International Journal of Gerontology 14 (2020) 179–184
https://doi.org/10.6890/IJGE.202008_14(3).0006

International Journal of Gerontology

journal homepage: http://www.sgecm.org.tw/ijge/

Original Article

Characteristics and Lethality of Suicide Attempters by Age Group in Korea: Retrospective Single-Centered Study

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ARTICLE INFO

Accepted 11 November 2019

Keywords:
age factors,
attempted suicide,
emergency departments,
preventative care,
retrospective study

SUMMARY

Background: Suicide is a major cause of death worldwide. While studies have been conducted on the predictors of suicide behaviors, these have not covered how lethality and the various predictors differ by age. We explored these age differences in the present study.
Methods: We retrospectively reviewed the medical records of suicidal patients in the emergency department (ED) of a university hospital in Seoul, South Korea, between September 2017 and August 2018. We extracted participants' data from the National Emergency Department Information System of Korea and their individual electronic medical records (EMRs), including demographic information (e.g., age, gender), details of their ED visit (e.g., suicide method), and medical history (e.g., physical illness, alcohol co-ingestion). We also used EMR data to complete the Risk-Rescue Rating Scale (RRRS).
Results: Of the 499 patients referred to the ED for suicide attempts, 427 were analyzed. We found that while younger participants were more likely to have repeated attempts, older participants' attempts were more likely to be fatal (e.g., higher RRRS risk scores and lower accessibility-to-rescue scores). After adjusting for demographics, older participants showed significantly higher scores on RRRS risk, impaired consciousness, and treatment required than younger participants.
Conclusion: Our findings clarified the characteristics of high-risk suicide attempters based onage, which could influence suicide-prevention policies (e.g., younger people tend to repeat suicide attempts, and thus may require continued surveillance). However, as older adults showed higher lethality and were more difficult to save, they may require suicide prevention coupled with social support interventions.

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1. Introduction

Suicide is one of the main causes of death throughout the world. Close to 800,000 people die due to suicide every year, which is one person every 40 seconds. In 2016, suicide accounted for 1.4% of all deaths worldwide, making it the 18th-leading cause of death in 2016.[1] Furthermore, in 2015, the suicide rate in Korea was 25.8 per 100,000 people, which was the second-highest among Organization for Economic Co-operation and Development (OECD) countries during the past 10 years.[2]

Epidemiological studies of individuals who attempted suicide have suggested that clinical risk factors have important implications for the severity of the act.[3] Clinical risk factors include presence of mental illness or physical illness, psychosomatic complaints of insomnia and headaches,[4] environment stress,[5] alcohol or drug abuse, ongoing interpersonal conflict and family history of mental illness or suicide.[6] In other words, some people at risk of suicide are in greater need of preventive care than others as there are clear differences among individual attempters. Although previous studies have reported that the factors associated with suicide lethality are multifaceted,[7] age is a well-established and well-understood risk factor for lethality.[8] A previous study found that middle-aged suicide attempters had relatively fewer relationship problems, and adolescent suicide attempters had comparatively fewer financial and medical problems in Asian society.[9] Therefore, age difference should be taken into consideration in the prevention and management of suicide attempts.

In addition, various kinds of studies on elderly suicide attempters have been conducted to identify their characteristic features using community-based, clinical, or nationally collected data.[10,11] Compared with other age groups, elderly attempter group has shown to have more affective disorders and major depressive episodes, and higher proportion of men.[12–14] Furthermore, in the elderly, physical illnesses and loss of social support are associated with a subjective decrease in well-being and self-esteem, and these psychosocial stressors are not only aggravating factors of previous psychiatric symptoms but also independent risk factors for psychiatric illness.[15] In contrast, resolution of stressful life event or participant was the only significant protective factor against suicide in young people.[16] Investigations of these differences can allow us to determine the best possible treatment and prevention strategies. However, there is little research comparing suicidal attempters of elderly with younger counterparts in Korea.

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In the clinical settings, the assessment of the seriousness of suicide is primarily attributed to the degree of lethality and intent. These two factors are commonly measured using psychological scales.[17] The most common scales used to assess suicide lethality are the Risk-Rescue Rating Scale (RRRS) and Self-Inflicted Injury Severity Form (SIISF). Especially, Kim et al. showed that the RRRS have a superior predictive ability for predicting suicide attempter's hospitalization in emergency settings than SIISF.[18] We assessed lethality by using RRRS, although there are few research which assessed lethality of suicide attempts by using RRRS in emergency setting.

Therefore, the aim of the present study was to explore the characteristics and lethality of the suicide attempters in the elderly, middle age and younger age in Korea. We hypothesized that each age group would have different characteristics and lethality of a suicide attempt.

2. Materials and methods

2.1. Study setting and participants

We retrospectively reviewed the medical records of patients who visited the emergency department (ED) of a university hospital in Seoul, Korea, between September 2017 and August 2018.

2.2. Data sources

Data of patients who visited EDs between September 2017 and August 2018 were extracted from NEDIS (National Emergency Department Information System) of Korea, which is a nationwide government system that has been in operation since 2003 and collects data from more than 150 Korean emergency centers. In Korea, patient information on the cause of ED admission is immediately reported to the NEDIS records. We analyzed the following variables provided by the NEDIS: patient demographic information (e.g., age, gender), injury intentionality, suicide method, initial mental status at ED, and disposition at ED.

After screening the NEDIS database, we reviewed the patients' electronic medical records (EMRs) to assess married status, whether living with or without family member, physical illness, psychiatric history, employment status, previous suicide attempt, and alcohol co-ingestion. Marital status was divided into married, unmarried, divorced, widowed, and unknown. Physical illness included any disease (e.g., hypertension, diabetes, cancer, arthritis, etc.) except psychiatric illness. Employment status was divided into three groups: employed, unemployed, and student or homemaker. In our medical center, the medical records of patients from 1993 to the present time can be accessed through the EMR system.

We also investigated the Risk-Rescue Rating Scale (RRRS) using information obtained from the EMRs. The scale assesses the lethality of a suicide attempt, defined as the probability of inflicting irreversible damage. It consists of 10 items: five items describe risk factors (i.e., method used, impaired consciousness, toxicity, reversibility, and treatment required) and five describe rescue factors (i.e., location, person initiating rescue, probability of discovery, accessibility to rescue, and delay until discovery). Higher risk-rating scores indicate more lethal suicide attempts, and higher rescue-rating scores mean less serious and more rescuable suicide attempts.

2.3. Statistical analysis

All statistical analyses were conducted using IBM's SPSS version 23.0 (SPSS, Chicago, IL, USA). To compare the distribution of the characteristics between each age group, we used a chi-squared test for categorical variables. The RRRS were compared using a one-way analysis of covariance regression analysis (ANCOVA) and a Scheffé test for post hoc. The RRRS scores were compared using the linear regression analysis for trends. In linear regression analysis, factors associated with impaired consciousness, treatment required or total risk point ($p < 0.001$) were included as covariates in the analysis of covariance (ANCOVA). ANCOVA was adjusted for gender, living alone/with others, and employment status. When the overall F value was significant, the post hoc test was performed using Bonferroni's correction method. Statistical significance was set with the p value at less than 0.05.

2.4. Ethics statement

The study was reviewed and approved by the Institutional Review Board and Ethics Committee at Ewha Womans University College of Medicine, and the need for patients' informed consent was waived.

3. Results

A total of 55,273 patients presented to the single emergency department (ED) of a university hospital during the 12-month period between September 2017 and August 2018. Of these, 499 patients had been referred to the ED for suicide attempts. Of these, four patients were excluded because their ED visits were ruled as not due to a suicide attempt in the final chart review. Sixty-eight patients were excluded from the study due to incomplete data. Finally, a total of 427 individuals were examined in this study (Figure 1).

The demographic and clinical characteristics of the 427 patients who attempted suicide are shown in Table 1. The patients were divided into four groups according to age. The average ages of these groups were 19.5 ± 2.8, 33.8 ± 5.8, 53.5 ± 5.7, and 76.6 ± 7.6 years old. Among the four age groups, there were significant differences in gender ($p = 0.019$), married status ($p < 0.001$), live alone ($p = 0.043$), employment status ($p < 0.001$), alcohol co-ingestion ($p < 0.001$), previous suicide attempt ($p < 0.001$), and any physical illness ($p < 0.001$). Only in the age group 65 years old and over were there more male subjects (50.8%) than female subjects (49.2%). The

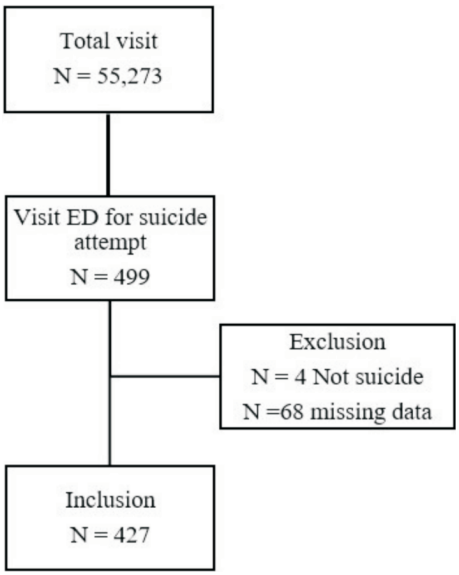

Figure 1. Flow chart of enrolled study subjects.

proportion of employment was highest in the age group 25–44 years old (49.7%). The age group under 24 years old showed the highest percentage of subjects with at least one previous suicide attempt (57.7%). There were no significant differences among the four groups regarding presence of the psychiatric history (p = 0.067).

Of the 427 patients, there were differences in suicide method (p < 0.001) and disposition of ED (p < 0.001) according to age (Table 2). Intoxication was the most common method in all the age groups. The proportion of wrist-cutting attempts was the second-highest in the age groups under 24 and 25–44 years old group, but hanging attempts were the second-highest in the age groups 45–64 and 65 years old and over. Discharge from the ED was lowest in the age group 65 years old and over (39.7%), but hospitalization to the intensive care unit (ICU) was the most frequent in the same age group (46.0%). In addition, 4.8% of the subjects in the age group 65 year old and over died in the emergency room — the highest rate among the four age groups.

The RRRS of each of the age groups is shown in Table 3. Among the risk factors, there were statistically significant differences among the age groups for RRRS scores, total risk-rating points, impaired consciousness, and treatment required (p < 0.001). Also, accessibility to rescue in the rescue factors showed differences by age group (p = 0.047). In addition, RRRS, risk score, impaired consciousness, and treatment required increased as the age increased (p_{trend} < 0.001).

Total risk-rating point (p = 0.008), impaired consciousness (p < 0.001), and treatment required (p < 0.001) were significantly associated with the age groups even after adjustment for gender, live alone/with others, and employment status (Table 4). The post hoc test using Bonferroni's correction showed that the age groups under 24 and 25–44 showed a significant difference in risk point (p < 0.05),

Table 1
Demographic and clinical variables of suicide attempters, comparing age groups.

Variables	≤ 24 N = 97	25–44 N = 153	45–64 N = 114	≥ 65 N = 63	p value
Mean age	19.5 ± 2.8	33.8 ± 5.8	53.5 ± 5.7	76.6 ± 7.6	
Sex					0.019
Male	28 (28.9%)	47 (30.7%)	37 (32.5%)	32 (50.8%)	
Marriage status					< 0.001
Unmarried	97 (100%)	79 (51.6%)	16 (14.0%)	1 (1.6%)	
Married	0 (0%)	57 (37.3%)	73 (64.0%)	41 (65.1%)	
Divorced	0 (0%)	13 (8.5%)	18 (15.8%)	5 (7.9%)	
Widowed	0 (0%)	2 (1.3%)	4 (3.5%)	15 (23.8%)	
Unknown	0 (0%)	2 (1.3%)	3 (2.6%)	1 (1.6%)	
Live with family					0.043
No	9 (9.3%)	34 (22.2%)	24 (21.1%)	15 (23.8%)	
Employment status					< 0.001
Employment	14 (14.4%)	76 (49.7%)	39 (34.2%)	5 (7.9%)	
Unemployment	16 (16.5%)	54 (35.3%)	40 (35.1%)	45 (71.4%)	
Home maker or, student	67 (69.1%)	23 (15.0%)	35 (30.7%)	13 (20.6%)	
Alcohol co-ingestion					< 0.001
Yes	21 (21.6%)	76 (49.7%)	54 (47.4%)	19 (30.2%)	
Previous suicide attempts					< 0.001
Yes	56 (57.7%)	55 (35.9%)	34 (29.8%)	6 (9.5%)	
Medical illness					< 0.001
Any physical illness	28 (28.9%)	45 (29.4%)	58 (50.9%)	50 (79.4%)	
Psychiatric history					0.067
Yes	62 (63.9%)	104 (68.0%)	75 (65.8%)	31 (49.2%)	

Table 2
Suicide method and disposition at ED by age group.

	≤ 24 N = 97	25–44 N = 153	45–64 N = 114	≥ 65 N = 63	p value
Method					< 0.001
Intoxication	57 (58.8%)	100 (65.4%)	80 (70.2%)	47 (74.6%)	
Wrist cutting	30 (30.9%)	18 (11.8%)	7 (6.1%)	5 (7.9%)	
Stabbing	2 (2.1%)	8 (5.2%)	9 (7.9%)	0 (0%)	
Drowning	1 (1%)	1 (0.7%)	1 (0.9%)	1 (1.6%)	
Hanging	0 (0%)	9 (5.9%)	8 (7.0%)	9 (14.3%)	
Gas inhalation	2 (2.1%)	11 (7.2%)	7 (6.1%)	1 (1.6%)	
Jumping	4 (4.1%)	6 (3.9%)	2 (1.8%)	0 (0%)	
etc.[a]	1 (1%)	0 (0%)	0 (0%)	0 (0%)	
Disposition at ED					< 0.001
Discharge from ED	72 (75%)	110 (71.9%)	75 (65.8%)	25 (39.7%)	
Admission					
ICU	14 (14.6%)	24 (15.7%)	20 (17.5%)	29 (46.0%)	
GW	4 (4.2%)	3 (2.0%)	3 (2.6%)	0 (0%)	
Transfer to other hospital	6 (6.3%)	15 (9.8%)	15 (13.2%)	6 (9.5%)	
Death	0 (0%)	1 (0.7%)	1 (0.9%)	3 (4.8%)	

[a] In this suicide attempt, person struck self with a stone.
ED = emergency department, ICU = intensive care unit, GW = general ward.

Table 3
Risk-Rescue Rating Scale of suicide attempters by age group.

Variables	≤ 24 N = 97	25–44 N = 153	45–64 N = 114	≥ 65 N = 63	p value	P_{Trend}
Risk rating point						
Method used	1.1 ± 0.5	1.2 ± 0.5	1.2 ± 0.4	1.2 ± 0.4	0.767	0.664
Impaired consciousness	1.0 ± 0.1	1.1 ± 0.4	1.2 ± 0.4	1.3 ± 0.6	< 0.001	< 0.001
Toxicity	1.7 ± 0.6	1.6 ± 0.6	1.6 ± 0.6	1.8 ± 0.6	0.145	0.338
Reversibility	1.8 ± 0.5	1.8 ± 0.5	1.8 ± 0.5	2.0 ± 0.7	0.183	0.068
Treatment required	1.6 ± 0.7	1.7 ± 0.7	1.9 ± 0.8	2.1 ± 0.8	< 0.001	< 0.001
Total risk point	7.3 ± 1.4	7.4 ± 1.9	7.7 ± 1.9	8.3 ± 2.3	< 0.001	< 0.001
Rescue rating point						
Location	2.8 ± 0.5	2.9 ± 0.3	2.9 ± 0.4	2.9 ± 0.4	0.160	0.805
Person initiating rescue	2.8 ± 0.5	2.9 ± 0.4	2.8 ± 0.5	2.8 ± 0.6	0.779	0.748
Probability of discovery	2.4 ± 0.7	2.4 ± 0.7	2.5 ± 0.6	2.4 ± 0.7	0.802	0.808
Accessibility to rescue	2.1 ± 0.9	2.1 ± 0.8	2.1 ± 0.9	1.8 ± 0.9	0.047	0.111
Delay until discovery	2.5 ± 0.7	2.6 ± 0.7	2.4 ± 0.8	2.4 ± 0.8	0.234	0.087
Total rescue point	12.6 ± 2.3	13.0 ± 2.1	12.8 ± 2.2	12.2 ± 0.3	0.154	0.258

Table 4
Total risk point, impaired consciousness, and treatment required, adjusted by demographics.

		Total risk point			Impaired consciousness			Treatment required		
	N	LSmean	SE	p value	LSmean	SE	p value	LSmean	SE	p value
≤ 24	97	7.347[a]	0.201	0.008	1.026[b]	0.042	< 0.001	1.672[b]	0.080	0.001
25–44	153	7.336[a]	0.158		1.097[b]	0.033		1.694[b]	0.063	
45–65	114	7.680	0.174		1.150	0.036		1.884	0.069	
≥ 65	63	8.245[a]	0.238		1.310[b]	0.050		2.091[b]	0.095	

Mean is the adjusted mean. P value was calculated by ANCOVA adjusted for gender, live alone/with others, and employment status. Post hoc test was conducted using Bonferroni's correction method.
[a] $p < 0.05$, [b] $P < 0.01$ in comparison with the low-stable group in the post hoc test.

impaired consciousness ($p < 0.01$), and treatment required ($p < 0.01$) compared with those in the 65 years old and over group.

4. Discussion

Suicide is currently the fourth leading cause of death in Korea, which has had the highest suicide rate among OECD countries during the past 10 years.[2] High suicide rates indicate that suicide is a major public health concern and that further suicide-prevention efforts are needed. In addition, studies in many countries have shown that the characteristics of suicide attempters vary with age.[13,19–21] Therefore, suicide-prevention planning must account for the characteristics of age-specific suicide.

The main results of this study can be summarized as follows: (1) among suicide attempters, the percentage of female attempters was higher among those younger than 65, but lower among those 65 years old and over; (2) more than half of the suicide younger than 24 had already attempted suicide previously, but among those 65 years old and over, only about 10% had attempted suicide previously; (3) the suicide attempters' age increased, the level of consciousness at presentation tended to be worse, the rate of treatment needed also tended to increase, and the percentage of high-risk suicide attempts also increased, regardless of sociodemographic factors such as gender, live alone/with others, or employment status. (4) Intoxication was the most frequent method of suicide attempts across all age groups and corresponded to other single-center study in Asia.[22]

In this study, there were more male suicide attempters than female attempters in the age group 65 years old and over, but female attempters were more prevalent in the under-65 groups. This result is consistent with several previous studies. According to Kim et al., the proportion of males hospitalized due to self-inflicted drug poisoning was 50.9% for those aged 65 years old and over, and but 30.2% in those under 65.[13] Another study also showed that the rate among female attempters was higher than among males at ages younger than 50, but the rate of male attempters was higher than female at ages older than 50.[23] This ratio difference can be explained by differences in how the different genders face the prospect of aging. Especially in Korean culture, males tend to seek success and wealth through gainful employment whereas females tend to seek relationships with others.This is supported by Korean previous study that showed a negative change in employment status as well as continuing precarious employment or unemployment are associated with having depression and these results were most pronounced in men, and in head of household women.[24] Furthermore, this finding is similar to those reported in foreign research on the gender differences in the rates of exposure to stressful life events and sensitivity to their depressogenic effects.[25] This previous study showed that women reported more interpersonal whereas men reported more legal and work-related stressful life events in interviews. And they are supported by another study that found that emotionally supportive social relationships are substantially more protective against major depression for women than for men.[26] As their ages increase, the proportion of the employed among the population decreases.[27] Therefore, among those whose self-worth is more closely tied to employment and productivity (more often, men), increasing age can lead to increasing dissatisfaction with life.

This study also showed that more than half of the suicide attempters younger than 24 years old had already attempted suicide whereas less than 10% (9.5%) of 65 years old and over had tried before. Previous studies have found similar results. One study relating to the incidence of repetition of suicide attempts to age showed that younger individuals are more likely to repeat their attempt.[28] Also, a study about the risk of recurrence after a first intentional drug overdose showed that younger age was associated with repeat

attempts.[29] Therefore, suicide-prevention programs should be designed specifically for this younger population. Furthermore, in showing the smaller percentage (9.5%) of repeat suicide attempts among those aged 65 and over, this study revealed that most of those in that age group (90.5%) had attempted suicide just once. Since people aged 65 and over should not be excluded from suicide-prevention efforts, efforts must be made to recognize those at risk other than previous suicide attempts. However, these differences could be due to poorer recall of past episodes, in the elderly. Another explanation would be the non-availability of elderly due to mortality or illness which may lead to a sampling bias. In addition, suicide is a cultural taboo in Korea; families prefer to consider the suicide of their relative as accidental death or the result of physical illness, which is an obstacle to suicidal research as well as to psychiatric assessment and treatment. The fact that the elderly tend to use lethal suicide methods such as hanging, also may explain the lack of prior attempts among the elderly.

The elderly patients had higher risk-rating scores in the present study. This finding agrees with previous findings that the older the suicide attempters were, the higher the likelihood of medical lethality as a result of the attempts.[7,8,13] In the present study's RRRS comparison, there was a significant difference in the rating points of impaired consciousness, treatment required, total risk point, and the accessibility to rescue by age. This might be partially explained not only by their higher physical vulnerability but also by their lower opportunities of being found by others due to a lower likelihood of their desiring help. Elderly patients are at a greater risk of cognitive impairment, fall risk, depression, functional decline, sensory disturbance, and polypharmacy.[30,31] Therefore, the elderly was especially vulnerable during suicide attempts, regardless of method. Also, studies on elderly attempters compared with nonelderly control groups have noted that the lower likelihood of older attempters being found and rescued increases the chances of serious medical conditions, longer stays in the hospital (particularly in the ICU), and higher risk of death.[12,14] Also, in this study, it was confirmed that the lethality of suicide increases with age, even when controlling for gender, independence, and employment status. Further investigation is needed to protect the high-risk elderly from severe consequences.

This retrospective, single-center study had several limitations. First, one major limitation was its retrospective design. Given that researchers reviewed retrospective EMR data, there was an inevitable risk of bias. Especially, the information of previous psychiatric history and suicide attempts of participants was limited. Second, we could not involve some completed suicides (especially those using high-lethality methods) or unconscious patients without caregivers due to a lack of data. Third, the sample was relatively small and from a single hospital. Fourth, this study did not explore important factors including financial status that determine lethality by suicide attempters in Asia. A retrospective single-centered study in Singapore found that serious financial problems was the strongest predictor of suicide.[32] For these reasons, our results should be interpreted cautiously.

5. Conclusion

The findings of the study are meaningful because they may help to identify the characteristics of suicidal people based on demographic profile, and this could have a significant impact on suicide-prevention policies going forward. Many young people tend to repeat suicide attempts, highlighting the need for special post-attempt observation, interventions, and management. This suggestion is supported by previous studies that investigated effect of interventions to prevent repeat suicidal behavior in patients admitted to EDs for a suicidal attempt.[33,34] These studies recommended that active contact and follow-up interventions for suicidal patients admitted to an ED to prevent repeat suicide attempts. Suicide attempters aged 65 and older showed a high risk of suicide attempts with lower opportunities for being saved and treated; thus, it is necessary to provide not only include the elderly in suicide-prevention efforts, and this should include a base of social support, especially since the risk of suicide tends to increase with age, regardless of whether those 65 and older are living alone or with someone or remain employed.

Declarations of interest

None.

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