

Characteristics of patients with mood disorders and schizophrenia who attempt suicide: a 15-year cross-sectional study in Japan

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Abstract

Introduction: Psychiatric disorders are an important risk factor for suicide. The aim of this study was to compare the characteristics of suicide attempts between patients with schizophrenia and mood disorders in Japan. **Methods:** From 596 patients treated after a suicide attempt in the Emergency and Critical Care Center (ECCC), during a 15-year period (2006 and 2021), two groups of patients were separated, 196 patients with mood disorders (21% bipolar mood disorder and 79% monopolar depression) and 112 patients with schizophrenia, who were compared according to sex, age, method of suicide attempt, and history of psychiatric treatment. We conducted multivariable logistic regression on the schizophrenia group and the mood disorder group, using those diagnoses as the dependent variable and age, suicide attempt method, sex, and history of psychiatric treatment as explanatory variables. **Results:** Patients with schizophrenia are significantly younger (39.4 ± 13.3 vs. 47.8 ± 17.9 ; $p < 0.001$) and significantly more frequently (89.3% vs. 64.3%; $p < 0.001$) had a history of psychiatric treatment than patients with mood disorders. Violent suicide methods were significantly more often used in the group of patients with schizophrenia (65.2% vs. 50.5%; $p = 0.017$) than in the group of patients with mood disorders. Jumping from a height was significantly more frequent in the group of patients with schizophrenia (36.6% vs. 16.8%; $p < 0.001$) than in the group of patients with mood disorders, while hanging was significantly more frequent in the group of patients with mood disorders (12.8% vs. 2.7%; $p = 0.003$) than in the group of patients with schizophrenia. As a result of multivariable logistic regression, the history of psychiatric treatment (OR = 0.25; 95%CI: 0.11–0.54; $p < 0.001$) was associated with high odds of the diagnosis of schizophrenia, while the use of the hanging method (OR = 7.25; 95%CI: 1.48–43.6; $p = 0.014$) was associated with high odds of the diagnosis of mood disorder. **Conclusions:** Patients with schizophrenia and mood disorders are groups with a high risk of suicidal behavior. Suicide prevention measures should consist of the urgent need for screening and evaluation of mental disorders by primary health care services, as well as successful treatment, successful follow-up of patients after hospitalization, improvement of adherence to therapy, and monitoring of risk factors.

Keywords: emergency medicine, psychiatry, suicide attempt, suicide prevention, mood disorder, schizophrenia

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1. Introduction

Suicidal behavior is a significant public health issue worldwide and results in an estimated 16 million suicide attempts and 800,000 suicides per year [1]. Furthermore, actual suicide rates may be higher than those reported because of stigma, misclassification, and limited surveillance systems [2]. Psychiatric disorders are a risk factor for suicide, and systematic reviews have indicated that more than 80% of individuals who commit suicide have a diagnosis of a psychiatric disorder [3–5]. Among the various psychiatric disorders, mood disorders and schizophrenia and schizophrenia-related disorders are the two most common illnesses, with suicide risk notably elevated and mood disorders and schizophrenia identified as two of the most significant contributors [6–8]. Therefore,

to develop suicide prevention measures, it is crucial that we not only characterize those who attempt suicide but also compare the profiles of patients who attempt suicide between those with mood disorders and schizophrenia.

Previous studies have shown that the lifetime risk of suicide and suicide attempts in patients with schizophrenia is 5% and 25–50%, respectively [9, 10]. Young age, male sex, a high level of education, a history of depressive disorders, comorbid depression, previous suicide attempts, drug misuse, agitation or motor restlessness, fear of mental disintegration, poor adherence to treatment, recent loss, worthlessness, hopelessness, and shorter illness length have been found to be important risk factors for suicide in patients with

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schizophrenia [10–13]. Additionally, recurrent relapses, high disease severity, impaired societal and occupational functioning, and an awareness of the negative impact of the disorder are considered schizophrenia-specific risk factors for suicide [14, 15]. Patients with schizophrenia are often unable to effectively and directly communicate their suicidal intent, and there are currently no established suicide prevention strategies for schizophrenia patients [7, 16].

A psychological autopsy study reported that 43% of suicide cases were diagnosed with a mood disorder [4]. Furthermore, a recent meta-analysis found that 2–8% of individuals diagnosed with major depression and 4–8% of individuals diagnosed with bipolar disorder die by suicide [17, 18]. Risk factors for suicide in patients with mood disorders include earlier illness onset, longer course of illness, hospital admission, family history of suicide, comorbidities, psychotic symptoms, treatment resistance, and personal and interpersonal circumstances [19]. Comorbid anxiety disorders are more prevalent in those with major depression and are strongly linked to suicidality [20], whereas substance use disorders are more common in those with bipolar disorder and are strongly linked to suicidality [21]. Individuals with major depression have a high risk of engaging in suicidal behavior, particularly within the year following a non-lethal self-harm incident and the first year after discharge [18]. Patients with bipolar disorder have an increased risk of suicide within the first few months following discharge from inpatient treatment for mixed and depressed episodes [22]. The development of educational programs provided by general practitioners and screening tools to improve diagnosis and treatment are essential for suicide prevention in patients with mood disorders [23–25]. Furthermore, distinguishing bipolar disorder patients from mood disorder patients is crucial to providing appropriate treatments [26].

The number of suicides annually in Japan has increased dramatically from 24,931 in 1997 to 32,863 in 1998 [27], which corresponds to a suicide rate of 19.3 per 100,000 people in 1997 to 26.0 per 100,000 people in 1998. In response to this serious situation, the “Basic Act on Suicide Countermeasures” was enacted in 2005, and the “Comprehensive Measures to Prevent Suicide” was established in 2006. Fifteen years later, in 2012, the number of annual suicides in Japan decreased to 27,858 (21.8 per 100,000 people); moreover, this number has followed a downward trend since 2010, falling below 21,000 for the first time in 37 years to 20,840 (16.5 per 100,000 people) in 2018. However, the situation remains serious, with more than 20,000 people committing suicide each year. In 2021, the suicide rate remained high at 16.8 per 100,000 people.

Our hospital, Fukuoka University Hospital, is a “tertiary emergency facility”, which serves patients with high-acuity conditions who require intensive care or emergency surgery. Approximately 70 patients who engage in suicidal behavior are transferred to the Emergency and Critical Care Center (ECCC) every year. Until 2005, patients who engaged in suicidal behavior were only evaluated by a psychiatrist upon request of the ECCC staff. However, since 2006, we initiated the suicide prevention liaison service, whereby psychiatrists in the suicide prevention team evaluated and treated all patients who exhibited suicidal behavior [28]. Previous research has shown that medically serious suicide attempters and completers are two populations that share common characteristics [29].

In this cross-sectional study, we investigated the characteristics of patients who had attempted suicide and had been diagnosed with a mood disorder or schizophrenia or a schizophrenia-related

disorder. Various characteristics were compared between the patient groups to obtain useful insight into specific suicide prevention strategies for each group. The novelty of this study lies in the fact that it included medically serious suicide attempters, rather than a less severe group such as self-harm patients, and collected 15 years of data from an urban general hospital. It is a unique study in Japan and has very important clinical implications in the follow-up of suicide attempters.

2. Materials and methods

2.1. Study design

We used a cross-sectional study design to compare the characteristics of suicide attempters between those who had been diagnosed with a mood disorder and those who had a diagnosis of schizophrenia or a schizophrenia-related disorder.

2.2. Study participants

This study was conducted at the ECCC of Fukuoka University Hospital from 1 April 2006 to 31 March 2021. Fukuoka City has a population of 1.5 million people and has three ECCCs. As reported previously, the suicide prevention group from the Department of Psychiatry attends regular conferences in the ECCC to discuss all patients who exhibit suicidal behavior [28]. If there was a patient who was suspected of having attempted suicide, the psychiatrist determined whether or not they had suicidal behaviors using the following criteria: (1) if the behavior was intentional; (2) if they had a clear intent to commit suicide; (3) if they employed lethal methods; (4) if they had considered the prospect of lethality; (5) if they had previous suicidal ideation; and (6) if their suicidal intent was confirmed objectively by a suicide note. We referred to the results of the inquest at the same time. If it was determined the behavior was suicidal, the patient was evaluated and treated by a psychiatrist in the suicide prevention group. During the study period, 821 patients who had engaged in suicidal behavior were admitted to the ECCC. If a patient had received a consultation or diagnosis at a different hospital, their referral document was obtained from that hospital. All patient data were stored in an electronic database with a security code.

The patients were divided into two categories: (a) patients who were alive at the time of discharge were classified as “suicide attempters” ($n = 596$) and (b) patients who were dead at the time of discharge were classified as “suicide completers” ($n = 225$). The 596 suicide attempters (253 men and 343 women) underwent a psychiatric evaluation, which comprised an interview and evaluation conducted by specialist psychiatrists of the suicide prevention team. We collected data on sex, age, method(s) of suicide attempt, psychiatric diagnosis, duration of emergency unit hospitalization, and history of treatment received from psychiatrists before admission. Psychiatric diagnoses were made by psychiatrists according to the *International Classification of Diseases, Tenth Revision* (ICD-10) criteria. Their intent to die was confirmed at least twice.

Of the 596 suicide attempters, 196 were classified as having a mood disorder (mood disorder group, ICD-10 classification F3, 32.9%) and 112 were classified as having schizophrenia or a related disorder (schizophrenia group, ICD-10 classification F2, 18.8%). We compared sex, age, methods of suicide attempt, and history of psychiatric treatment between the two groups. Of the 196 mood

disorder group patients, we classified patients with bipolar affective disorder (ICD-10 classification F31) as “bipolar,” and those with a depressive episode (ICD-10 classification F32) and recurrent depressive disorder (ICD-10 classification F33) as “monopolar,” according to ICD-10 criteria. In the field of suicide prevention, “monopolar” and “bipolar” are often grouped together under the broader category of mood disorders [8]. One of the reasons is the difficulty in distinguishing between the two disorders in cross-sectional diagnostic assessments. Without long-term monitoring, it is difficult to make a definitive diagnosis, and in many clinical settings, it may be impractical to separate these two conditions, especially in the early stages of treatment.

2.3. Medically serious suicide attempters

We defined medically serious suicide attempters using the criteria of Beautrais et al. [29]. These patients were defined as those who required hospitalization for >24 h and met one of the following treatment criteria: (1) treatment in an intensive care unit; (2) surgery under general anesthesia (patients with superficial cuts not requiring surgical repair were excluded); and (3) extensive medical treatment (beyond gastric lavage, activated charcoal, or routine neurological observations), including antidotes for drug overdoses, telemetry, or repeated tests or assessments. In addition, individuals who attempted suicide using a method with a high risk of fatality (i.e., hanging or jumping) and who were hospitalized for more than 24 h but did not meet the preceding treatment criteria were also included in the medically serious suicide attempters group. All participants fulfilled these criteria.

2.4. Statistical analysis

Groups were compared using Fisher’s exact test or Student’s *t*-test. The logistic regression model was used to calculate the adjusted odds ratio (OR) with 95% confidence interval (CI) for diagnosis associated with age, suicide attempt method, sex, and history of psychiatric treatment. Statistical analyses were performed using JMP 12.2 (SAS Institute Inc., Cary, NC, USA). All statistical tests were two-tailed, and *p* < 0.05 indicated statistical significance.

2.5. Ethics

This study was an observational study. Because it was a retrospective study, we did not obtain consent from patients. However, we did consider patient privacy. We publicized our research proposal on our website. The study was approved by the Ethics Committee of Fukuoka University Hospital (ethical approval code U21-856, 10 November 2021).

3. Results

3.1. Psychiatric diagnosis

Table 1 shows the distribution of psychiatric disorder diagnoses of the 596 suicide attempters. Schizophrenia and schizophrenia-related disorder patients (ICD-10 classification F2, 18.8%), mood disorder patients (ICD-10 classification F3, 32.9%), and neurotic, stress-related, and somatoform disorder patients (ICD-10 classification F4, 22.2%) accounted for a large proportion of suicide attempters. Of the 196 mood disorder patients, 155 patients (79%)

had “monopolar” depression, and 41 patients (21%) had “bipolar” disorder.

3.2. Sociodemographic background

Table 2 shows the age, sex, history of psychiatric treatment, and length of hospital stay of the mood disorder and schizophrenia groups. The schizophrenia group (39.4 ± 13.3 years) was significantly younger than the mood disorder group (47.8 ± 17.9 years; *t*(306) = 4.333, *p* < 0.001). The suicide rate of those with a history of psychiatric treatment was significantly higher in the schizophrenia group (89.3%) than in the mood disorder group (64.3%; *p* < 0.001). The duration of hospitalization was similar across the two groups (range 14–17 days). There were no sex differences between the two groups.

3.3. Method of suicide attempt

Table 3 shows the methods of suicide attempts used by the two groups. The most common methods used by the schizophrenia group were jumping from a height (36.6%), followed by poisoning by prescribed drugs (25%), and the use of cutting/piercing instruments (19.6%). The most common methods in the mood disorder group were prescription drugs (32.1%), followed by jumping from a height (16.8%), the use of cutting/piercing instruments (16.3%), and hanging (12.8%).

We defined poisoning as a non-violent method and all other methods as violent methods, in line with the definition used by Dumais et al. [30]. Patients in the mood disorder group used non-violent (49.5%) and violent methods (50.5%) equally as often, whereas patients in the schizophrenia group used violent methods (65.2%) significantly more frequently than non-violent methods (34.8%; *p* = 0.017). Jumping from a height was significantly more common in the schizophrenia group (36.6%) than in the mood disorder group (16.8%; *p* < 0.001). Hanging was significantly more common in the mood disorder group (12.8%) than in the schizophrenia group (2.7%; *p* = 0.003). Poisoning by pesticides was significantly more common in the mood disorder group (6.6%) than in the schizophrenia group (0.9%; *p* = 0.021). Poisoning by gas was significantly more common in the mood disorder group (6.6%) than in the schizophrenia group (0%; *p* = 0.003).

3.4. Multivariable logistic regression

Table 4 shows multivariable logistic regression on the schizophrenia group (F2) and the mood disorder group (F3), using F2/F3 as the dependent variable and age (categorized in 10-year increments, X age group/others), suicide attempt method (method Y/others), violent method of suicide attempt, sex, and history of psychiatric treatment as explanatory variables.

In the multivariate analysis, significant differences were found in the following items: the history of psychiatric treatment (OR = 0.25; 95%CI: 0.11–0.54; *p* < 0.001), the use of the hanging method (OR = 7.25; 95%CI: 1.48–43.6; *p* = 0.014), age < 20 (OR = 8.96 × 10^{−9}; 95%CI: 0–0.64; *p* = 0.023), age 20–29 (OR = 6.03 × 10^{−9}; 95%CI: 0–0.36; *p* = 0.005), age 30–39 (OR = 5.06 × 10^{−9}; 95%CI: 0–0.30; *p* = 0.003), age 40–49 (OR = 7.31 × 10^{−9}; 95%CI: 0–0.44; *p* = 0.009), age 50–59 (OR = 1.47 × 10^{−8}; 95%CI: 0–0.89; *p* = 0.041), and age 60–69 (OR = 1.29 × 10^{−8}; 95%CI: 0–0.80; *p* = 0.033).

Table 1 • Diagnosis of suicide attempters.

	Total (N = 596)
	N (%)
Diagnosis	
F0: Organic, including symptomatic, mental disorders	21 (3.5)
F1: Mental and behavioral disorders due to psychoactive substance use	32 (5.4)
F2: Schizophrenia, schizotypal, and delusional disorders	112 (18.8)
F3: Mood disorders	196 (32.9)
Monopolar	155 (26.0)
Bipolar	41 (6.9)
F4: Neurotic, stress-related, and somatoform disorders	132 (22.2)
F6: Disorders of adult personality and behavior	39 (6.5)
F8: Disorders of psychological development	25 (4.2)
Others	39 (6.5)

4. Discussion

We compared the characteristics of suicide attempters between those diagnosed with a mood disorder and those diagnosed with schizophrenia or a related disorder. Our findings revealed that numerous factors differed between the two groups. The schizophrenia group patients were younger, had attempted suicide despite having an extensive history of psychiatric treatment, and were characterized as impulsive, as reflected in their use of violent methods of suicide (especially jumping). In contrast, the mood disorder group patients were older, and approximately one-third of patients had never visited a psychiatrist before attempting suicide. They typically used methods of suicide that required planning, such as hanging or poisoning by pesticides and gas.

Analysis of nominal logistics estimated factors that predicted a diagnosis of schizophrenia/mood disorder, including the history of psychiatric treatment, the use of the hanging method, and age (<20, 20–29, 30–39, 40–49, 50–59, and 60–69). These may be more important because they appear in multivariate as well as univariate analyses.

Suicide attempters of the schizophrenia group differed from those of the mood disorder group in several ways. The patients in the schizophrenia group were significantly younger than those in the mood disorder group ($p < 0.001$), which is consistent with a previous study of suicide attempters in Japan and previous psychological autopsy studies [7, 31, 32]. This age difference may be attributed to the younger age of onset of the schizophrenia group. Therefore, when diagnosing young suicide attempters, schizophrenia and schizophrenia-related disorders should be considered.

The suicide rate of those with a history of psychiatric treatment was significantly higher in the schizophrenia group than in the mood disorder group ($p < 0.001$). This was also a significant item in the multivariate logistic regression. Although almost 90% of patients in the schizophrenia group had undergone psychiatric treatment, this did not prevent suicidal behavior. We must always keep in mind that individuals with schizophrenia are at risk for suicide attempts even with psychiatric treatment, and we should provide active crisis intervention as needed.

Patients in the schizophrenia group used violent methods significantly more than non-violent methods ($p = 0.017$). The most common method in the schizophrenia group was jumping from a height (36.6%), which was also used significantly more frequently than in the mood disorder group ($p < 0.001$). The association between schizophrenia and the suicide method of jumping from a height has been pointed out in previous studies [7, 33]. This may be attributed to the influence of hallucinations on deciding to jump from a height in these patients [7]. In clinical practice, some schizophrenic patients after jumping state that they were influenced by auditory hallucinations, which could mean that their psychotic symptoms were worsening. In addition, the high impulsivity of patients with schizophrenia may contribute to such behavior [34, 35]. Many neurobiological studies have implicated dysfunctional frontotemporal circuitry in impulsivity and aggression in schizophrenia [36]. And suicide attempts, especially by jumping, have been noted to be highly associated with impulsivity [37]. Although these are consistent with actual clinical experience, further exploration is warranted in the future.

In our study, approximately one-fifth of the mood disorder group had bipolar disorder, which is similar to a previous study by Hantouche et al., although their number of bipolar disorder patients doubled after careful systematic assessment [26]. Therefore, we must be cautious about the latency before the diagnosis of bipolar disorder in patients in the mood disorder group. Treatments for unipolar depression (primarily antidepressants) and bipolar disorder (primarily mood stabilizers and antipsychotic drugs) are distinct. Furthermore, a systematic review revealed that the risk factors for suicide and attempted suicide in bipolar disorder patients are previous suicide attempt, hopelessness, family history of suicide, early onset of bipolar disorder, the high extent of depressive symptoms, increasing severity of affective episodes, the presence of mixed affective states, rapid cycling, comorbid Axis I disorders, and alcohol and drug abuse [38].

Hanging was used significantly more frequently in the mood disorder group than in the schizophrenia group ($p = 0.003$). This was also a significant item in the multivariate logistic regression. This is in line with a previous study conducted in Japan [7]. This may be reflected in the difference in impulsivity between the two groups,

Table 2 • Sociodemographic characteristics of suicide attempters.

		Total (N = 308)	Mood disorder group (N = 196)	Schizophrenia group (N = 112)	Statistics	
		N (%)	N (%)	N (%)	p-value	t-value
Age	<20	14 (4.5)	9 (4.6)	5 (4.5)	1.000	
	The others		187 (95.4)	107 (95.5)		
	20–29	52 (16.9)	29 (14.8)	23 (20.5)	0.209	
	The others		167 (85.2)	89 (79.5)		
	30–39	67 (21.8)	33 (16.8)	34 (30.4)	0.007 *	
	The others		163 (83.2)	78 (69.6)		
	40–49	60 (19.5)	34 (17.3)	26 (23.2)	0.233	
	The others		162 (82.7)	86 (76.8)		
	50–59	51 (16.6)	38 (19.4)	13 (11.6)	0.082	
	The others		158 (80.6)	99 (88.4)		
	60–69	41 (13.3)	30 (15.3)	11 (9.8)	0.222	
	The others		166 (84.7)	101 (90.2)		
	70–79	15 (4.9)	15 (7.7)	0 (0.0)	0.002 *	
	The others		181 (92.3)	112 (100.0)		
	>80	8 (2.6)	8 (4.1)	0 (0.0)	0.055	
	The others		188 (95.9)	112 (100.0)		
	Mean ± S.D.	44.7 ± 16.9	47.8 ± 17.9	39.4 ± 13.3	<0.001 †	4.333
Gender	Male	125 (40.6)	87 (44.4)	38 (33.9)	0.091	
	Female	183 (59.4)	109 (55.6)	74 (66.1)		
History of psychiatric treatment	With	226 (73.4)	126 (64.3)	100 (89.3)	<0.001 *	
	Without	81 (26.3)	69 (35.2)	12 (10.7)		
	Unknown	1 (0.3)	1 (0.5)	0 (0.0)		
Stay in hospital (days)	Mean ± S.D.	15.2 ± 17.4	14.6 ± 17.7	16.3 ± 16.8	0.386	–0.856

*: p-values calculated by Fisher’s exact test; †: p-values calculated by Student’s t-test.

which has been reported previously [7, 31]. Hanging, which requires planning and premeditation, may be related to the relatively low impulsivity and depressive symptoms of the mood disorder group. Poisoning by pesticides ($p = 0.021$) and by gas ($p = 0.003$) were also significantly more common in the mood disorder group than in the schizophrenia group.

The distribution of the psychiatric diagnoses of 596 suicide attempters was similar to that of suicide attempters at other hospitals in Japan [39]. All of our patients were medically serious suicide attempters who had been admitted to the ECCC. Although we consider suicide completers and medically serious suicide attempters to be different populations, they share many similarities [29]. The illness severity of our participants suggests that the characteristics of the suicide attempters at our ECCC are similar to those of suicide completers. However, the subjects of this study were limited to severe suicide attempters in urban areas, and the results may have been different if the region or severity of the condition was different.

The concept of emergency medicine differs between Japan and Western countries [40, 41]. In Japan, the emergency medicine system in Japan was established to better utilize emergency medical service resources by triaging patients according to acuity of presentation. There are three levels of designated emergency care in Japan: (1) “primary emergency care”, which serves patients with low-acuity conditions who can be safely discharged to their homes; (2) “secondary emergency care”, which serves patients with moderate-acuity conditions who require admission to a general inpatient unit; and (3) “tertiary emergency care”, which serves patients with high-acuity conditions who require intensive care or emergency surgery. In major metropolitan areas, each medical facility can provide a designated level of emergency care and

accepts patients from the emergency medical system. Historically, the staffing of emergency departments has been based on a “multi-specialist model”, with specialist physicians representing different services.

As we mentioned above, previous research has shown that medically serious suicide attempters and completers are two populations that share common characteristics [29]. Moreover, a history of previous suicide attempts is a key risk factor for subsequent suicide [42]. Given that assertive case management for those who attempt suicide reduces repeated suicide attempts [43], our suicide prevention team at Fukuoka University Hospital has continued to manage patients who attempted suicide since 2006.

The findings of the schizophrenia group may indicate that close attention should be paid to their risk of completing suicide using violent methods during psychiatric consultations. Furthermore, given that suicide can occur at any point during the course of schizophrenia [44], appropriate antipsychotic drug treatment, careful follow-up monitoring, and crisis intervention are crucial to prevent suicidal behavior in patients with schizophrenia. Excess mortality is primarily observed in patients not using antipsychotic drugs [45]. In terms of suicide attempts during early psychosis, such as first-episode schizophrenia (FES) or at-risk mental state, both active illness and depressive symptoms are highly prevalent immediately before suicide [44]. In such patients, antipsychotic drugs may be effective. Second-generation antipsychotics, especially clozapine, are more effective than first-generation antipsychotics in preventing suicide [46–48]. In chronic-phase schizophrenia patients, medication adherence is a critical factor in preventing suicide [45]. In addition, psychosocial interventions play a key role in the treatment of suicidal patients with schizophrenia. Supportive, reality-orientated therapies are important in the management of patients

Table 3 • Suicide method used by suicide attempters.

	Total	Mood disorder group	Schizophrenia group	Statistics
	(N = 308)	(N = 196)	(N = 112)	
	N (%)	N (%)	N (%)	p-value
Methods				
Non-violent methods	136 (44.2)	97 (49.5)	39 (34.8)	0.017 *
Violent methods	172 (55.8)	99 (50.5)	73 (65.2)	
Non-violent methods				
Poisoning by prescribed drugs	91 (29.5)	63 (32.1)	28 (25.0)	0.197
The others		133 (67.9)	84 (75.0)	
Poisoning by pesticides	14 (4.5)	13 (6.6)	1 (0.9)	0.021 *
The others		183 (93.4)	111 (99.1)	
Poisoning by chemicals	5 (1.6)	1 (0.5)	4 (3.6)	0.061
The others		195 (99.5)	108 (96.4)	
Poisoning by detergent	13 (4.2)	7 (3.6)	6 (5.4)	0.558
The others		189 (96.4)	106 (94.6)	
Poisoning by gas	13 (4.2)	13 (6.6)	0 (0.0)	0.003 *
The others		183 (93.4)	112 (100.0)	
Violent methods				
Jumping	74 (24.0)	33 (16.8)	41 (36.6)	<0.001 *
The others		163 (83.2)	71 (63.4)	
Cutting/piercing	54 (17.5)	32 (16.3)	22 (19.6)	0.534
The others		164 (83.7)	90 (80.4)	
Hanging	28 (9.1)	25 (12.8)	3 (2.7)	0.003 *
The others		171 (87.2)	109 (97.3)	
Others	16 (5.2)	9 (4.6)	7 (6.3)	0.597
The others		187 (95.4)	105 (93.8)	

* p-values calculated using Fisher’s exact test.

with psychotic disorders [49], and family interventions have been shown to increase adherence to pharmacological therapy [50]. Because family members who express strong emotions can contribute to suicidal behavior in patients with schizophrenia [51], the primary goal of family interventions is to reduce psychological distress and expressed emotions among family members of patients with schizophrenia.

Schizophrenia patients at a high risk of suicidal behavior who undergo psychiatric treatment require careful follow-up and monitoring [52]. The prevention of suicide in schizophrenia patients is achieved via successful treatment of affective symptoms, improvement of treatment adherence, and constant vigilance of risk factors, especially after recent loss events [11]. Additionally, suicidal thoughts and a history of suicide attempts must be considered as primary factors when assessing schizophrenia patients for the risk of suicide [11, 44]. If a patient is deemed at high risk of suicide via follow-up and monitoring, they should be hospitalized as a crisis intervention [28, 52]. Another important factor in preventing suicide in the schizophrenia group is early detection and intervention. We found that 10.7% of patients in the schizophrenia group had no history of psychiatric treatment. This finding is consistent with a previous study that reported that 16.9% of patients in the schizophrenia group, all of whom were diagnosed with FES, had not received any psychiatric treatment [53]. Therefore, we suggest community screening and awareness programs to promote the early detection and intervention of schizophrenia.

We found that approximately one-third of the mood disorder group had no history of psychiatric treatment. It has been previously shown that although most depressed patients seek help from primary care services, their depressive symptoms are often overlooked [24]. There is an urgent need for screening and evaluation

for depression and suicide risk by primary care services as well as campaigns that promote psychiatric care. The importance of training gatekeepers in the community as a role to support and link high-risk individuals who have not yet been treated by a psychiatrist to treatment has also been pointed out [2]. Recently, Internet-based interventions have been shown to be an option for untreated at-risk individuals and provide low-cost screening, psychoeducation, and web-based psychotherapeutic treatment interventions [54]. Assertive case management for individuals who have attempted suicide is effective in preventing a subsequent suicide attempt [43]. Moreover, social support helps reduce the number of suicide attempts and completions in mood disorder patients [55].

Two-thirds of the patients in the mood disorder group attempted suicide despite undergoing psychiatric treatment. Patients with mood disorders require vigilant monitoring, support, and assistance following discharge to ensure their overall well-being [18]. Patients with treatment-resistant depression (TRD) have a higher rate of suicide than non-TRD patients [56]. Therefore, optimizing pharmacological treatments for patients with TRD using evidence-based algorithms and guidelines is recommended [18]. Studies have shown that lithium is effective in lowering the risk of suicide in individuals with mood disorders, independent of its mood-stabilizing effect [57]. Additionally, electroconvulsive therapy (ECT) has been shown to reduce suicide risk in hospitalized patients with severe depression [58].

Hanging, poisoning by pesticides, and poisoning by gas were significantly more common in the mood disorder group than in the schizophrenia group. Restricting access to the means of suicide is also a suicide prevention strategy. Unfortunately, restricting access to the suicidal method of hanging is not so practical [59]. Arranging for equipment to prevent the hooking of strings is both important

Table 4 • Odds ratios and 95% confidence intervals of diagnosis of schizophrenia/mood disorder associated with covariates.

Variable		OR	95% CI	p-value
Age	<20	8.96×10^{-9}	0–0.64	0.023 *
	20–29	6.03×10^{-9}	0–0.36	0.005 *
	30–39	5.06×10^{-9}	0–0.30	0.003 *
	40–49	7.31×10^{-9}	0–0.44	0.009 *
	50–59	1.47×10^{-9}	0–0.89	0.041 *
	60–69	1.29×10^{-8}	0–0.80	0.033 *
	70–79	1.40	-	1.000
	>80	1.00	0.58–1.73	-
Gender				
Male			Reference	
Female		0.80	0.43–1.50	0.485
History of psychiatric treatment		0.25	0.11–0.54	<0.001 *
Methods				
Non-violent methods			Reference	
Violent methods		0.55	0.02–14.2	0.678
Non-violent methods				
Poisoning by prescribed drugs		1.62	0.05–48.7	0.755
Poisoning by pesticides		5.02	0.11–310	0.387
Poisoning by chemicals		0.08	0.00–4.12	0.196
Poisoning by detergent		0.23	0.01–9.04	0.401
Poisoning by gas		9.15×10^7	-	0.082
Violent methods				
Jumping		0.89	0.26–3.04	0.851
Cutting/piercing		0.83	0.23–3.02	0.783
Hanging		7.25	1.48–43.6	0.014 *
Others		1.00	0.58–1.89	-

*: p-values calculated by multivariable logistic regression. CI = confidence interval.

and feasible in places that provide intensive care, such as psychiatric wards. Although not all cases will necessarily be carried out in a publicly visible manner, if one encounters a situation in which hanging is attempted, the priority should be to intervene promptly to keep the person away from that means and to obtain appropriate psychiatric treatment. Many studies have indicated that restrictions on access to and availability of pesticides, gases, and other lethal substances can lead to suicide prevention [2, 60, 61].

4.1. Methodological considerations

The first limitation of our study is that structured interviews were not used for the diagnosis of psychiatric disorders. Although the psychiatrists in the suicide prevention group attempted to interview all patients exhibiting suicidal behavior, it was not possible in some cases in which the physical condition of the patient was too serious or they were not conscious. It was also difficult to conduct structured interviews with all patients because of the short hospitalization period at our ECCC. Instead, psychiatric diagnoses were made by the specialist psychiatrists in our suicide prevention group following discussions of the cases. We made an effort to obtain as much information as possible using methods that were appropriate for the context of the ECCC. The second limitation is that some patients who attempted suicide could not participate in our study. For example, some patients had disturbances in consciousness due to brain damage, which prevented us from conducting an interview, and some patients were socially isolated and had no family members who could be interviewed. The third limitation is selection bias and our findings may be limited to those living in urban areas because our study was conducted at a single

center only in an urban area. A similar study conducted in a rural area may yield different results. Thus, a further multicenter study is needed to gain more generalizable insight into suicide prevention. The fourth limitation is potential confounding variables. We acknowledge that several potential confounding variables, such as comorbidities, economic background, psychological stress, and connections with social resources, may have influenced the findings of this study. The cross-sectional design limits our ability to account for all confounders.

5. Conclusions

This study focused on medically serious suicide attempters. The patients in the schizophrenia group were younger and may be more likely to use violent methods of suicide (especially jumping), despite having an extensive history of psychiatric treatment. The mood disorder group patients were older, and approximately one-third of patients had never visited a psychiatrist before attempting suicide. They typically used the hanging method of suicide which required planning. We must always keep in mind that individuals with schizophrenia are at risk for suicide attempts even with psychiatric treatment. Appropriate antipsychotic drug treatment, careful follow-up monitoring, and crisis intervention are crucial to prevent suicidal behavior in patients with schizophrenia. For suicide prevention in patients with mood disorders, various support systems to support patients without a history of psychiatric treatment and approaches to treatment resistance in patients with a history of psychiatric treatment are important. Follow-up systems for patients with a history of suicide attempts and restrictions on

access to methods of suicide attempts are important for both groups.

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Author contributions

Conceptualization, K.H. and N.E.; methodology, K.H. and N.E.; software, L.G.; validation, K.H., N.E. and L.G.; formal analysis, L.G.; investigation, K.H., N.E., M.M., M.I. and Y.O.; resources, K.H., N.E., M.M., M.I. and Y.O.; data curation, K.H., N.E. and L.G.; writing—original draft preparation, K.H.; writing—review and editing, K.H., N.E., L.G. and H.H.; visualization, L.G.; supervision, H.H.; project administration, K.H. and N.E. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflicts of interest.

Data availability statement

Data supporting these findings are available within the article or upon request.

Institutional review board statement

This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Fukuoka University Hospital (protocol code U21-856, 2021 Nov 10).

Informed consent statement

Patient consent was waived. Because of the retrospective nature of the study, we did not obtain consent from the patients. However, we did take their privacy into consideration. The research proposal was published on our website.

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