Comparative Study of Suicide Methods During 1991-2008 in the Ulaanbaatar Community

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Objectives: The purpose of our study is to compare the prevalence and the methods used for fatal suicidal behaviors among the population in Ulaanbaatar, Mongolia. **Methods:** A descriptive and retrospective study was conducted based on all data related to fatal suicidal behaviors among the Ulaanbaatar community through reanalysis of secondary data from two epidemiological studies. **Results:** Totally, 3498 fatal suicide cases were recorded among the Ulaanbaatar population in 1991-2008. Most of the fatal suicide cases (85.1%) were males and 71.6% of the total respondents strangled oneself for fatal suicide, making strangulation the most commonly-used suicide method. Fatal suicide cases due to acute alcohol intoxication (4.6%) or committing suicide while being drunk (3.0%) were recorded in 1991-2002, but were not recorded during 2003-2008. For the fatal suicide cases, being strangled from the *ger toono* accounted for 12.9% of the total strangulation cases and it was a specific characteristic for Mongolia. More 18-34 year-olds were registered as fatal suicide cases than other age groups (40.7% in 1991-2002 and 53.3% in 2003-2008). **Conclusion:** In Ulaanbaatar, the group most likely to complete suicide was 18-34 year-old males, therefore intervention strategies to reduce suicide in Mongolia should focus particularly on this group.

Keywords: Parasuicide, Self-Injurious Behavior, Self Mutilation, Mongolia

Introduction

Suicide is a serious mental and public health problem worldwide and in Mongolia [1, 2]. An important issue for researchers and mental public health officials is to seek effective intervention strategies for suicide prevention. Studies about the methods of suicide in relation to different cultural, ethnic, gender and age groups can provide useful information for developing an effective intervention and prevention program. Differences and similarities in suicide research occur between countries, target communities and study periods [3-5].

Empowering the global protection of human rights, Mongolia's government joined the Human Rights Declaration and Mongolia's Constitution affirms it by stating "every citizen shall be guaranteed the privilege to enjoy the fundamental right to live" [6]. Mongolia's Constitution serves to protect

Mongolians' freedom and right to live on its land and it is linked to the Declaration of Human Rights. However, the perception, idea and behavior of suicide have existed in communities from ancient days to the present day [7]. The ancient Greek-Roman medicine explained suicide in early times and later in 1878 Durkheim, the German sociologist, conducted the very first data-based study on suicide, making a valuable contribution to suicide study (suicidology) [8].

Over 20 years, nearly 4000 lives were lost through suicide in Mongolia. According to Annual Health Report, 14.2% and 15.7% of total external causes morbidity and mortality were death due to fatal suicidal behaviors in 2011 and 2013, respectively [9, 10]. Further, the number of fatal suicide cases increased 5.4 and 6.1-fold in 2011 and 2013, respectively [9, 10]. Deaths due to suicide are a huge loss for a country like Mongolia with a small population of just over 3 million.

The world suicide rate is defined by the number of suicide cases per 100,000 population and is considered low for under 10, medium for 10-20, and high for more than 30 cases. According to a World Health Organization (WHO) report, Mongolia is a medium suicide rate country with 15.5 cases per 100,000 population [11]. In addition, fatal suicidal behaviors are increasing worldwide, including in Mongolia. Prevention of suicidal behaviors amongst the population is an essential problem according to the WHO's objectives. Little is known about why the suicide rate has increased so rapidly in Mongolia over the last 20 years.

Suicide risk factors are very complex and interwoven. Therefore, we chose to focus on the lethality of the suicide methods used and their association with the increasing suicide rate. Spicer and Miller showed that the particular suicide method chosen is strongly linked to suicide completion [12]. Studies on suicide in Asia suggest that the availability of fatal suicide methods can increase suicide rates [11].

The objectives of this paper were to use data collected in Ulaanbaatar, the capital city of Mongolia, from 1991 until December 2008 to (1) comparatively analyze the lethality of suicide methods by calculating method-specific case fatality, (2) examine the relationship of sex and age to method-specific case fatality and (3) define changes over time in method-specific case fatality.

Materials and Methods

1. Data collection
Our team previously conducted two epidemiological research projects on fatal and non-fatal suicidal behaviors to determine the prevalence, some predisposing factors and methods used for fatal and non-fatal suicidal behaviours. These studies were a partnership between the Mongolian National University of Medical Sciences, the Ministry of Health and the WHO.

The first research project titled "Epidemiological study of completed or non-completed suicide among the Ulaanbaatar community" was conducted in 2003 and the research team consisted of surveyors from organizations related to registration and health care on suicidal behaviors. Data was collected in 2003 and analyses were made on selected records or patient histories for 5056 people who committed or attempted suicide among the Ulaanbaatar community during 1991-2002.

The second research project titled "Epidemiological study for fatal and non-fatal suicidal behaviors in Mongolia, 2003-2008" was conducted in 2009-2012. Data and local archive records were obtained from 21 aimag (provincial) health centers, particularly psychiatric-addiction care organizations; all local prosecution offices in rural areas; the Metropolitan Police Office; the Metropolitan Emergency Care Center; the Center of Treatment for Poisoning; the National Center of Trauma and Orthopedics; the Forensic Service Centre; the National Centre Against Violence; the National Centre for Mental Health; etc.

All data related to fatal suicidal behaviors among the Ulaanbaatar community from these two epidemiological studies were selected and secondary data was reanalyzed after the completion of these two studies. The study design is descriptive and retrospective. Fatal suicide methods were coded and classified according to the codes X60-X84 defined by the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10; World Health Organization, 1992) [13].

2. Statistical analysis
Data was entered, coded, and analyzed using SPSS software (version 21) including error review, descriptive statistics, and analysis. Basic characteristics of the study groups by age, gender, and number of cases were compared with chi-square test for the categorical variables. In this paper, "fatal episodes"

of self-harm means completed suicides. Case lethality for each method was estimated by dividing suicide deaths for that method by total cases involving the same suicide method. Analysis was performed by sex, age, and year. Data was divided into two periods chronologically due to the separate studies used (Table 1). Group-specific case fatality was non-normally distributed, hence the non-parametric tests Wilcoxon-Mann-Whitney and Kruskal-Wallis were used for analysis of the sex and age-group variables, respectively. For all tests, a p-value of <0.05 was considered statistically significant.

3. Ethical statement

The research proposal was reviewed and approved by the Academic Committee of the Mongolian National University of Medical Sciences on January 08, 2010 (№ 04/08-01). Ethical approval was obtained from Biomedical Ethics Committee of the Mongolian National University of Medical Sciences on June

05, 2015 (№16/3/2015-16). Data were collected only after the administrative approvals were obtained.

Results

5056 suicide cases were registered (fatal: n = 1766, 34.9%; non-fatal: n = 3290, 65.1%) in 1991-2002 and 4699 suicide cases (fatal: n = 1732, 36.8%; non-fatal: n = 2967, 63.2%) were registered in 2003-2008 among the Ulaanbaatar population. In total, 9755 attempted suicide cases were registered in 1991-2008 among the Ulaanbaatar population and of those 3498 cases completed suicide. Table 1 shows a summary of fatal episodes of self-harm. Overall, males completed suicide more than females and those aged 18-34 completed suicide more than other age groups. Also, used strangulation accounted for the majority (60.6-82.6%) of all suicide deaths in Ulaanbaatar during 1991-2008.

Table 1. Fatal episodes of self-harm in Ulaanbaatar during 1991-2008

Characteristic	First study period (1991-2002)		Second study period (2003-2008)		p-value
	n	%	n	%	
Sex					
Males	1438	81.4	1473	85.1	p<0.001
Females	328	18.6	259	14.9	
Age					p<0.001
<10	0	0.0	3	0.2	
10-17	146	8.3	89	5.1	
18-34	719	40.7	924	53.3	
35-54	395	22.4	563	32.6	
≥55	106	6.0	153	8.8	
Unclear	400	22.6	0	0.0	
Method					
Strangulation (X70)	1071	60.6	1431	82.6	p<0.001
Jumping from a height (X80)	219	12.4	130	7.5	
Firearm (X76)	106	6.0	13	0.8	
Used medical and chemical substances (X60-69)	99	5.6	70	4.0	
Sharp object (X78)	49	2.8	70	4.0	
Alcohol used cases (X65)	135	7.6	0	0.0	
Other methods (X84)	87	5.0	18	1.1	
Total	1766	100.0	1732	100.0	

Total episodes of fatal intentional self-harm rose from 40 in 1991 to 142 in 2008 among the Ulaanbaatar population. Fatal episodes (suicide deaths) increased from 6.9 in 1991 to 41.3 in 2005 then decreased to 13.77 in 2008 per 100,000 population. Figure 1 shows all fatal suicide cases in Ulaanbaatar from 1991-2008. The number of fatal suicide cases registered in 2005 and 2006 (n = 354 and 384, respectively), is 10 times greater than number of suicide cases in 1991 (n = 40). It should be noted that for years 1991-2008 suicide numbers might be incomplete because of an unsatisfactory suicide registration system. For all study years, males accounted for 81.4-85.1% of total fatal cases and females for 14.9-18.6%, resulting in a sex ratio of 3:1 (p ≤0.001).

As shown in Figure 2, case fatality varied between methods in much the same way for males and females, but the propotion of fatal cases was lower for females for every method besides the methods jumping from a height (23.7%) and used medical and chemical substances (15.1%). Fatal suicide cases due to alcohol poisoning (4.6%) or committed suicide while being drunk (3.0%) were recorded in 1991-2002, but deaths due to alcohol poisoning cases noted by fatal suicide cases was inappropriate. Fatal suicide cases due to alcohol poisoning or committed suicide while being drunk were not recorded during 2003-2008.
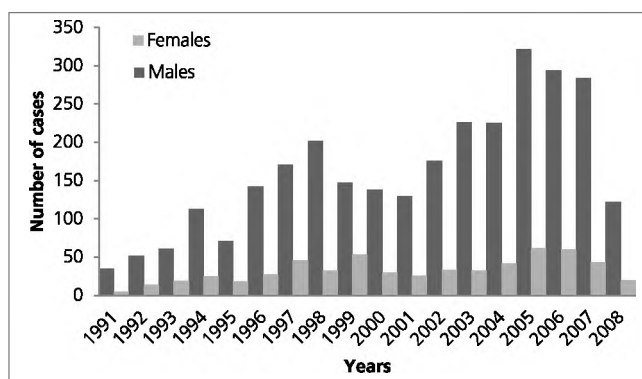

Figure 1. All fatal suicide cases among the Ulaanbaatar population in 1991-2008 subdivided by sex. Males completed suicide more often than females (*p ≤0.001).
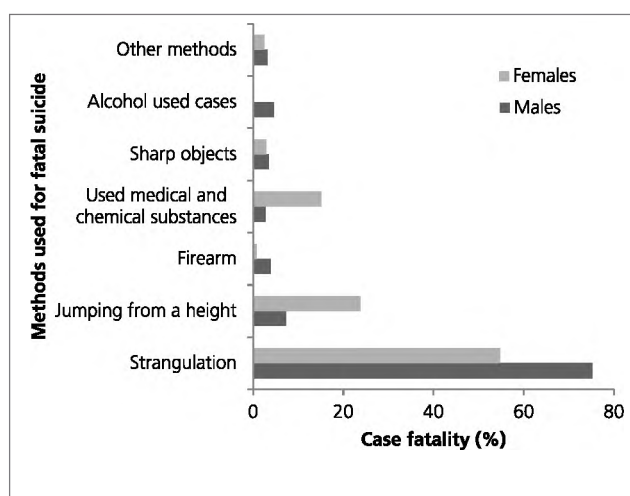

Figure 2. Method-specific case fatality by sex in Ulaanbaatar from 1991-2008. Differences between males and females are significant (Wilcoxon-Mann-Whithey test, p <0.05) for each method.

Table 2. Comparison of suicide methods overall and by male and female

Suicide method	Rate[a]	Case fatality (%)		Method-specific propotion of fatal cases	p-value
	Fatal episodes	Males	Females		
Strangulation (X70)	325.9	74.7	50.5	71.6	
Jumping from a height (X80)	45.5	7.3	23.7	10.0	
Firearm (X76)	15.5	3.9	0.8	3.4	
Used medical and chemical substances (X60-69)	22.0	2.8	15.2	4.8	p ≤0.001
Sharp object (X78)	15.5	3.5	2.9	3.4	
Alcohol used cases (X65)	17.6	4.6	4.4	3.8	
Other methods (X84)	13.7	3.2	2.5	3.0	
All methods	455.7	100.0	100.0	100.0	

[a]Fatal episodes are annual average rates per 100,000 in the Ulaanbaatar population for 1991-2008

Table 2 summarizes suicide methods by rate of fatal episodes, case fatality between males and females, and fatal case proportion for all study years. The differences between sexes are significant (Wilcoxon-Mann-Whitney test, p <0.05) for each method. The most lethal suicide method was strangulation (71.6%), followed by jumping from a height (9.9%), used medical and chemical substances (4.8%). Strangulation was statistically significantly higher compared to all other methods (p ≤0.001).
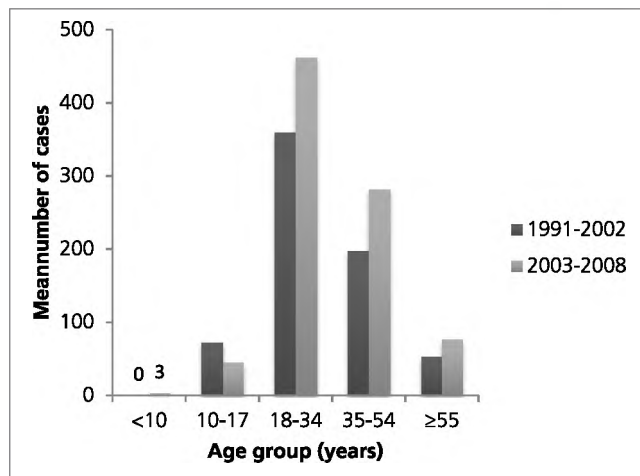

Figure 3. Mean number of fatal suicide cases in 1991-2008 years by age group.

The mean number of fatal suicide cases by age in both study periods is shown in Figure 3. Those aged 18-34 had more registered suicide fatalities than other age group cases (p ≤0.001, 40.71% in 1991-2002 and 53.34% in 2003-2008) and the majority cases were male. Furthermore, cases for those <10 years of age or ≥55 years of age were less than other age groups for both studies.

Table 3 summarizes fatal episodes by age. The data show that fatal episodes involving several methods increased with age group to a peak number at ages 18-34, then decreased with increasing age. Case fatality variation between age groups is significant for each method (Kruskal-Walls test, p <0.001).

Most suicide completers chose places and locations visible to others such as in a forest, street or outside. However, for strangulation many people completed suicide within their *ger* (traditional Mongolian home), specifically from the *ger toono*, which is the peak of the *ger* as shown in Figure 4. Particularly, 8.7% of total fatal suicide cases in 1991-2002, 17.1% in 2003-2008 and totally 12.9% (n = 453) were strangled oneself from the ger toono in 1991-2008.

Table 3. Method-specific results of intentional self-harm by age group in Ulaanbaatar from 1991-2008

Suicide method	Age group (years)												p-value
	<10		10-17		18-34		35-54		≥55		Total		
	n	%	n	%	n	%	n	%	n	%	n	%	
Strangulation (X70)	3	100.0	147	81.6	1253	73.1	696	72.4	403	63.0	2502	72.0	
Jumping from a height (X80)	0	0	14	7.8	225	13.1	67	7.0	43	7.0	349	10.0	
Firearm (X76)	0	0	1	0.6	40	2.3	57	6.0	21	3.0	119	3.0	
Used medical and chemical substances (X60-69)	0	0	14	7.8	88	5.1	37	4.0	30	5.0	169	5.0	p≤0.001
Sharp object (X78)	0	0	2	1.1	45	2.6	18	2.0	40	6.0	105	3.0	
Alcohol used cases (X65)	0	0	2	1.1	56	3.3	43	4.5	18	3.0	119	3.0	
Other methods (X84)	0	0	0	0	7	0.5	43	4.5	85	13.0	135	4.0	
All methods	3	100.0	180	100.0	1714	100.0	961	100.0	640	100.0	3498	100.0	

Figure 4. Outside and inside of the traditional Mongolian house or *ger.*

Discussion

The present study was an epidemiological examination of ICD-10 coded deaths which described, compared and analyzed the patterns of the six most frequent suicide methods by sex and age group in the Ulaanbaatar community. The data reported is based on the results of two epidemiological study projects that included a large number of fatal and non-fatal suicide cases that were registered among the Ulaanbaatar population. However, the sample sizes were unequal and all the parameters could not be compared between the two studies. Therefore, in the current article, methods of suicidal behavior as defined by WHO classification were used.

A total of 3514 fatal suicide cases were recorded at Ulaanbaatar police departments during 1991-2008, but the annual number of cases varied. One problem was that the records were incomplete and not sufficient as shown by the fact that the number of fatal suicide cases recorded by the police and the health organizations were different. This issue was related to an insufficient registration system for fatal and non-fatal suicide cases, preservation of archival documents, and lack of inter-sectorial cooperation [14].

According to the 66th Assembly of the WHO held in 2013, worldwide 804000 people died from fatal suicidal behaviors in 2012 but the data is incomplete [2]. In some countries, suicide is on the rise, in others, it is stable. For example, suicide mortality among middle-aged males has risen substantially during the 1990s in Japan and South Korea, but suicide rates for both Hong Kong and Singapore have varied only slightly over the last two decades remaining around 20 per 100,000 [15]. A major issue overall is that many countries have an insufficient registration system for fatal and non-fatal suicidal behavior cases. An annual global age-standardized suicide rate was of 11.4 per 100,000 people (15.0 for males and 8.0 for females) in 2014 [2]. Our study showed that men died more of suicide (81.4-85.1%) than women in Mongolia, which agrees with these worldwide results.

According to a WHO study, strangulation (50%) and self-harmed by shotgun and firearm discharge are the most-used methods for fatal suicide in developed countries and jumping from a high place is the most-used method in highly-urbanized countries, such as Hong-Kong, China and Singapore. [11]. Spicer and Miller revealed that strangulation, firearm and drowning were the most lethal methods and Varnik et al. found strangulation to be the most predominant method of suicide in 16 European countries [3, 12]. In fact, 54.3% of males and 35.6% of females in European countries died due to strangulation [3, 12].

As strangulation is universally available, it makes sense that it is the most common suicide method in many countries, however, there is considerable variability internationally [16]. A study of suicide methods in a large number of cases in United States and India revealed that India had a higher proportion of strangulation at 26% for males and 24% females, than in the United States at 18.2% for males and 16.2% for females [5, 17]. According to the WHO Suicide Trends in At-Risk Territories (START) study, strangulation was the most common method of suicide in all countries [18]. This method was particularly observable in Pacific Islands such as Fiji (78.0% of males, 72.5% of females), French Polynesia (85.0% of males, 82.1% of females), Guam (75.4% of males, 57.1% of females), and Tonga

(79% of males, 50% of females), and in the Philippines (77.2% of males, 75% of females) [18]. The current study in Ulaanbaatar showed that 71.6% of total respondents strangled oneself for fatal suicide, which is similar to the Pacific Island countries mentioned above.

Strangulation was the most commonly-used method in Ulaanbaatar (76.1%) followed by jumped from a height (10.0%) and used medical and chemical substances (4.8%). Other methods were not so common. For example, there were 106 cases of used firearms for fatal suicide in 1991-2002 and in 2003-2008, the number decreased to 13. Also fatal suicide cases due to acute alcohol intoxication (4.6%) or committed suicide while being drunk (3%) were low (1991-2002 data only) [1, 14].

Public health research has assessed age factors in suicide in the past, but has rarely gone beyond basic trend analyses. One such paper by McKeown et.al looked at suicides from 1970 through 2002 and showed that suicide risk generally increases with age in the United States [19]. In 2002, adolescents and young adults aged 15-24 had a suicide rate of 9.9 per 100,000, the lowest among the four age groups that were assessed [19]. The highest rate of 15.6 per 100,000 was observed in the oldest age group (≥65) [19, 20]. According to a WHO 2014 report, suicide accounts for 8.5% of all deaths globally among young adults 15-29 years of age and is ranked as the second leading cause of death (after traffic accidents) [2]. Among adults aged 30-49 years, it accounts for 4.1% of all deaths and is ranked the fifth leading cause of death. Remarkably, suicide accounts for 17.6% and 16.6% of all deaths for males and females, respectively, among young adults aged 15-29 years and represents the leading cause of death for both sexes in high-income countries and some countries of the South-East Asia Region [2]. The median age of death by suicide was found to be notably younger in Tonga (22 years), Vanuatu (21 years), and Guam (27 years) than in countries such as Australia (41 years) [2]. In all areas, the median age of suicide cases was between 24 and 37 [2]. As reported in the WHO START study, compared to Australia, China-Hong Kong SAR, New Zealand, and the Philippines, suicide cases were more often of a younger age in Pacific Island countries which has been attributed to vast social and cultural change, intergenerational conflict, unemployment, and lack of employment opportunities [18]. In Ulaanbaatar, age-group analysis for method-specific case fatality showed that

the 18-34 year-old age group has more registered fatal suicide cases than other age groups (40.71% in 1991-2002 and 53.34% in 2003-2008). Furthermore cases from the <10 or ≥55 age groups were less than other age groups, which is consistent with the global WHO data [2].

There are several limitations in our study. First, for fatal suicide cases, it was difficult to identify the causes that lead to fatal suicidal behaviors. Second, information about whether the completer was alcoholic or used alcohol for fatal suicide was limited. Third, the lack of a good registration system may introduce variance to the results. However, a strength of our study was that our data provided detailed information about the conditions and method of strangulation, which is information not provided in international studies.

In conclusion, totally 3498 fatal suicide cases and 6257 non-fatal suicide cases were recorded among the Ulaanbaatar population during 1991-2008. The method of "strangled oneself" was the most commonly-used among suicide completers in the Ulaanbaatar population. The group most likely to complete suicide was 18-34 year-old males, therefore, future intervention strategies should focus particularly on this group.

Conflict of Interest

The authors state no conflict of interest.

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References

1. Khishigsuren Z, Oyunsuren D. Country report of epidemiological study on fatal and non-fatal suicidal behaviors in 2003-2008. Ulaanbaatar, Mongolia; 2014. p 1-8.
2. World Health Organization. Preventing suicide: a global imperative. Geneva, Switzerland: World Health Organization; 2014. p 3-7.

3. Varnik A, Kolves K, van der Feltz-Cornelis CM, Marusic A, Oskarsson H, Palmer A, et al. Suicide methods in Europe: a gender-specific analysis of countries participating in the "European Alliance Against Depression". J Epidemiol Community Health 2008; 62: 545-551.

4. Tsirigotis K, Gruszczynski W, Tsirigotis M. Gender differentiation in methods of suicide attempts. Med Sci Monit, 2011; 17: PH65-PH70.

5. Elnour AA, Harrison J. Lethality of suicide methods. Inj Prev 2008; 14: 39-45.

6. The Mongolian State Constitution, Chapter 2, Article 16.1.

7. Gombosuren B. Ethics. Ulaanbaatar, Mongolia: ARVAI Print; 2008. p 129-131.

8. Marunyak SB. Suicidology. Arkhangelsk, Russia: Northern Federal University; 2010. p 5-7.

9. Health Development Agency. Annual Health Report 2011. Ulaanbaatar, Mongolia: MOH Press; 2012. p 62-63.

10. Health Development Agency. Annual Health Report 2013. Ulaanbaatar, Mongolia: MOH Press; 2014. p 88-90.

11. WHO. Suicide and suicide prevention in Asia. Edited by Hendin H Geneva, Switzerland: WHO Document Production Services; 2008. p 7-18.

12. Spicer RS, Miller TR. Suicide acts in 8 states: Incidence and case fatality rates by demographics and method. Am J Public Health 2000; 90:1885-1891.

13. WHO. International Classification of Diseases (ICD) [accessed on 6 May 2016]. Available at: http://www.who.int/classifications/icd/icdonlineversions/en/.

14. Tuya N, Byambasuren S, Khishigsuren Z, Tsetsegdary G. The Epidemiology of suicides among population in Ulaanbaatar city. Ulaanbaatar, Mongolia: ERKHES Print; 2003. p 8-13.

15. De Leo D, Evans R. International suicide rates and prevention strategies. Ashland, OH, USA: Hogrefe & Huber Pub; 2004. p 60-61.

16. Lester D. Changes in the methods used for suicide in 16 countries from 1960-1980. Acta Psychiatr Scand 1990; 81: 260-261.

17. Kumar S, Verma A.K, Bhattacharya S, Rathore S. Trends in rates and methods of suicide in India. Egyptian Journal of Forensic Sciences 2013; 3:75-80.

18. De Leo D, Milner A, Fleischmann A, Bertolote J, Collings S, Amadeo S, et al. The WHO START Study: Suicidal behaviors across different areas of the world. Crisis 2013; 34: 156-163.

19. McKeown RE, Cuffe SP, Schulz RM. US suicide rates by age group, 1970-2002: An examination of recent trends. Am J Public Health 1996; 96: 1744-1751.

20. Manion T, Akinyemi A, Nooraddini I, Haile E. Comparison of suicide characteristics and precipitating circumstances by age group among Maryland residents: Data from the Maryland violent death reporting system, 2003-2009. Suicidology Online 2012; 3:131-137.