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Clinical Characteristics of Adolescents Hospitalized Through Emergency Room for Intentional Self-Harm or Suicide Attempts

Tae Yeon Yoon[1], Hyun Sook Lee[2], Jung-Woo Son[3], Sang Mi Kim[4], and Je Jung Lee[1]

[1]Department of Psychiatry, Gongju National Hospital, Gongju, Korea
[2]Department of Health Administration, Kongju National University, Gongju, Korea
[3]Department of Neuropsychiatry, Chungbuk National University College of Medicine, Cheongju, Korea
[4]Department of Health Management, College of Medical Sciences, Jeonju University, Jeonju, Korea

Objectives: This study aimed to investigate the clinical characteristics of adolescents hospitalized through the emergency room for intentional self-harm or suicide attempts.
Methods: This retrospective study used data from the Korean National Hospital Discharge In-depth Injury Survey conducted between 2006 and 2018 for individuals aged 10–24 years. The clinical characteristics of the patients were analyzed and compared across sex and age groups using the Rao-Scott chi-square tests and multiple logistic regression analysis for complex survey data.
Results: The most common psychiatric diagnosis was mood disorder (22.0%), and more female patients were diagnosed with it than male patients (p=0.010). The 19–24 years age group was diagnosed with mood disorder the most compared to other younger groups (p=0.012). Male patients used lethal methods more than female patients (p=0.008), and the 19–24 years age group used more drug poisoning and cutting or piercing (p<0.001) for intentional self-harm or suicide attempts than younger groups.
Conclusion: Adolescents hospitalized for intentional self-harm or suicide attempts showed significant differences in clinical characteristics across sex and age groups. These findings suggest that measures for preventing self-harm or suicide attempts need to be differentiated according to the sex and age of adolescents.

Keywords: Adolescent; Self-harm; Suicide attempt; Inpatients; Emergency room.

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Address for correspondence: Je Jung Lee, Department of Psychiatry, Gongju National Hospital, 623-21 Gobunti-ro, Gongju 32601, Korea
Tel: +82-41-850-5700, Fax: +82-41-855-6969, E-mail: selfobjc@naver.com
Address for correspondence: Sang Mi Kim, Department of Health Management, College of Medical Sciences, Jeonju University, 303 Cheonjam-ro, Wansan-gu, Jeonju 55069, Korea
Tel: +82-63-220-2087, Fax: +82-63-220-2054, E-mail: seasea12@jj.ac.kr

INTRODUCTION

Self-harm is an action that intentionally injures oneself and is divided into self-injury with suicidal intention (suicide attempt) and non-suicidal self-injury, which does not involve suicidal intention [1]. Patients who self-harm are 56.8 times more likely to die by suicide than the general population [2], and patients with non-suicidal self-injury are three times more likely to attempt suicide in the future [3]. This suggests that all self-harm behaviors should be considered a risk factors for suicide, regardless of suicidal intention [2].

According to the '2021 White Paper on Suicide Prevention,' suicide is the leading cause of death among teenagers and 20s in Korea, and in 2019, the suicide rate of 10–24-year-old in Korea was 1.8 times higher than the average of OECD member countries [4]. Male adolescents are more successful in suicide than female adolescents, whereas female adolescents are more likely to have suicidal ideation or plans [5]. However, the male-female ratio of youth suicide rates in Korea decreased from 1.2 times in 2018 to 1.0 times in 2019 [2,4]. Meanwhile, worldwide, the suicide rate among those aged 15–19 years is higher than that of those aged 10–14 years, and the suicide rate rapidly increases with age in the late teens [6]. Such suicide-related characteristics according to sex and age should be considered when planning suicide prevention strategies for adolescents.

In 2019, of the suicidal methods taken among adolescents aged 10–25 years who died by suicide in Korea, jumping accounts for 38.5%, hanging for 37.4%, and gas poisoning for 14% [4]. It has been reported that the suicide rate among Korean adolescents increases as they use lethal methods of suicide [7],

suggesting that reducing access to lethal methods of suicide is an important way to prevent suicide among adolescents.

Although it is difficult to determine the scale of self-harm and suicide attempts among adolescents in Korea, it is speculated that many patients will visit the emergency room when they urgently need medical treatment due to self-harm or suicide attempts. Therefore, emergency room-based research on suicide is being actively conducted in Korea and abroad [8]. The National Emergency Department Information System is an emergency room-based data, although the information are collected from a relatively small number of medical institutions; thus, it is limited in estimating the entire suicide population in Korea. Nonetheless, data from the Korean National Hospital Discharge In-depth Injury Survey (KNHDIIS) by the Korea Centers for Disease Control and Prevention (KCDC) can overcome this limitation because their data include national healthcare statistics using patients' medical records discharged from medical institutions. Meanwhile, suicide-related studies have been conducted using data from the KNHDIIS [9,10], but none of these studies have focused on adolescents.

Therefore, this study investigated the characteristics and risk factors of adolescents hospitalized through the emergency room for self-harm and suicide attempts using the medical information of discharged patients between 2006 and 2018, which were collected from the KNHDIIS, and compared them according to sex and age. The results can be used as baseline data for establishing a therapeutic approach and prevention policies according to the characteristics of adolescents at high risk of suicide who visit emergency rooms.

METHODS

Data sources

This study used data from the KNHDIIS between 2006 and 2018, which was provided by the KCDC. The KNHDIIS data include national healthcare statistics using the medical records of discharged patients from medical institutions. Of the patients discharged from general hospitals with more than 100 beds nationwide, excluding hospitals with a single department, convalescent hospitals, geriatric hospitals, veteran hospitals, military hospitals, and rehabilitation hospitals, the KNHDIIS data selected approximately 9% of the discharged patients using the stratified two-stage cluster sampling method [11]. The data for this study were provided after being reviewed by the KCDC for the use of raw data, except for personally identifiable information such as medical institution code numbers and patient registration numbers, and were approved for exemption from review by the Institutional Review Board of the Gongju National Hospital in 2021 (IRB No. 2021-10).

Based on the KNHDIIS data of 2773351 patients collected from 2006 to 2018, the study participants included 8484 patients with external cause codes X60–X84, which consisted of cases of intentionally self-poisoning or injury and suicide (suicide attempts) according to the Korean Standard Classification of Disease and Cause of Death (KCD-8th) [12] and International Classification of Disease and Cause of Death (ICD-9-CM, Vol. III). According to the age criteria of the World Health Organization [13], which is most matched with the development of adolescents in the life cycle, 980 patients aged 10–24 years were selected as the final study participants (Fig. 1).

Measures

The demographic characteristics of the participants were investigated by sex, age, and rurality of residence. According to the enrollment periods of elementary schools, middle schools, high schools, and universities in Korea, age was divided into the following: 10–15 years old, including upper grades of elementary school and middle school students; 16–18 years old high school students; and 19–24 years old university students. Residential areas were classified as metropolitan cities (Seoul, Busan, Daegu, Incheon, Gwangju, Daejeon, and Ulsan) with a population of more than 1 million and small cities, including Gyeonggi-do, Gangwon-do, Chungcheongnam-do, Chungcheongbuk-do, Jeollanam-do, Jeollabuk-do, Gyeongsangnam-do, Gyeongsangbuk-do, and Jeju-do.

According to the disease code, comorbid psychiatric diagnosis were classified as mental and behavioral disorders caused by the use of psychoactive substances (from now on, substance use disorders: F10–19); schizophrenia, schizotypal, and delusional disorders (from now on, schizophrenia-related disorders: F20–29); mood (affective) disorders (F30–39); neurotic, stress-related, and somatoform disorders (from now on, neurotic and stress-related disorders: F40–49); adult personality and behavioral disorders (from now on, personality disorders: F60–69); mental retardation, developmental disorders, and behavioral and emotional disorders that occur mainly in childhood and adolescence (from now on, developmental and behavioral disorders: F70–99); and others with no disease code (unknown).

According to the research method of Spicer and Miller [14], the mechanisms of damage were classified into non-lethal methods for drug poisoning and cutting or piercing (by blunt or sharp objects); and lethal methods for gas or pesticide poisoning, jumping, hanging, car or train crash, and others, such as drowning, firearm uses, and burns (drowning and other methods). The place of implementation was divid-

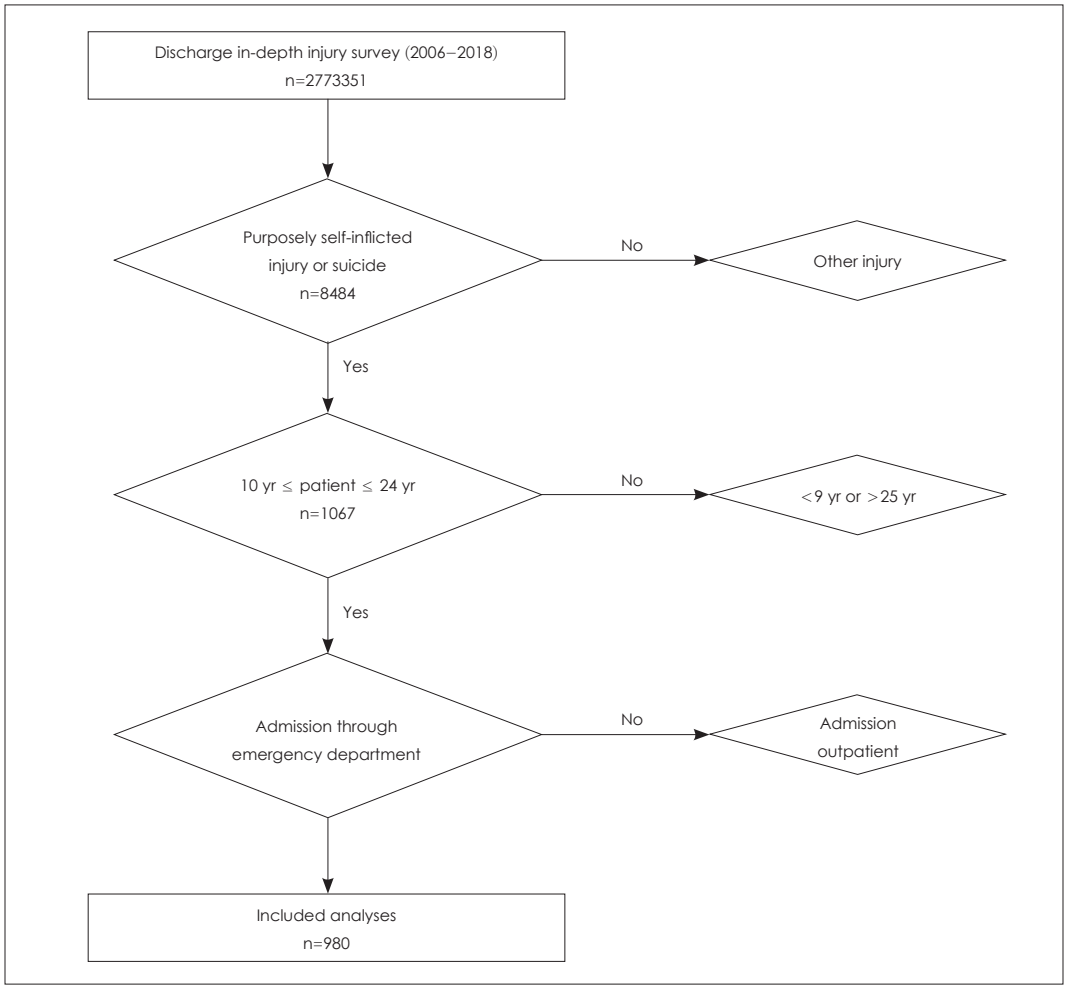

Fig. 1. Flow diagram for study participants.

ed into home, including home and nearby buildings, and not home, which was not a residential area such as schools or public buildings. Risk factors were classified as family problems, including conflict with family members and family death; psychiatric problems; and others, including financial problems, physical illness, and unknown cases.

Statistical analysis

The sampling design for the KNHDIIS is a complex sample survey that recommends calculating weights for hospitals or patients (a final extraction unit) when estimating parameters [11]. Therefore, in this study, weights were applied to estimate the national size. As a contingency table analysis method for complex sample data, we used the Rao-Scott chi-square statistic, a modified value of Pearson's chi-square statistic [15], to analyze whether there were differences in the psychiatric diagnosis, type of methods, lethality of the methods, place of implementation, risk factors, and rurality of residence according to sex and age. In addition, multiple logistic regression analysis for complex survey data was performed to check the interaction between independent variables according to sex. Statistical significance was set at $p<0.05$ (two-sided). All analyses were performed using SPSS (version 24.0; IBM Corp., Armonk, NY, USA).

RESULTS

General characteristics

From 2006 to 2018, 980 patients aged 10–24 years who visited the emergency room for intentional self-harm or suicide attempts were generalized to 30046 patients using a weighted complex sample design. Females accounted for 64.9%, which was more than males (35.1%). By age groups, 19–24-year-olds accounted for 63.2%, 16–18-year-olds for 23.8%, and 10–15-year-olds for 13.0%. Mental disorders were unknown in 68.9% and with a diagnosis in 31.1%. Mood (affect) disorders was in 22.0% of all participants, neurotic and stress-related disorders in 3.2%, schizophrenia-related disorders in 2.1%,

personality disorders in 1.6%, substance use disorders in 1.5%, and developmental and behavioral disorders in 0.7% (Table 1).

Characteristics by sex

Diagnosis of mental disorders accounted for 27.6% of males and 33.0% of females (Table 2). The most common disease was mood (affective) disorder, which was diagnosed in 17.9% of the males and 24.3% of the females (p=0.010) (Supplementary Table 1 in the online-only Data Supplement). Regarding self-harm and suicide attempts, lethal methods were used more frequently by males than by females, whereas non-lethal methods were used more frequently by females (p=0.008) (Table 2). Drug poisoning, a non-lethal method, was used more frequently by females (65.1%) than by males (42.1%), whereas cutting or piercing were more frequently used by males (28.3%) than by females (14.3%) (p<0.001) (Supplementary Table 2 in the online-only Data Supplement). Regarding the place of implementation, 58.3% of females committed suicide at their residence and 53.5% of males committed suicide at places other than their residence (p=0.003) (Table 2). Other risk factors (p=0.179) and rurality of residence (p=0.424) were not statistically significantly different between sexes (Table 2).

Table 1. Descriptive characteristics of participants

	Total (n=980, N=30046)		
	n	N	%
Sex			
Male	345	10535	35.1
Female	635	19511	64.9
Age (yr)			
10–15	139	3894	13.0
16–18	239	7165	23.8
19–24	602	18987	63.2
Rurality of residence			
Metropolitan city	475	13784	45.9
Small city	505	16262	54.1
Dx			
MOOD	237	6625	22.0
NEU	35	966	3.2
SPR	25	644	2.1
PD	17	466	1.6
SUB	11	452	1.5
DEV	8	197	0.7
Unknown	647	20696	68.9
Method of self-harm			
Drug poisoning	544	17141	57.1
Cutting/piercing	184	5773	19.2
Gas/pesticide poisoning	135	3826	12.7
Jumping	71	1986	6.6
Hanging	25	699	2.3
Car/train crash	10	291	1.0
Drowning and other methods	11	330	1.1
Lethality of methods			
Lethal	252	7132	23.7
Non-lethal	728	22914	76.3
Place of the implementation			
Home	561	16272	54.2
Not home	419	13774	45.8
Risk factors			
Family problems	255	6846	22.8
Psychiatric problems	289	7610	25.3
Others/unknown	436	15591	51.9

n, patient number; N, weighted patient number; Dx, psychiatric diagnosis; MOOD, mood (affective) disorders; NEU, neurotic and stress-related disorders; SPR, schizophrenia-related disorders; PD, personality disorders; SUB, substance use disorders; DEV, developmental and behavioral disorders

Multiple logistic regression analysis was performed to determine how different the rurality of residence, lethality of the methods, place of implementation, and risk factors were by sex (Table 3). Males were 1.649 times more likely to use lethal methods than females (p=0.008). In addition, the odds of self-harm and suicide attempts at places other than their residence were (variables: not home) 1.561 times higher for males than for females (p=0.005).

Characteristics by age

In the psychiatric diagnosis classification, the number of cases without a diagnosis was the highest at 80.1% for patients aged 10–15 years, 70.9% for those aged 16–18 years, and 65.8% for those aged 19–24 years (p=0.010) (Table 4). The diagnosis of mood (affective) disorder was lower at 15.1% for those aged 10–15 years compared to 21.5% for those aged 16–18 years and 23.7% for those aged 19–24 years (p=0.012) (Supplemantary Table 1 in the online-only Data Supplement). In all age groups, drug poisoning accounted for a higher proportion than other methods (p<0.001) (Supplemantary Table 2 in the online-only Data Supplement). Cutting or piercing were 6.5% for those aged 10–15 years, 16.3% for those aged 16–18 years, and 22.9% for those aged 19–24 years. As for risk factors, among age groups family problems accounted for the most at 32.6% in patients aged 10–15 years, whereas psychiatric problems accounted for the least at 15.0% in patients aged 10–15 years (p=0.006) (Table 4).

DISCUSSION

Using the KNHDIIS, a national disease statistic, this study analyzed characteristics related to self-harm and suicide attempts in 30046 patients by sex and age, applying weights for the 980 adolescents aged 10–24 years who were hospitalized

Table 2. Characteristics of patients by sex

Characteristics	Sex (N=30046)		$\chi^{2\dagger}$	p
	Male (n=10535)	Female (n=19511)		
Age (yr)			0.84	0.432
10–15	1135 (10.8)	2760 (14.1)		
16–18	2573 (24.4)	4592 (23.5)		
19–24	6827 (64.8)	12159 (62.3)		
Rurality of residence			0.64	0.424
Metropolitan city	4605 (43.7)	9179 (47.0)		
Small city	5930 (56.3)	10332 (53.0)		
Dx			2.55	0.093
Known	2910 (27.6)	6440 (33.0)		
Unknown	7625 (72.4)	13071 (67.0)		
Lethality of methods			7.08	0.008*
Lethal	3125 (29.7)	4007 (20.5)		
Non-lethal	7410 (70.3)	15504 (79.5)		
Place of the implementation			9.16	0.003*
Home	4902 (46.5)	11370 (58.3)		
Not home	5633 (53.5)	8141(41.7)		
Risk factors			1.64	0.195
Family problems	2008 (19.1)	4837 (24.8)		
Psychiatric problems	2648 (25.1)	4962 (25.4)		
Others/unknown	5879 (55.8)	9712 (49.8)		

Values are presented as number (%). *$p<0.05$; †Rao-Scott χ^2 statistic. N, weighted patient number; Dx, psychiatric diagnosis

Table 3. Multiple logistic regression model of characteristics by sex

Variables		AOR (95% CI)	p
Rurality of residence	Small city	1.079 (0.770–1.513)	0.657
Lethality of methods	Lethal	1.649 (1.141–2.384)	0.008*
Place of the implementation	Not home	1.561 (1.145–2.127)	0.005*
Risk factors	Psychiatric problems	1.159 (0.737–1.822)	0.234
	Others/unknown	1.297 (0.844–1.992)	0.565

Reference: female, metropolitan city, non-lethal method, home, and family problems. *$p<0.05$. OR, odd ratios; AOR, OR adjusted by sex; CI, confidence interval

through emergency rooms for intentional self-harm and suicide attempts from 2006 to 2018.

The emergency room is an important treatment environment for children and adolescents who attempt self-harm and suicide [8,16]. Recently, in Korea and worldwide, the number of visits to the emergency room for self-harm has increased [16]. In particular, it is known that women and older adolescents visit emergency rooms more frequently [4,16], which is consistent with the results of this study. Since 2013, the Life Love Crisis Response Center (suicide crisis response center), which is based in emergency rooms, has been installed and expanded in Korea. However, most of them are in large hospitals, at least at the university hospital level; thus, there are problems such as limited accessibility and lack of connection to the centers [8]. Therefore, it is necessary to increase the accessibility of response systems so that more adolescent patients can be connected.

Findings from psychological autopsies in Korea and abroad have reported that approximately 80%–90% of people who committed suicide had a mental illness, which is an important predictor of suicidal behavior [17]. A study conducted in China found that 57.5% of adolescents who visited the emergency room of a university hospital after a suicide attempt had a mental illness [18]. However, this study was a parametric estimation of patients with self-harm and suicide attempts who visited the emergency rooms of hospitals with more than 100 beds; only 31% of the patients had a psychiatric diagnosis. Our findings resulted from the possibility that the doctors in the emergency rooms, in case they were not a psychiatrist, would not have been able to make a psychiatric

Table 4. Characteristics of patients by age group (N=30046)

	Age (yr)			$\chi^{2\dagger}$	p-value
	10–15 (n=3894)	16–18 (n=7165)	19–24 (n=18987)		
Rurality of residence				3.92	0.021*
Metropolitan city	1409 (36.2)	2936 (41.0)	9439 (49.7)		
Small city	2485 (63.8)	4229 (59.0)	9548 (50.3)		
Dx				4.62	0.010*
Known	774 (19.9)	2085 (29.1)	6490 (34.2)		
Unknown	3120 (80.1)	5080 (70.9)	12497 (65.8)		
Lethality of methods				1.49	0.227
Lethal	3120 (80.1)	5690 (79.4)	14103 (74.3)		
Non-lethal	774 (19.9)	1475 (20.6)	4884 (25.7)		
Place of the implementation				0.69	0.501
Home	2295 (58.9)	3684 (51.4)	10293 (54.2)		
Not home	1599 (41.1)	3481 (48.6)	8694 (45.8)		
Risk factors				3.68	0.006*
Family problems	1268 (32.6)	1869 (26.1)	3708 (19.5)		
Psychiatric problems	583 (15.0)	1960 (27.4)	5067 (26.7)		
Others/unknown	2043 (52.5)	3336 (46.6)	10212 (53.8)		

Values are presented as number (%). *$p<0.05$; †Rao-Scott χ^2 statistic. N, weighted patient number; Dx, psychiatric diagnosis

diagnosis or would not refer the patient with a psychiatrist [19]. In addition, it reflects the reality that access to psychiatric care is limited as the number of closed psychiatric wards in tertiary hospitals in Korea has drastically reduced [20].

In this study, there were fewer cases of psychiatric diagnoses among young people aged 10–15 years than in other age groups. It seems that mental complaints such as depression and anxiety increase as adolescents face new situations and experience more social demands as they age [21]. In addition, in the case of younger adolescents, their cognitive development is low, and they have difficulty expressing symptoms; thus, it may not be possible to draw a diagnosis through a short interview [22].

The presence of mood disorders, substance misuse, and borderline personality disorders have been identified as major risk factors for adolescent suicide [23]. Similar to previous studies [16,24], this study found that mood disorders were the most common mental disorder, and that there were more mood disorders in women than in men. In addition, East Asian countries, such as Japan and South Korea, are characterized by an increasing trend in teenage suicides, with a narrowing gender gap [6]. Therefore, since active coping with mood disorders can help lower the suicide rate among women in Korea, it is important to pay attention to female adolescents visiting the emergency room and their psychiatric diagnosis in suicide prevention.

It is known that suicides due to psychiatric problems, family problems, and romantic relationship problems are higher in teens and 20s compared to other age groups [4,25]. In this study, family problems accounted for a greater proportion for those aged 10–15 years and psychiatric problems for those aged 19–24 years. Developmentally, adolescence is a period of independence from parents, and conflicts with parents increase with the onset of adolescence [26]. Studies have shown that problematic family support systems affect negative emotions such as depression and anxiety in adolescents, and that when there is difficulty in family relationships, the risk of suicide increases [24]. In addition, adolescents aged 19–24 years go to universities in Korea, and psychiatric problems may be prominent due to increased stress, such as adjusting to a new environment after being separated from the family [27].

Unlike previous studies, this study found that men used cutting or piercing more frequently than women [4,28]. This may be because patients with mild injuries would not visit emergency rooms because they would not feel the need for treatment, and men would visit emergency rooms more because the damage would have been more severe than that in women [29]. In addition, in this study, men were 1.649 times more likely to use lethal methods than women, similar to the Nationwide Emergency Department Sample, a large-scale emergency department data in the United States [30]. Since self-harm patients who use lethal methods in nonfatal events are at high risk of future suicide [2] and the lethal method is a strong risk factor for suicide, special attention in male adolescents should be paid to the method of self-harm and suicide attempts [7].

In contrast, drug poisoning decreased with increasing age,

whereas cutting or piercing increased. Younger people prefer less complex and more immediate self-harm or suicide attempt methods. This suggests that younger age groups are more likely to use drug poisoning, which is more accessible, and less likely to use complex methods, such as cutting or piercing [24]. However, existing studies on age-specific differences in self-harm and suicide attempt methods are insufficient; hence, more structured studies are needed.

A limitation of this study is that the KNHDIIS data cannot represent all patient groups because the data excluded hospitals with less than 100 beds and a single department. Especially the data exclude psychiatric hospitals with a single department, where patients with psychiatric disorders were specifically admitted. So there is a possibility that the diagnosis rate of psychiatric disorders was underestimated in this study. Second, patients who visited a psychiatric outpatient clinic other than the emergency room, those who did not visit the hospital, and those who died were excluded. Third, this study relied on data recorded using a retrospective method. Medical records were prepared by medical doctors at each hospital and were not investigated in person; therefore, information related to self-harm and suicide attempts may have been omitted, reduced, or expanded. Despite these limitations, this study has the strength of identifying the characteristics and risk factors of adolescents' self-harm and suicide attempts at the national level. Through the results of this study, it is possible to find a therapeutic approach for adolescents who have attempted self-harm or suicide. Furthermore, the study results can be used as baseline data for national health policy establishment and suicide prevention projects in the future.

CONCLUSION

More than half of the adolescents hospitalized through the emergency room for self-harm or suicide attempts were not diagnosed with a psychiatric disorder. More females than males were diagnosed with mood disorders, and the younger they were, the more likely they were to be undiagnosed. Males used more lethal methods than females, and among age groups there were differences in the methods, such as increasing the number of cutting or piercing as age increased. Therefore, based on an understanding of the differences according to the age and sex of adolescents who have attempted self-harm or suicide, more effective suicide prevention strategies can be prepared.

Supplementary Materials

The online-only Data Supplement is available with this article at https://doi.org/10.5765/jkacap.220002.

Availability of Data and Material

The data supporting the findings of this study were obtained from Korea Centers for Disease Control and Prevention under the terms of a data use agreement which prohibits redistribution of the data. The original data sets can be obtained by any qualified researcher from https://www.kdca.go.kr/injury.

Conflicts of Interest

Jung-Woo Son, a contributing editor of the *Journal of the Korean Academy of Child and Adolescent Psychiatry*, was not involved in the editorial evaluation or decision to publish this article. All remaining authors have declared no conflicts of interest.

Author Contributions

Conceptualization: Tae Yeon Yoon, Hyun Sook Lee, Sang Mi Kim, Je Jung Lee. Data curation: Sang Mi Kim. Formal analysis: Tae Yeon Yoon, Sang Mi Kim, Je Jung Lee. Investigation: all authors. Methodology: Tae Yeon Yoon, Hyun Sook Lee, Sang Mi Kim, Je Jung Lee. Project administration: all authors. Resources: Tae Yeon Yoon, Hyun Sook Lee, Sang Mi Kim, Je Jung Lee. Software: Sang Mi Kim, Je Jung Lee. Supervision: Hyun Sook Lee, Jung-Woo Son, Sang Mi Kim, Je Jung Lee. Validation: Je Jung Lee, Tae Yeon Yoon. Visualization: Tae Yeon Yoon. Writing—original draft: Tae Yeon Yoon, Je Jung Lee. Writing—review & editing: all authors.

ORCID iDs

Tae Yeon Yoon	https://orcid.org/0000-0003-2730-0874
Hyun Sook Lee	https://orcid.org/0000-0003-2338-3692
Jung-Woo Son	https://orcid.org/0000-0003-4972-3923
Sang Mi Kim	https://orcid.org/0000-0002-6657-3624
Je Jung Lee	https://orcid.org/0000-0002-0606-2304

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