Seasonality in Violent and Nonviolent Methods of Suicide Attempts: A Cross-Sectional Study on Systematic Registry Data

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

[1] *Psychosocial Injuries Research Center, Ilam University of Medical Sciences, Ilam, Iran*

[2] *Department of Clinical Epidemiology, School of Health, Ilam University of Medical Sciences, Ilam, Iran*

[3] *Department of Biostatistics, School of Health, Ilam University of Medical Sciences, Ilam, Iran*

[4] *Social Determinants of Health Research Center, Kurdistan University of Medical Sciences, Sanandaj, Iran*

[5] *Department of Epidemiology, Research Center for Health Sciences, School of Health, Shiraz University of Medical Sciences, Shiraz, Iran*

Received:* 22 *Aug. 2016; Accepted:* 23 *Apr. 2017

Abstract- Little attention has been paid to seasonality in suicide in Iran. Time pattern in suicide deaths and suicide attempts for some related factors such as gender, mental disorders has been found. In present study, we focus on suicide methods and the association with seasonality and other putative covariates such as gender. Through a cross-sectional study, overall identified suicide attempts and suicide deaths in the province of Ilam from 1 January 2010 and 31 December 2014 were enrolled. We used Edwards' test for test of seasonality in suicide methods. Seasonal effect (peak/trough seasons) and (deaths/attempts suicide) was explored by ratio statistics, the null hypothesis being that the attempted suicides in each method group are evenly distributed over a year. More suicide attempts by hanging 29.4% and self-immolation 41.4% were observed in spring and differ by season pattern in both genders. The overall distribution of suicides by violent and non-violent methods was (males x^2=6.3, *P*=0.041, females x^2=7.7, *P*=0.021) and (males x^2=44.5, *P*=0.001, females x^2=104.7, *P*=0.001), respectively. The peak and trough seasons was observed in taking medications and self-poisoning for spring and winter. Suicide with alcohol was no differ by season pattern (x^2=1.0, *P*=0.460). Suicide in Ilam illustrates a significant seasonality for both violent and non-violent methods of suicide, in both genders, the two peaks were observed in spring and autumn for violent suicides, and spring and summer in non-violent suicides.

Acta Med Iran 2017;55(8):507-513.

Keywords: Seasonality; Suicide; Methods; Iran

Introduction

In the two recent decades, epidemiological studies reveal that more than 3-6% of the people attempted to suicide in the life span (1). Seasonality and time pattern in suicide deaths and suicide attempts and some related factors such as gender, mental disorders has been found (2). In addition, sex disparity showed in methods that chosen by attempters (3). Commonly, one peak in spring and early summer and bottoms out in autumn and winter months has been shown (4). Some studies indicates a peaks in spring and autumn in Western countries (5,6). Apart from the difference in Eastern and Western societies, seasonal variation are more evident in countries with geographically higher latitude, in the elderly people, in rural areas, among those who use violent methods (such as jumping from high places and hanging) (7,8). Other findings currently showed a decreasing trend of seasonal variations in suicide (9), but all data is not consistent (10).

Linkowski *et al.*, (1992) found a seasonal trend in suicide by violent methods, whereas suicide by nonviolent methods shows no clear (11). Analyzing of suicide method showed poison had a peak in spring for males. Add to this, for suicide by hanging or firearm had a bimodal distribution two peaks, one in spring and the other in autumn. Female had a bimodal distribution two peaks summer and autumn peaks for firearm method and spring and autumn peaks for suicide by poison and hanging (12).

Although causes for the seasonality in suicide in not clear, but some models such as personality factors,

Corresponding Author: A. Delpisheh
Department of Clinical Epidemiology, School of Health, Ilam University of Medical Sciences, Ilam, Iran
Tel: +98 843 2240404, Fax: +98 843 2240404, E-mail address: alidelpisheh@yahoo.com

genetic, and sociopolitical influences is discussed (13). Bioclimatic and socio-demographic model are two of main models for explain seasonality in suicide. In bio-climatic model climatic factors such as environmental heat increases the spring peak in suicide rates probably result of an increase in excitability of the nervous system. Socio-demographic model proposes that the spring peak is a consequence of increasing in occupational and public activity (14). Results of rural areas supported socio-demographic view because it is more expected that public and occupational activities that connected to seasonal changes (15).

Based on national reports Ilam have a first rank of suicide rate (19.45 per 100000 people) among 31 provinces in Iran (16-18). Since the investigation of seasonal variation can be providing evidence for suicide prevention and interventions (19).therefore we examine seasonality in violent and non-violent methods of suicide in Ilam, western Iran, 2010-2014.

Materials and Methods

Through a 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 have been 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 6818 attempted suicides from 21 March 2010 and 11 December 2014 were recruited. The data for the present study consisted of all suicide attempts in the Ilam province of Iran by residents ages six years and older who had admitted to healthcare during the period of study. In systematic registration suicide data (SRSD), suicide attempts were determined through the analysis of physician claims and hospital admission records, in addition to daily suicide counts according to a structured schedule which involved nine items: age, sex, 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. Suicide methods are mostly divided into two main categories: firearm, hanging, cutting and piercing with sharp objects, jumping from high places, and getting run over by train or other vehicles are classified as violent methods; while ingestion of pesticides, poison by gases, suffocation, and overdose are classified as nonviolent methods (14,20,21). In current study hanging, self-immolation (act or an instance of setting fire to oneself), self-harm (someone that deliberate injury to oneself), and firearm as the violent methods and self-poisoning by medications, alcohol, and chalk ingestion as the nonviolent methods (21).

Statistical analysis

The definitions for seasons in this study were used: 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 being that the attempted suicides in each method group are evenly distributed over a year. Test of seasonality in our study was Edwards' test; this procedure has been used commonly in suicide in previous studies (7,9). Edwards test shows the distribution of suicide in 12 month period with peak and one trough by the simple harmonic curve. 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 approximates higher than 5.99 indicates significant seasonality at a significance level of α=0.05.The statistical software package was STATA for Windows version 11.2.

Results

Table 1 shows the results of the seasonality tests of violent and non-violent methods of suicide attempts by genders. Of the total attempters, 8.8% of males and 4.2% of females used violent methods of suicide. Despite this low percent, 64.7% of deaths in males and 35.3% of deaths in females occurred result of violent methods. The number of violent suicide attempts fluctuated by season; the number was highest in spring/autumn for both genders. In non-violent methods, the highest were in spring/summer in both genders. The overall distribution of suicides by violent methods (males χ^2=6.3, P=0.041, females χ^2=7.7, P=0.021) and non-violent methods (males χ^2=44.5, P=0.001, females χ^2=104.7, P=0.001) differed significantly between seasons for both genders. 29.4% suicide attempts by hanging, and 41.4% self-immolation were observed in spring. Suicide attempts by hanging and self-immolation were differ by season pattern in both genders, (χ^2=8.03, P=0.01, χ^2=6.02, P=0.01) in males and (χ^2=6.29, P=0.01, χ^2=6.61, P=0.03) in females, respectively. The peak and trough season for taking medications method was observed in spring and winter. Also, same patterns

were observed for self-poisoning method. Against these we not found seasonal pattern for alcohol method (χ^2=1.0, *P*=0.460).

Table 1. Suicide attempts and seasonality by violent and nonviolent methods in Ilam, Iran between 2010 and 2014

		Males					Females				
		Suicide attempt (n=3157)	χ2		Edwards test		Suicide attempt (n=3661)	χ2		Edwards test	
			x^2	*P*	T	*P*		x^2	*P*	T	*P*
Violent	Hanging	137	8.03	0.01	7.45	0.001	77	6.29	0.01	11.25	0.001
	Self-immolation	92	6.02	0.01	6.33	0.018	241	6.61	0.03	4.16	0.021
	Self-harm	109	2.6	0.16	2.06	0.321	49	3.07	0.36	3.25	0.036
	Firearm	33	2.9	0.13	1.02	0.258	26	2.08	0.22	4.03	0.051
	All violent	371	6.3	0.04	8.05	0.003	393	7.70	0.02	6.45	0.001
Nonviolent	Taking medications	2440	6.23	0.01	6.12	0.033	2877	7.29	0.02	5.34	0.003
	poisoning	274	5.45	0.01	8.94	0.022	373	5.61	0.02	5.23	0.018
	Alcohol	51	1.02	0.46	1.28	0.242	9	1.34	0.14	1.66	0.261
	Chalk	21	1.02	0.35	1.66	0.245	9	1.91	0.23	2.75	0.142
	All non-violent	2786	44.50	0.001	11.09	0.001	3268	104.7	0.001	12.04	0.003

Table 2 shows the results of the seasonality tests of violent and non-violent methods in suicide death by genders. Seasonality was more evident especially in hanging and self-immolation in both genders. In non-violent methods, significant differences were observed by gender in all methods, except alcohol and chalk, across of season.

Table 2. Suicide death and seasonality by violent and nonviolent methods in Ilam, Iran between 2010 and 2014

		Males					Females				
		Suicide death (n=255)	χ2		Edwards test		Suicide death (n=291)	χ2		Edwards test	
			x^2	*P*	T	*P*		x^2	*P*	T	*P*
Violent	Hanging	64	3.03	0.03	6.45	0.032	33	3.39	0.04	6.22	0.034
	Self-immolation	75	4.03	0.02	5.33	0.025	183	4.61	0.04	4.12	0.025
	Self-harm	2	0	0	0	0	0	0	0	0	0
	Firearm	2	0	0	0	0	0	0	0	0	0
	All violent	143	7.4	0.01	8.45	0.011	216	8.25	0.01	7.88	0.001
Nonviolent	Taking medications	72	4.01	0.04	5.12	0.049	53	6.11	0.04	6.66	0.026
	Poisoning	27	3.15	0.04	6.33	0.041	16	4.36	0.04	5.44	0.046
	Alcohol	1	0	0	0	0	0	0	0	0	0
	Chalk	12	5.02	0.02	6.25	0.036	6	4.88	0.04	4.22	0.036
	All non-violent	112	4.74	0.01	11.04	0.012	75	9.01	0.05	7.22	0.055

Analysis of data revealed that taking medications (78.0%) and self-poisoning (9.5%) were the most common methods for suicide. Other common methods included self-immolation (4.9%), hanging (3.1%), self-harm (2.3%), alcohol (0.9%), firearm (0.9%), and chalk (0.4%). Taking medications accounted about 87.6% of all nonviolent suicides among males and over 88% of female non-violent suicides. Nonetheless, only 2% of those who had attempted suicide by taking medications had eventually died. In other methods, 44% of those who used a self-immolation, 38% of those who poisoned themselves with chalk, and 31% of those who hanged

themselves had died (Figure 1). In the violent methods, males used hanging as a suicide method in about 36% of the cases. On the other hands, females used hanging about 19%. Females had a much higher 25 percentage committing suicide by self-immolation when compared with males.

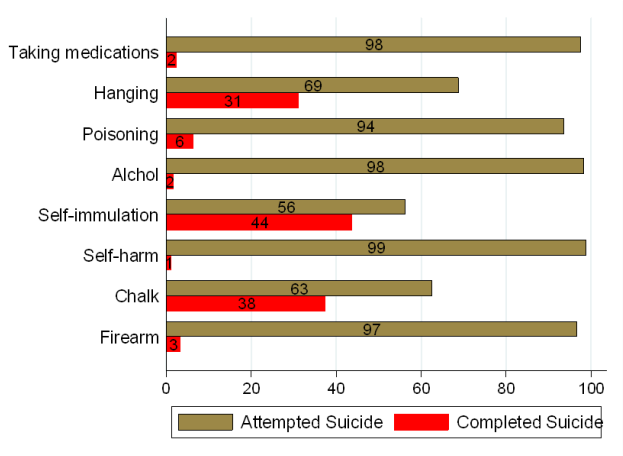

Figure 1. The methods of suicide (percentages show the proportion of completed suicide and attempted suicide for each method in all cases of suicide), Ilam province, Iran between 2010 and 2014

When we calculated seasonality by month in all suicide attempts by violent and not violent methods the peak in spring was May, and the peak in autumn was September in nonviolent methods. Results for violent methods showed the peak months for attempts from suicide were in May, June, and July. According to the monthly distribution, suicide death by violent and not violent methods the peak months in non-violent seemed to be Mars in spring and November in autumn season, similar trend observed in violent methods but with triple peak in May, October, and November (Figure 2).

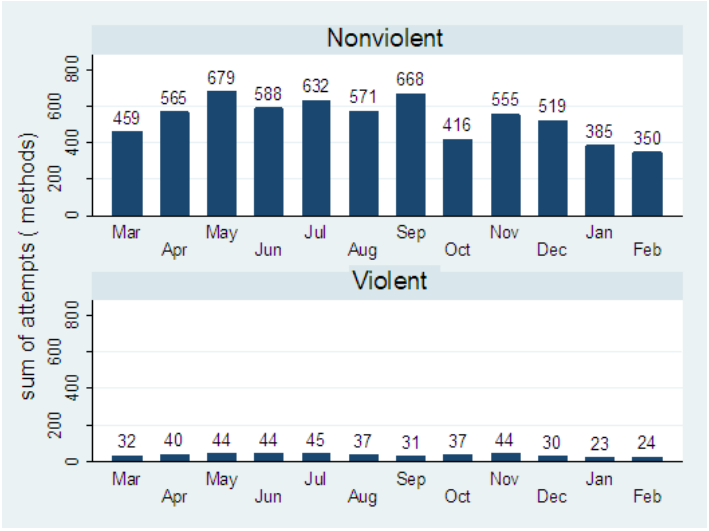

Figure 2. Monthly suicide attempts in Ilam, Iran, by violent and nonviolent methods, 2010-2014

Discussion

We examined seasonality in suicide attempts using SRSD, Ilam province, Western Iran for the time period 2010–2014. As anticipated, results have shown significant seasonal variations in suicide. In the present study, the highest peak was observed in spring. In the

violent suicide attempts, the numbers were highest in spring/autumn for both genders, and the highest were in spring/summer in both genders for nonviolent methods. This is consistent with several studies that have reported a suicide peak in spring (22,23). Our results challenge some previous reports (24) that reported the converse relationship between suicide and temperature that implies that lower deaths take place in spring and summer and higher suicide deaths occur in winter and autumn.

From the past, most divergent findings on seasonality in suicide have been reported on suicide method. In the earliest reports about seasonality in suicides, suicide by hanging was significant (25) but no seasonality in suicide by poisoning. In the latter studies, since that non-violent suicide was defined as poisonings, had shown that seasonality in non-violent suicide is different compared to violent studies (11,26). In subsequent studies, seasonality on suicides methods has been reported in Italy (3,27) and in Finland (8).

Some biological aspects such as age and gender were evaluated to examine of seasonality pattern in suicide by age and gender. Our results showed that the number suicide attempts were highest in spring/autumn in violent methods and spring/summer in non-violent for both genders. When we have focused on finding in specific methods by gender results are not different, for example,

The Same pattern was observed in self-immolation in both genders. Preti and Miotto (1998) found that seasonal patterns in hanging and drowning in both genders, jumping from height in mans, poisoning in women (27).

When we have examined seasonality by age in different methods, interesting finding is that in younger age groups (16-25, and 26-35 age groups) have a clear peak in spring but in older groups (36-45, and 46-45 age groups) generally have a peak in autumn. In addition, non-violent suicides were more evident, especially in younger groups. Although the reason for this phenomenon is not clear, it might be related to the academic failure and stress among students that occur more frequently in spring when most important exams are conducted. Especially national college entrance examination (konor) in Iran that can virtually determine the candidates' future for a college entry exists (30).

Our findings showed significant seasonal variations in suicide by hanging, self-immolation, taking medications, self-poisoning, and chalk with one or two peaks in spring and late autumn and one trough in winter. Consistent with this, Lester (1999) (28) and Ajdacic-Gross *et al.,* (2003) (9) found a seasonal variation in hanging, jumping from height and drowning but not in other methods. In other results, we not found seasonality in self-harm, firearm, and poisoning by alcohol. Rasanen *et al.,* (2002) (29) found no seasonality in firearm, and an unclear pattern in poisoning suicides was reported in Finland that consistent with our finding. Seasonal distributed within the seasons showed the timing of the peaks differs between the methods in this study, more suicide attempts by hanging and self-immolation in spring. The peak and trough seasons were observed in tacking medications and self-poisoning for spring and winter (30).

The present study suggests that over 12% of both genders who committed suicide in Ilam during 2010-2014 choose a violent method. Hanging was the majority of violent methods among males and self-immolation was common means in females. Taking medications was the most common means for non-violent suicide in both genders. When compared to other national reports, the attempters in Ilam seem to use more violent methods in committing suicide. This is apparent from a recent study (Afghah *et al.,* 2014) where the percentage in violent suicide means for males and females in sari similar to our result (31).

There are limitations in our study. First, Underreporting has been also a concern in the SRSD, and the suicide rate is very likely to be underestimated (32). Second, the SRSD system is available in the provincial capital of Ilam province, and other cities of the province cannot register data directly therefore under reporting may be accrued. This may negatively affect the generalization of the findings in this study.

In conclusion, this study shows that the violent and non-violent suicide attempts fluctuated by season, the number was highest in spring/autumn for both sexes in violent methods, and the highest were in spring/summer for both sexes in nonviolent methods. Suicide attempters that are using violent methods have very high completed suicide risk (47%) from the nonviolent methods (3.1%). We found non-violent suicides were more evident seasonality especially in younger age groups and showed a clear peak in spring but in older groups generally, have a peak in autumn. Seasonality was observed in specific methods by hanging, self-immolation, taking medications, self-poisoning, and chalk with one or two peaks in spring and late autumn and one trough in winter.

Acknowledgments

We would like to thank Vice-chancellor of Research and Technology of Ilam University of Medical Sciences for financial support of this study.

References

1. Kessler RC, Borges G, Walters EE. Prevalence of and risk factors for lifetime suicide attempts in the National Comorbidity Survey. Arch Gen Psychiatry 1999;56:617-26.
2. Petridou E, Papadopoulos FC, Frangakis CE, Skalkidou A, Trichopoulos D. A role of sunshine in the triggering of suicide. Epidemiology 2002;13:106-9.
3. Preti A, Miotto P. Influence of method on seasonal distribution of attempted suicides in italy. Neuropsychobiology 2000;41:62-72.
4. Veisani Y, Delpisheh A, Sayehmiri K, Moradi G, Hassanzadeh J. Associations of Suicide Seasonality with Rural- Urban Residence and Mental Disorders in Ilam, Iran. Iran J Med Sci 2016;41:461-2.
5. Parker G, Walter S. Seasonal variation in depressive disorders and suicidal deaths in New South Wales. Br J Psychiatry 1982;140:626-32.
6. Ho TP, Chao A, Yip P. Seasonal variation in suicides re-examined: no sex difference in Hong Kong and Taiwan. Acta Psychiatr Scand 1997;95:26-31.
7. Ajdacic-Gross V, Bopp M, Ring M, Gutzwiller F, Rossler W. Seasonality in suicide – A review and search of new concepts for explaining the heterogeneous phenomena. Soc Sci Med 2010;71:657-66.
8. Hakko H, Rasanen P, Tiihonen J. Seasonal variation in suicide occurrence in Finland. Acta Psychiatr Scand 1998;98:92-7.
9. Ajdacic-Gross V, Wang J, Bopp M, Eich D, Rössler W, Gutzwiller F. Are seasonalities in suicide dependent on suicide methods? A reappraisal. Soc Sci Med 2003;57:1173-81.
10. Rocchi MB, Sisti D, Miotto P, Preti A. Seasonality of suicide: relationship with the reason for suicide. Neuropsychobiology 2007;56:86-92.
11. Linkowski P, Martin F, De Maertelaer V. Effect of some climatic factors on violent and non-violent suicides in Belgium. J Affect Disord 1992;25:161-6.
12. Lester D, Frank ML. Sex differences in the seasonal distribution of suicides. Br J Psychiatr 1988;153:115-7.
13. Brezo J, Paris J, Turecki G. Personality traits as correlates of suicidal ideation, suicide attempts, and suicide completions: a systematic review. Acta Psychiatr Scand 2006;113:180-206.
14. Jia C-X, Zhang J. Characteristics of Young Suicides by Violent Methods in Rural China. J forensic Sci 2011;56:674-8.
15. Oravecz R, Rocchi MBL, Sisti D, Zorko M, Marusic A, Preti A. Changes in the seasonality of suicides over time in Slovenia, 1971 to 2002. J Affect Disord 2006;95:135-40.
16. 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:e005227.
17. Veisani Y, Delpisheh A, Sayehmiri K, Moradi G, Hassanzadeh J. Suicide Attempts in Ilam Province, West of Iran, 2010-2014: A Time Trend Study. J Res Health Sci 2016;16:64-7.
18. Veisani Y, Delpisheh A, Sayehmiri K, Moradi G, Hassanzadeh J. Decomposing Socioeconomic Inequality Determinants in Suicide Deaths in Iran: A Concentration Index Approach. Korean J Fam Med 2017;38:135-40.
19. Seghatoleslam T, Habi H, Rashid RA, Mosavi N, Asmaee S, Naseri A. Is Suicide Predictable? Iran J Public Health 2012;41:39-45.
20. Lin HC, Chen CS, Xirasagar S, Lee HC. Seasonality and Climatic Associations with Violent and Nonviolent Suicide: A Population-Based Study. Neuropsychobiology 2008;57:32-7.
21. Sun S-H, Jia C-X. Completed Suicide with Violent and Non-Violent Methods in Rural Shandong, China: A Psychological Autopsy Study. PLoS One 2014;9:e104333.
22. Kalediene R, Starkuviene S, Petrauskiene J. Seasonal patterns of suicides over the period of socio-economic transition in Lithuania. BMC Public Health 2006;6:40.
23. Malakouti SK, Davoudi F, Khalid S, Ahmadzad Asl M, Moosa Khan M, Alirezaei N, et al.. The Epidemiology of Suicide Behaviors among the Countries of the Eastern Mediterranean Region of WHO: a Systematic Review. Acta Medica Iranica 2015;53:257-65.
24. Rotton J. Determinism Redux: Climate and Cultural Correlates of Violence. Environ Behav 1986;18:346-68.
25. Massing W, Angermeyer MC. The monthly and weekly distribution of suicide. Soc Sci Med 1985;21:433-41.
26. Maes M, Scharpé S, Verkerk R, D'Hondt P, Peeters D, Cosyns P, et al. Seasonal variation in plasma l-tryptophan availability in healthy volunteers: Relationships to violent suicide occurrence. Archiv Gen Psychiatr 1995;52:937-46.
27. Preti A, Miotto P. Seasonality in suicides: the influence of suicide method, gender and age on suicide distribution in Italy. Psychiatr Res 1998;81:219-31.
28. Lester D. Seasonal variation in suicide and the methods used. Percept Mot Skills 1999;89:160.
29. Rasanen P, Hakko H, Jokelainen J, Tiihonen J. Seasonal

variation in specific methods of suicide: a national register study of 20,234 Finnish people. J Affect Disord 2002;71:51-9.

30. Amiri B, Pourreza A, Rahimi Foroushani A, Hosseini SM, Poorolajal J. Suicide and associated risk factors in Hamadan province, west of Iran, in 2008 and 2009. J Res Health Sci 2012;12:88-92.
31. Afghah S, Aghahasani M, Noori-Khajavi M, Tavakoli E. Survey of suicide attempts in sari. Iran J Psychiatr 2014;9:89-95.
32. Dixon PG, McDonald AN, Scheitlin KN, Stapleton JE, Allen JS, Carter WM, et al. Effects of temperature variation on suicide in five U.S. counties, 1991–2001.. Int J Biometeorol 2007;51:395-403.