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Seasonality and time patterns in attempted suicide in Ilam province of Iran: An appraisal of current data of 2010 -2014

Yousef Veisani[1], Ali Delpisheh*[2], Kourosh Sayehmiri[3], Ghobad Moradi[4], Jafar Hassanzadeh[5]

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Abstract

Background: Seasonality in suicide has been investigated from the early 19th century to explore the productive environmental variables. Seasonality studies can provide information on prevention and interventions in suicide. In this study, we examined seasonality in suicide and aimed to explore the differences in seasonality between rural and urban areas, mental disorders, and genders.

Methods: In this cross-sectional study, overall identified suicide cases in Ilam province from 21 March 2010 and 11 December 2014 were identified, using systematic registration suicide data (SRSD). Two methods were used separately to analyze seasonality (Chi-square, Edwards' T). Seasonal effect (peak/ trough seasons) and (deaths/ attempts suicide) was explored by ratio statistics. The null hypothesis was that the completed suicides in each method group were evenly distributed over a year.

Results: Significant seasonality was observed in suicide during the study period, with one peak in the spring and one in the winter. Our results showed that suicide seasonality following mental disorders was statistically significant with a peak in the spring, regardless of other factors such as gender and age. When all non- mental suicides are taken into account, the seasonality remains statistically significant, but the peak season is shifted to autumn.

Conclusion: Investigating suicide in Ilam revealed a significant seasonality for both rural and urban areas, which was greater in the urban part. A significant seasonality in suicide was observed in attempters with mental disorders. In suicide attempters with mental disorders, findings showed two peaks in the spring and the autumn.

Keywords: Seasonality, Suicide, Mental disorders, Ilam, Iran

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Introduction

Suicide is one of the ten leading causes of death in Western countries, and the second leading cause for individuals between the ages of 15 and 19 years (1). Not surprisingly, 84% of all emerging cases will do so in low- and middle-income developing countries (2). Epidemiological studies have investigated geographical variations in suicide in an effort to identify additional explanatory variables (3,4).

Seasonality is thought to have a major role in suicide attempts (5). This is supported by increasing number of studies suggesting a relationship between seasonal change and suicidal risk (6) with a spring peak for both genders (7-9). A seasonal distribution, highest during the spring months and lowest in the autumn, was found among men attempting suicide by violent methods (10). Durkheim further revealed the interplay between seasonal variations and an urban or rural setting (11). Although the implications of season on suicide are unclear, several models have considered additional factors such as personality traits, genetic makeup, and socio-political influences (12).

Corresponding author: Dr Ali Delpisheh, alidelpisheh@yahoo.com

1. Psychosocial Injuries Research Center, Ilam University of Medical Sciences, Ilam, Iran.
2. Department of Clinical Epidemiology, Ilam University of Medical Sciences, Ilam, Iran.
3. Social Medicine Department, Ilam University of Medical sciences, Ilam, Iran.
4. Social Determinants of Health Research Center, Kurdistan University of Medical Sciences, Sanandaj, Iran.
5. Research Center for Health Sciences, Department of Epidemiology, School of Health, Shiraz University of Medical Sciences, Shiraz, Iran.

↑What is "already known" in this topic:
Suicide attempt is related to some of factors among them seasonality, personal traits, living area (rural/urban), and socio-demographic variables are mentioned in earlier studies. In Iran, Western provinces have been reported to have high rates of suicide of which Ilam has had the highest rate.

→What this article adds:
The effect of seasonality on suicide attempters in urban and rural areas in Ilam province was confirmed with one peak in the spring and one in fall. However, it highly correlated with mental disorders. Considering all variables, the rate of suicide in urban areas of Ilam was higher than that of rural regions.

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Studies on suicide in Iran revealed that the majority of the attempts originated in the urban areas (13,14). A recent systematic review focusing on seasonal variation found that most suicide cases were committed in the spring and summer seasons (15).

The two leading models for explaining the effect of seasons on suicide are the bioclimatic and sociodemographic models. The bioclimatic model analyzes the ways in which climate-related and environmental factors, such as heat, influence the springtime peak in suicide rates, which is similar to our findings of an increased excitability in the nervous system. The sociodemographic model proposes that the spring peak is a consequence of increased occupational and public activity (16). The sociodemographic view is most closely associated with and supported by trends in rural communities, where public and occupational activities are connected to seasonal change (17).

Ilam located in the West of the Iran, bordering Iraq, covering an area of 19,086 square kilometers, with the population of approximately 600,000 (2015 estimate)) has a first rank of suicide rate (19.45 per 100,000 people) among 31 provinces in Iran (18). This study, with representative and fresh data aimed to examine seasonality in suicide. As the second objective, it explored the differences in seasonality between the rural and urban areas, mental disorders, and genders.

Methods

Data

In this cross-sectional study, overall identified suicides were extracted from the systematic registration suicide data (SRSD). SRSD system is supported by Ilam University of Medical Sciences since 2010. In SRSD, suicide data are collected daily from medical centers and updated monthly by data from the Center of Province Forensic Medicine to confirm and compare a completed suicide cases. Overall, 546 suicide deaths and 6,818 attempted suicides from 21 March 2010 and 11 December 2014 were recruited. The data for this study consisted of all suicide attempts in Ilam province by residents aged six years and older who were admitted to the healthcare centers during the study period. In SRSD, suicide attempts were determined through the analysis of the physicians' claims and hospital admission records, as well as the daily suicide counts according to a structured schedule, which involved nine items: Age, gender, marital status, educational level, job status, partners' job status and educational level, region of residence, race, and other demographic information. Data concerning mental disorders, addiction, methods of suicide attempt, and outcome were collected from individual outpatient visits on a monthly basis.

Statistical Analysis

The following definitions for seasons were used in this study: Winter (December–February), spring (March–May), summer (June–August), autumn (September–November). Seasonal effect (peak/ trough seasons) was explored by ratio statistics. The null hypothesis was as follows: The completed suicides in each method group are evenly distributed over a year. Two methods were separately used to analyze seasonal variation in suicide in this study. The first was the seasonal distribution between the proportions of suicides; and the second was mental disorders and non- mental disorders. Rural-Urban subgroups, and genders was tested with the x^2 -test for independence. The following equation was used to calculate x^2, where x_i refers to the number of suicide cases in month i (1, 2, 3 …12) and x_E is the number of suicides expected for every month.

$$X^2 = \sum_{i=1}^{12} \frac{(x_i - x_E)2}{x_E}$$

The other test of seasonality was Edwards' test. This procedure has been used commonly in suicide in previous studies (14, 19). Edwards test shows the distribution of suicide in a 12-month period, with a peak and one trough by simple harmonic curve. The statistic for Edwards T was calculated through the following equation:

$$T = \frac{(8 \sum_{i=1}^{12} Ni) \times ((\sum_{n=1}^{12} \sqrt{Ni}\, sin\, \theta i)2 + (\sum_{i=1}^{12} \sqrt{Ni}\, cos\, \theta i)2)}{(\sum_{i=1}^{12} Ni)\, 2}$$

In Edwards T, N = suicide cases by month, I = month (1, 2, 3… 12), θi = (2i-1)π/12. For instance, a chi-square distribution with a degree of freedom of 2 at the p = 0.05 level was 5.99, and if Edwards' T approaches to higher than 5.99, it indicates significant seasonality at a significance level of α = 0.05 (20).The statistical software package was Stata for Windows Version 11.2.

Results

The total number of suicide attempts in the study period was 6,818; the ratio of completed into committed suicide was 0.08 (95%CI: 0.073-0.086). We found that suicide death in rural areas, 0.10, (95% CI: 0.092-0.122) was higher than the urban areas, 0.07, (95% CI: 0.064-0.076), which represents the use of violent suicide methods in rural areas. The excess significant death from suicide was observed in attempters with mental disorders, 0.09 (95% CI: 0.050-0.070) compared to attempters with no mental disorders, 0.06 (95% CI: 0.081-0.098. Suicide death for males and females were 0.08 (95%CI: 0.071-0.090) and 0.07 (95% CI: 0.070-0.088), respectively. Although suicide death was higher in males, this difference was not statistically significant (p=0.3).

The results of this study revealed that the number of suicide attempts in rural and urban areas fluctuated by season; the number was highest in spring/autumn for both genders, and in the rural areas the highest seasons were spring/summer in both genders. Rural suicide by gender exhibited significant seasonal variations (male p=0.004, female p=0.003) and there was no significant seasonality in urban suicide by gender (male p=0.113, female p=0.066). Suicide data in years 2010 to 2014 revealed that suicide following mental disorders showed statistically significant seasonality with a peak in springs, regardless of other factors such as gender (p=0.001). When all non-mental suicides were taken into account, the seasonality

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Table 1. Suicide Attempts and Seasonality by Residence, Age Group and Mental Disorders in Ilam, Iran between 2010 and 2014 (n=6,818)

Variable	Category	Male			Female		
		Suicide attempt n (%)	P(χ2)	P (Edwards Test)	Suicide attempt n (%)	P(χ2)	P (Edwards Test)
Residence	Rural	710(22.4)	0.004	0.061	921(34.6)	0.003	0.011
	Urban	2447(77.5)	0.113	0.798	2740(65.4)	0.066	0.061
Mental Disorder	Yes	1967(62.3)	0.113	0.485	1965(53.6)	0.033	0.011
	No	1190(37.7)	0.002	0.513	1696(46.4)	0.001	0.061
Age (yrs)	<20	62(1.9)	0.003	0.043	94(2.5)	0.003	0.043
	20-29	1792(56.7)	0.003	0.032	1990(54.3)	0.004	0.058
	30-39	1035(32.7)	0.002	0.032	1150(31.4)	0.004	0.061
	40-49	164(5.2)	0.001	0.045	251(6.8)	0.003	0.042
	50-59	68(2.3)	0.001	0.011	110(3.0)	0.003	0.063
	≥60	36(1.2)	0.002	0.061	66(2.0)	0.004	0.052

Table 2. Suicide Death and Seasonality by Residence, Age Group and Mental Disorders in Ilam, Iran between 2010 and 2014

Variable	Category	Male			Female		
		Suicide Death n (%)	P(χ2)	P (Edwards Test)	Suicide Death n (%)	P(χ2)	P (Edwards Test)
Residence	Rural	90(35.2)	0.023	0.032	86(29.7)	0.033	0.011
	Urban	165(64.8)	0.022	0.525	205(69.3)	0.033	0.061
Mental Disorder	Yes	140(24.9)	0.115	0.241	121(41.6)	0.033	0.025
	No	115(75.1)	0.03	0.522	170(58.4)	0.022	0.078
Age (yrs)	<20	6(2.3)	0.044	0.048	3(1.0)	0.044	0.026
	20-29	107(41.9)	0.044	0.036	122(42.2)	0.033	0.096
	30-39	102(40.0)	0.022	0.028	84(29.0)	0.033	0.068
	40-49	17(6.6)	0.022	0.036	32(11.0)	0.044	0.036
	50-59	15(5.9)	0.011	0.012	30(10.3)	0.055	0.055
	≥60	8(3.3)	0.033	0.058	20(6.5)	0.033	0.069

remained statistically significant, but the peak season shifted to autumn in 2010, 2011, and 2012. According to the monthly distribution, the peak months seemed to be in May and September, while the trough was typically in March and October (Table 1).

Table 2 demonstrates the results of the seasonality tests and the peak/low ratios for suicide death from 2010-2014. Urban suicide in all years exhibited significant seasonal variations, with a peak in the spring and lowest in the winter (p=0.022).The peak and trough seasons were observed in rural areas (0.032) in the spring and winter, respectively, with significant seasonality. As Significant seasonality was observed in all age groups for both males and females, with minimal gender differences. Seasonal variation was more evident in younger groups, especially for female suicide **(Table 2)**.

When we calculated seasonality by month in all suicide attempts and suicide death, we found that the peak in the spring was in the month of May, the peak in the autumn was in September and the peak months for death from suicide in attempters were in March, October and January **(Figs. 1, 2)**. According to the monthly distribution, the peak months in the rural areas seemed to be May in the spring and November in the autumn; a similar trend was observed in the urban areas, but with triple peak in May, September and November **(Fig. 3)**. In non- mental disorders attempters and attempters with mental disorders, the peak months were mostly May, September and November. Similar distribution of suicide attempts was observed in males and females, but the distribution in females was bimodal **(Fig. 4)**.

Discussion

A review of the literature revealed disparities between recorded suicide rates in Ilam province and the national reports (21). A national analysis also revealed that Western provinces including Ilam, Kermanshah, and Hamedan had the highest rate of suicide in Iran, with the rates of 20, 14, and 10, respectively per 100,000 people between the years 2006 and 2010 (18,21-23). In addition, suicide rates in the recent years (2006–2010) revealed a higher annual percentage change (APC) in Ilam (+10%) compared to other provinces (18). Based on the SRSD, the overall suicide rate in Ilam was 19.54 per 100,000 persons between the years 2010 and 2014; the likely explanation for this rate could be the low economic development, extensive regional war zones (1980- 1986), and dominance of traditional culture (24).

Data regarding suicide attempts by month suggest that the spring peak occurred in May and the autumn peak was in September, whereas the peak months for suicide death were March, October, and January. In general, suicides peaked in springtime and early summer, and platitude in the autumn and winter months. Several studies indicated that patterns or springtime and autumn peaks were more common in Western countries (11,14). Aside from cultural differences between the Eastern and Western societies, seasonal variations are more prevalent among the elderly in rural areas in countries with geographically higher latitude, and among individuals who use violent methods such as jumping from high places or hanging (12). Subsequent findings in the recent years have shown a decreasing trend of seasonal variations in both suicide attempts and suicide deaths (16) although not all data are consistent (17).

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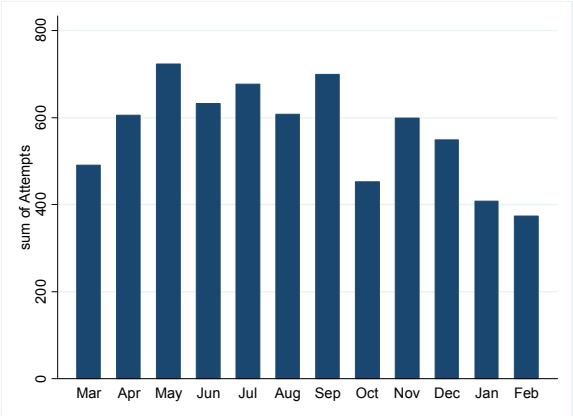


Fig. 1. Aggregated Monthly Frequencies of Suicide Attempts in Ilam Province, Iran, between 2010 and 2014

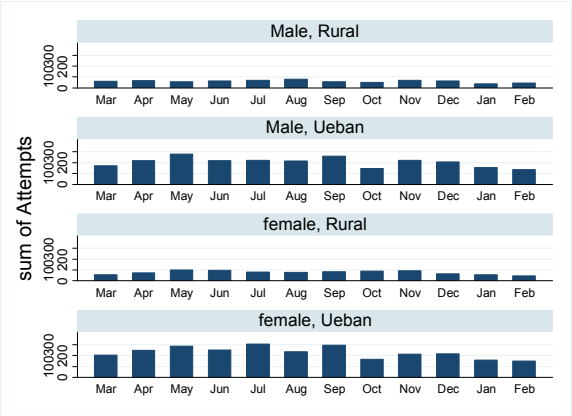


Fig. 3. Monthly Suicide Percentages in Ilam, Iran, by Gender and Residence, 2010–2014

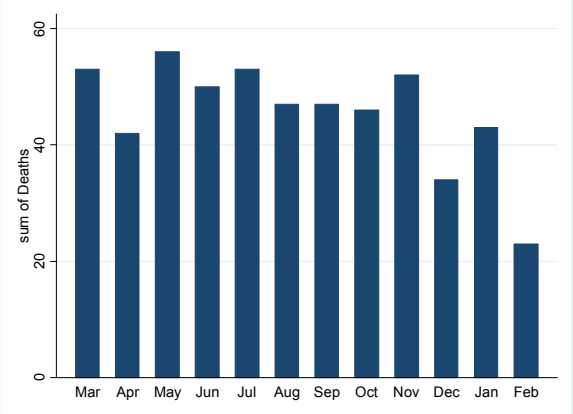


Fig. 2. Aggregated Monthly Frequencies of Suicide Death in Ilam Province, Iran, between 2010 and 2014.

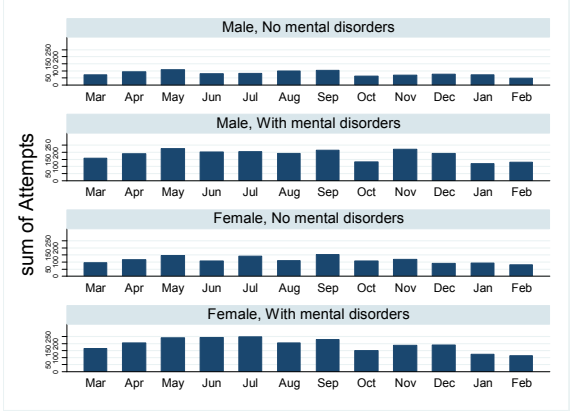


Fig. 4. Monthly Suicide Percentages in Ilam, Iran, by Gender and Mental Disorders, 2010–2014

We used SRSD to examine the effect of season on suicide attempts and deaths in Ilam province between 2010 and 2014. As anticipated, findings demonstrated significant seasonal variations in suicide deaths in the study period, with one or two peaks in the spring and late autumn, and one downturn in the winter. National data also revealed a similar pattern, indicating a peak in the springtime and a dip in the winter (25).

The effect of seasonal change on suicide has been demonstrated on a global scale as well. Since the early 19th century, seasonal variations in suicide attempts have been identified in most countries; however, researchers show inverse patterns in the Northern and Southern hemispheres (26). The results of this study challenged the previous findings (17) that reported an inverse relationship between suicide and temperature and implied that fewer suicide-related deaths take place in springtime and summer, and more occur in the winter and autumn.

Both rural and urban areas showed seasonal variation in suicide attempts although a greater seasonal effect was observed in rural areas. Basing his research on the sociological model, Durkheim illustrated the difference between rural and urban locations, demonstrating that variables effecting suicide are more prevalent in rural areas (24,27). A different result was obtained; it was found that seasonal effect on suicide was higher in urban areas than in rural regions in Italy (28). Simkin (2003) focused on suicide in rural groups such as farmers, but found no correlating seasonal effects, concluding that the joint effect of season and region on suicide involves several explanatory factors (27).

The results of this study revealed a similar distribution of suicide attempts among males and females. The research also discovered a bimodal distribution in the female population that was not consistent with the results in Western countries like England (14), which found more suicide attempts by males than females (15). Suicides by Italian females were more strongly associated with weather factors such as rainfall and temperature (29), an explanation for which might be that males tend to spend more time outside, whereas females generally have indoor jobs. Stress from temperature or heat in outdoor workplaces was relatively difficult to avoid for males, whereas Violani and Lombardo (2003) reported that males lack the ability to control their peripheral skin temperature to the extent that females are able (30).

Finally, in this study those with mental disorders and attempted suicide showed a peak in the spring and summer, especially in the summer. We investigated the presence of mental disorders in terms of seasonal variation in suicide and found a higher frequency in springtime deaths. Sever-

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al studies have examined the interplay between psychiatric disorders and seasonal change on suicide inclination (31); for example, Doganay et al. (2003) found that attempts by individuals who suffered from depression and suicidal tendencies tended to peak in the spring and the summer months, which was consistent to our findings (29). Other studies reported that mood disorder-prompted suicide attempts by both males and females tended to cluster on weekends, and highlighted that mental disorders may emerge as a result of seasonal variation and climate conditions, an effect on social and relational habits (4).

This study suffered from several limitations, including data reliability, underreporting, and generalizability. As a result of using self-reported data, we ran the risk of introducing bias into our analysis. In addition, the SRSD is often assumed to fall victim to underreporting; therefore, the proposed suicide rate was potentially underestimated in this study (32). Finally, while the SRSD system is available in the provincial capital of Ilam, other cities of the province cannot register data directly; therefore, the findings of this study may not be generalizable to larger populations. Nonetheless, the results of this study provide valuable insight into possible suicide prevention and intervention techniques. Further research is needed to examine the specific interactions between suicide, seasonal changes, urban and rural regions, gender, and mental disorders.

Conclusion

This study examined seasonal variation in suicide attempts and deaths, using recent data from 2010 to 2014 in Ilam province in Iran. Although seasonal changes appear to play a role in suicide attempt in both rural and urban areas, the effect seems to be greater in rural regions. Significant seasonal effects were evident in suicide victims who also suffered from mental illnesses, with attempts peaking in springtime and autumn months.

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Conflict of Interest

The authors declare that they have no conflicts of interest.

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