinical factors. Suicide prevention strategies in Iran prioritize substance abuse treatment and integrate it with mental health services. Furthermore, tailored interventions considering gender, marital status, and education level should be developed. Future research should focus on longitudinal designs, incorporate a wider range of psychosocial factors, and explore the interactions between substance abuse, mental health, and sociocultural contexts in shaping suicide risk in Iran.

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.

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Data Availability Statement

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Conflict of interest

The authors declare that there is no conflict of interests.

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