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Research paper

# Trends in patient suicide rate after psychiatric discharge in Korea from 2010 to 2018: A nationwide population-based study



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# ABSTRACT

*Background:* There is limited quantitative evidence to investigate short-term suicide rates although the risk of suicide in psychiatric patients is exceptionally high in the early post-discharge period. This study aimed to explore the trends of the 30 days suicide rate after discharge using population-based data from Korea. *Methods:* This study was conducted on psychiatric patients aged 15 years or older discharged between 2010 and 2018. Patients were extracted from the National Health Insurance Claim Database (NHICD) and information on suicide was obtained from the National Statistical Office. Age standardized suicide rate (ASP) and Standardized Statistical Office.

suicide was obtained from the National Statistical Office. Age-standardized suicide rate (ASR) and Standardized Mortality Ratio (SMR) within 30 days after discharge was estimated and tested using joinpoint regression. *Results:* Of the 1,576,028 patients discharged from hospitals from 2010 to 2018, 53.9 % were male and 47.9 % were aged between 40 and 59 years. The 30 days ASRs for psychiatric patients after discharge varied from 174.9 to 218.0 per 100,000 patients with no clear trend excluding patients with schizophrenia and anxiety disorder.

The SMR for suicide within 30 days after discharge was 66.8 in 2016–2018, and patients aged 20 to 39, female, and patients with depression had high SMRs compared to other groups. *Limitations:* Factors that may impact the suicide were not considered in this study. Since the NHICD data is

collected for payment of medical expenses, there may be scope for inaccuracies. *Conclusions*: The 30 days suicide rate after psychiatric discharge has failed to decrease between 2010 and 2018.

*Conclusions:* The 30 days suicide rate after psychiatric discharge has failed to decrease between 2010 and 2018. This study recommends early interventions after discharge and intensive interventions for patient groups who may be vulnerable to suicide.

# 1. Introduction

Suicide is a major public health issue worldwide and has an adverse impact on the lives of many people, especially those with psychiatric disorders (World Health Organization, 2021). In particular, patients discharged from hospital with psychiatric disorders are a high-priority target for the national suicide prevention policy of countries including South Korea because they have an exceptionally higher suicide rate in the early post discharge period (Forte et al., 2019; Paik et al., 2018). According to a meta-analysis study of psychiatric disorders, patients indicated a 100 times higher suicide rate within three months of discharge than the global suicide rate in 2012 (Chung et al., 2017). In another study analyzing short-term suicide rates after discharge, the suicide rates within 7 days and 30 days were 2950 and 2060 per 100,000 persons, respectively, which were higher than long-term suicide rates after discharge (Chung et al., 2019).

Supportive interventions including daycare hospitals and early outpatient follow-ups are crucial to reducing the risk of suicide in patients with psychiatric disorders (Baek et al., 2015; Crawford, 2004). In a UK-based study that investigated the suicide rate based on days between discharge and death, a follow-up within three days of discharge from inpatient care was recommended for discharge and safety planning (Bojanić et al., 2020). Fontanella et al. (2020) reported that the youths who received outpatient care within 7 days of discharge had a significantly lower adjusted relative risk of suicide than those who did not receive the same within six months after psychiatric discharge.

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#### Table 1

Demographic characteristics of the study population.

		Tota	1	2010-2	2012	2013–2	2015	2016–2	2018	P-value
		N	%	Ν	%	Ν	%	Ν	%	
	Number of patients	1,576,028	100	519,977	100	526,754	100	529,297	100	_
Age	Mean $\pm$ standard deviation	51.9 $\pm$	16.8	50.2 $\pm$	1.8	51.5 $\pm$	16.1	51.9 $\pm$	16.7	< 0.0001
Ū.	15–19	44,757	2.84	15,033	2.89	13,823	2.62	15,901	3.00	< 0.0001
	20–39	317,451	20.14	111,729	21.49	102,304	19.42	103,418	19.54	
	40–59	754,893	47.90	256,010	49.23	257,486	48.88	241,397	45.61	
	60–79	389,977	24.74	118,779	22.84	130,079	24.69	141,119	26.66	
	80+	68,950	4.37	18,426	3.54	23,062	4.38	27,462	5.19	
Sex	Male	848,998	53.87	284,708	54.75	287,085	54.50	277,205	52.37	< 0.0001
	Female	727,030	46.13	235,269	45.25	239,669	45.50	252,092	47.63	
Diagnosis	Alcohol use disorder	382,432	24.27	136,391	26.23	129,266	24.54	116,775	22.06	< 0.0001
Ū	Schizophrenia	356,441	22.62	119,318	22.95	119,485	22.68	117,638	22.23	
	Bipolar disorder	108,271	6.87	33,750	6.49	36,926	7.01	37,595	7.10	
	Depression	285,575	18.12	95,394	18.35	95,765	18.18	94,416	17.84	
	Anxiety disorder	216,802	13.76	60,449	11.63	69,593	13.21	86,760	16.39	
	Other mental disorders	226,507	14.37	74,675	14.36	75,719	14.37	76,113	14.38	

An epidemiological analysis of the exact risk of suicide after hospital discharge is imperative in informing priorities and policies for mental healthcare services (Reutfors et al., 2010). Nevertheless, there is currently limited quantitative evidence to investigate short-term suicide rates after discharge, especially in a mental health system with a high suicide rate and hospitalization-based system such as in Korea (Chung et al., 2019; Park et al., 2013). Therefore, this study aimed to explore for the first time the trends in short-term suicide rates after the discharge of patients with psychiatric disorders using population-based representative data from Korea.

# 2. Methods

#### 2.1. Data source and study population

This cross-sectional study was conducted on patients with psychiatric disorders aged 15 years or older who were discharged from hospitals between 2010 and 2018. Patients discharged alive with a primary or secondary diagnosis code of mental health and behavior (International Classification of Disease version 10 [ICD-10]: F10-F69 and F90-F99) were included in the study (Organization for Economic Co-operation and Development, 2021).

Data on patients with psychiatric disorders were extracted from the National Health Insurance Claim Database (NHICD) managed by the Health Insurance Review and Assessment Service. The NHICD has been established for the payment of medical expenses and includes patients' demographic and clinical characteristics, including detailed service information such as prescription and examination (Kim et al., 2017).

# 2.2. Outcome measures and variables

The outcome measure was the occurrence of death by suicide within 30 days after hospital discharge. Index admission was used to define the last admission per year to reflect patients' final health outcome when patient had multiple hospitalization in the year. The occurrence of suicide death (ICD-10: X60-X84) was obtained by linking the NHICD to the causes of death from the National Statistical Office of Korea, which provides a complete account of state-recorded deaths in Korea (Im et al., 2011). The data were collected from January 1, 2010, to December 31, 2020.

Demographic characteristics included age at hospital discharge (15–19 years, 20–39 years, 40–59 years, 60–79 years, and over 80 years), sex, and psychiatric disorders. Psychiatric disorders were classified as alcohol use disorder (ICD-10: F10), schizophrenia (ICD-10: F20-F29), bipolar disorder (ICD-10: F30-F31), depression (ICD-10: F32-F39), anxiety disorder (ICD-10: F40-F41), and other mental disorders (ICD-10: remainder of F10-F69, F90  $\sim$  F99) based on primary diagnoses (Na

et al., 2019). The year of discharge was divided into three time periods: 2010–2012, 2013–2015, and 2016–2018.

# 2.3. Statistical analysis

Descriptive statistics including frequencies and percentages were analyzed for demographic characteristics by time periods and the comparisons were tested by analysis of variance and Chi-square tests. Crude and age-standardized suicide rates for the 30 days period from hospital discharge were estimated using the direct method with reference to the general Korean population in 2018 provided by the National Statistical Office. The significant changes in the suicide rate by sex and psychiatric disorder group were analyzed using a joinpoint regression model (Joinpoint regression program (Version 4.9.0.1.), 2022), which was utilized to find the inflection points where the slope of trend changes (Kim et al., 2000).

The Standardized Mortality Ratio (SMR) was calculated to compare the 30 days suicide rate of patients discharged with psychiatric disorders to that of the general population. The SMR is calculated as the expected number of deaths by suicide of patients with psychiatric disorders and the actual number of deaths. In order to use an equivalent time window of 30 days when calculating SMR, this study assumed that the expected number of deaths by suicide during 30 days would be 1/12th of that expected at 1 year based on the life tables in 2018 (Bergh et al., 2021).

The SMR was further stratified according to the year of discharge, age group, sex, and psychiatric disorder group. All statistical analyses were performed using SAS Enterprise Guide 7.1. (SAS Institute Inc., Cary, NC, US) and the Joinpoint Regression Program version 4.9.0.1. P < 0.05 was considered statistically significant.

#### 2.4. Ethical considerations

Data on the suicide rate in Korea are publicly accessible via the Korean Statistical Information Service website (http://kosis.kr). Data on patients with psychiatric disorders were extracted from the NHICD and analyzed anonymously without any privacy or confidentiality concerns. This study was approved by the Institutional Review Board of the Health Insurance Review and Assessment Service (No. 2022008).

# 3. Results

# 3.1. Demographic characteristics

Of the total 1,576,028 psychiatric patients discharged from hospitals from 2010 to 2018 in Korea, 53.9 % were male and 47.9 % were aged between 40 and 59 years, which was higher than that of other age groups. Alcohol use disorder (24.3 %) was the most common admission

	2010	2011	2012	2013	2014	2015	2016	2017	2018		Trend 1			Trend 2	
										Period	APC (95%CI)	P-value	Period	APC (95%CI)	P-value
Total	206.6	218.0	197.1	189.7	185.9	197.6	196.8	174.9	198.1	2010-2018	$-1.2\ (-2.7,\ 0.4)$	0.120			
Sex															
Male	228.0	233.9	220.1	218.6	221.2	242.4	213.7	220.1	222.3	2010 - 2018	-0.4(-1.7, 0.9)	0.495			
Female	179.3	204.3	173.7	155.0	143.3	146.6	180.9	134.7	175.1	2010 - 2018	-2.1(-5.8, 1.7)	0.233			
Diagnosis															
AUD	140.3	210.7	215.0	178.3	214.9	224.5	169.2	185.8	134.6	2010 - 2015	8.2(-3.4, 21.3)	0.125	2015 - 2018	$-14.0\left(-33.2, 10.8\right)$	0.174
Schizophrenia	212.2	215.8	190.5	182.5	164.3	187.2	197.5	145.4	167.8	2010 - 2018	-3.2(-5.8,-0.5)	0.027			
Bipolar disorder	175.3	178.1	163.3	175.2	202.5	159.4	144.2	210.1	158.0	2010 - 2018	-0.1 $(-4.1, 4.0)$	0.948			
Depression	333.3	348.1	303.4	307.6	252.3	259.7	364.2	251.4	364.4	2010 - 2018	-0.3(-4.9, 4.5)	0.876			
Anxiety disorder	120.7	115.0	123.4	88.5	67.5	111.0	94.1	78.9	59.4	2010 - 2018	-6.5 (-11.8, -0.9)	0.030			
Other	169.0	194.3	182.0	142.3	203.1	149.9	145.2	213.0	258.8	2010 - 2016	$-2.7\left(-12.1, 7.6 ight)$	0.491	2016-2018	29.7 (-25.8, 126.7)	0.265
Abbreviation: AUD (.	alcohol use	disorder),	, APC (ann	ual percent	: change), (	CI (confide	nce interva	J), Other	(other mer	ital disorders).					

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diagnosis, followed by schizophrenia (22.6 %), depression (18.1 %), and anxiety disorder (13.8 %).

The demographic characteristics of the patients in each time period were similar to those of patients during the overall study period. However, there were significant differences in the age group, sex, and psychiatric disorder group between the different time periods. In 2016–2018, the number of elderly and female patients significantly increased compared to 2010–2012 and 2013–2015 (P < 0.0001).

By psychiatric disorder group, the number of patients discharged for bipolar affective disorder and anxiety disorder in 2016–2018 was more compared to 2010–2012, while the number of discharged patients with schizophrenia and depression decreased gradually (Table 1).

#### 3.2. Trend of age-standardized suicide rate

Table 2 shows the 30 days age-standardized suicide rate (ASR) of patients after hospital discharge. The 30 days ASR was found to be 198.1 per 100,000 patients in 2018 and 206.6 per 100,000 patients in 2010. The annual percent change (APC) of the 30 days ASRs was -1.2 (95 % Confidence Interval [CI]: -2.7 to 0.4); however, this change was not statistically significant over the study period (p = 0.120). Comparing the 30 days ASR by sex, the 30 days ASR of male patients in 2015 was the highest (242.4 per 100,000 patients), whereas the APC of 30 days ASRs was not notably observed among both genders (male p = 0.495, female p = 0.233). The 30 days ASR of patients with depression in 2018 was 364.4 per 100,000 patients, which was the highest over the study period. However, the APCs by psychiatric group were not statistically significant except for schizophrenia and anxiety disorder. The 30 days ASRs of patients with schizophrenia fluctuated between 145.4 and 215.8 per 100,000 patients and the APC was -3.2 (95 % CI: -5.8 to -0.5) with statistical significance (p = 0.027). The 30 days ASRs of patients with anxiety disorder were lower than that among the other psychiatric disorder groups and the APC was -6.5 (95 % CI: -11.8 to -0.9, p = 0.030). The APCs of patients with alcohol use disorder and other mental disorders indicated inverse changes at the two points, but neither reached statistical significance.

# 3.3. Standardized mortality ratio

The SMR for suicide was 66.8 (95 % CI: 62.7 to 70.9) in 2016–2018 and decreased steadily over the time periods (2010–2012: 74.9, 95 % CI 70.5 to 79.3; 2013–2015: 67.9, 95 % CI 63.8 to 72.0). In 2016–2018, patients aged 20 to 39 years, female patients, and patients with depression had high SMRs compared to other groups. The SMR for female patients was 107.5 (95 % CI: 96.9 to 118.1), which was twice that of male patients (SMR = 54.0, 95 % CI: 49.8 to 58.2) in 2016–2018 and decreased over the study period. The SMR of the 20–39 years age group was the highest at 114.9 (95 % CI: 99.8 to 130.1) and the SMRs attenuated with increasing age except for the age group 15–19 years. Regarding the psychiatric diagnosis group, patients with depression had the highest SMR (SMR = 122.7, 95 % CI: 108.9 to 136.5), followed by schizophrenia (SMR = 66.0, 95 % CI: 57.0–75.1), and bipolar affective disorder (SMR = 64.1, 95 % CI: 48.4–79.8) (Table 3).

#### 4. Discussion

The present study investigated the trends in the 30 days suicide rate after hospital discharge for patients with psychiatric disorders in Korea, which relies on a hospital-based mental health system. A fluctuating trend was observed in 30 days ASR between 2010 and 2018. However, the risk of suicide within 30 days from hospital discharge with psychiatric disorders was about 66.8-fold higher than that of the general population in 2016–2018. The SMRs of patients who were aged 15–19 years, male patients, and patients with schizophrenia or bipolar disorder decreased over the study period.

The 30 days ASR was 174.9 per 100,000 patients in 2018, which was

# Table 3

Standardized mortality ratios of the suicide within 30 days after psychiatric discharge.

	2010–2012					2013–2015						2016–2018				
	Obs. Exp.		SMR		Obs.	Exp.		SMR		Obs.	Exp.		SMR			
			Estimate 95 % CI				Estimate	95 9	% CI			Estimate	95 9	% CI		
Total	1113	14.9	74.9	70.5	79.3	1048	15.4	67.9	63.8	72.0	1031	15.4	66.8	62.7	70.9	
Age																
15–19	17	0.1	155.5	81.6	229.5	12	0.1	119.4	51.9	187.0	8	0.1	69.2	21.3	117.2	
20-39	213	2.1	100.9	87.4	114.5	185	1.9	96.1	82.2	109.9	221	1.9	114.9	99.8	130.1	
40-59	549	7.6	72.5	66.5	78.6	514	7.6	68.0	62.1	73.9	484	6.9	69.9	63.7	76.1	
60-79	306	4.0	76.6	68.0	85.2	295	4.5	66.2	58.7	73.8	273	4.8	56.6	49.9	63.3	
80+	28	1.1	25.8	16.3	35.4	42	1.4	30.3	21.1	39.4	45	1.7	27.3	19.3	35.2	
Sex																
Male	672	11.5	58.4	54.0	62.9	690	11.9	57.8	53.4	62.1	634	11.7	54.0	49.8	58.2	
Female	441	3.4	131.0	118.8	143.2	358	3.5	102.8	92.2	113.5	397	3.7	107.5	96.9	118.1	
Diagnosis																
AUD	235	5.3	44.5	38.8	50.2	277	5.1	54.5	48.0	60.9	217	4.6	47.5	41.2	53.8	
Schizophrenia	256	3.0	85.1	74.6	95.5	211	3.1	67.8	58.6	76.9	206	3.1	66.0	57.0	75.1	
Bipolar disorder	61	0.8	75.9	56.9	95.0	67	0.9	70.8	53.8	87.7	64	1.0	64.1	48.4	79.8	
Depression	333	2.3	141.8	126.5	157.0	282	2.5	114.4	101.1	127.8	303	2.5	122.7	108.9	136.5	
Anxiety disorder	80	1.5	52.5	41.0	64.1	73	1.8	40.6	31.3	49.9	82	2.2	36.6	28.7	44.5	
Other	148	1.9	77.7	65.2	90.2	138	2.0	68.3	56.9	79.7	159	2.0	78.0	65.8	90.1	

Abbreviation: AUD (alcohol use disorder), Obs (observed number), Exp (expected number), SMR (standardized mortality ratio), CI (confidence interval), Other (other mental disorders).

lower than 206.6 per 100,000 patients in 2010. However, the 30 days ASR showed a fluctuating trend, and the decreasing trend was not observed among both sexes and psychiatric diagnosis groups except for schizophrenia and anxiety disorder. Unlike in South Korea, suicide rates after psychiatric discharge have steadily decreased in countries that have implemented deinstitutionalization and decentralization of mental health systems. In Finland (Pirkola et al., 2007), the suicide rate decreased from 1985 to 2001, and in Denmark (Madsen and Nordentoft, 2013), the suicide rate decreased steadily within three months after hospital discharge from 1998 to 2005 (Hazard ratio = 0.93, 95 % CI: 0.88 to 0.99). Furthermore, in Sweden (Ljung, 2007), the suicide rate decreased after discharge from 1987 to 2004 (Relative risk = 0.89 in 1999-2004 compared with 1987-1992), and in the UK, the suicide rate decreased from 24.8 to 19.5 per 100,000 persons within three months of discharge (While et al., 2012). Numerous evidence has been reported on the benefits of preventive interventions in reducing the risk of suicide after hospital discharge. Regular monitoring and early outpatient follow-up of high-risk groups immediately after discharge have been strongly recommended to prevent suicide (Choi et al., 2019; Goldacre et al., 1993; While et al., 2012). Additionally, the role of experts has been emphasized to reduce the risk of suicide in patients with psychiatric disorders after discharge (Ljung, 2007). South Korea has been actively implementing a national suicide prevention program since 2002, especially targeting people with psychiatric disorders who are at a high risk of suicide. In particular, South Korea is planning to shift from a hospital-based mental health system to a community-based system, however, the social support system for a patient with a psychiatric disorder to adapt to the community is weak (Lee et al., 2014). Therefore, there is a need for both systematic approaches such as coordination of care with the community and clinical initiatives during the period of transition of the patient.

Consistent with previous studies, it was found that the risk of suicide within the 30 days after discharge for patients with psychiatric disorders was 66.8-fold higher than that of the general population in 2016–2018. In a recent study, the risk of suicide attempts within 1 year after discharge was found to be 18.2-fold higher than that of the general population (Olfson et al., 2021) and the risk of suicide was 7.38 times higher in patients with severe mental illnesses who were discharged after long-term hospitalizations (Kondo et al., 2017). However, compared to previous studies, a direct comparison was limited due to the differences in durations of follow-up after discharge and additional factors that may affect suicide such as patient characteristics, length of

stay, and mental health systems. Nevertheless, the current findings emphasize the importance of intensive follow-ups after the discharge of patients with psychiatric disorders and the need to evaluate medical records including suicide attempts or self-harm.

The SMR of female patients was almost two-fold higher than that of males during the study period. Most previous studies found that females had a higher risk of suicide than males (Listabarth et al., 2020; Pirkola et al., 2007; Qin and Nordentoft, 2005), which can be explained in that females are more likely to feel suicidal due to stressful situations or life events (Listabarth et al., 2020). Therefore, these findings hold higher risk implications for females. The SMRs decreased with age; however, the SMR of the 20-39 years age group was particularly high. These results have been consistently reported in previous studies (Choi et al., 2019; Ho, 2003; Park et al., 2013; Qin, 2011). These findings indicate that the younger the patient with psychiatric disorders, the higher the risk of suicide. Meanwhile, in this study, it was found that SMRs of 15-19 years age groups low in 2016-2018 compared to the previous year, which could be because the number of suicides among 15-19-yearold patients during the period was less. With respect to the psychiatric disorder group, the SMR of patients with depression was the highest, followed by schizophrenia and bipolar disorder. A U.S. study reported that the risk of suicide was the highest for discharged patients with depressive and bipolar disorders, followed by schizophrenia and substance use disorder (Olfson et al., 2016). In a Danish study comparing SMRs, the suicide risk among patients aged 35 years or younger with schizophrenia was the highest in both sexes, and alcohol use disorder in males and other personality disorders, and recurrent depression in females were the highest risk for middle-aged adults (Qin, 2011). A metaanalysis of suicide risk for the first year after discharge reported that major depressive disorders excluding schizophrenia, bipolar disorder, and substance use disorder are associated with a significantly increased relative risk of suicide (Large et al., 2011). These findings imply that patients with depression have a higher risk of suicide after discharge than patients with other psychiatric disorders. Therefore, optimal discharge decisions and planning should be implemented in the hospital before discharging a patient with a psychiatric disorder.

# 4.1. Limitations

Although the present study reveals important findings, it has several limitations. First, socioeconomic factors such as income, marital status, family history of suicide, and suicide attempt history that may impact

the occurrence of suicide were not considered. Second, patients with psychiatric disorders were extracted from the NHICD based on primary and secondary diagnosis; however, as the NHICD is collected for payment of medical expenses, there may be scope for inaccuracies. However, admission data with high diagnostic accuracy, rather than outpatient care data, was targeted, and the concordance of diagnosis for psychiatric disorders was higher than for other diseases (Park et al., 2003). Finally, the suicide rate within 30 days after psychiatric discharge was calculated as the suicide of a patient who was discharged alive. However, it was not possible to confirm whether they survived and were discharged from the NHICD. In addition, there is a possibility that the 30-day suicide rate may be overestimated as patients who committed suicide in the hospital and were discharged from the hospital have also been included. However, a total of 44 patients committed suicide among all admitted patients in Korea in 2020, including patients with psychiatric disorders (Korea Institute for Healthcare Accreditation, 2020), which is not expected to significantly affect the suicide rate within 30 days after discharge.

Despite the above limitations, this is the first study in Korea reporting the 30 days suicide rate after discharge for patients with psychiatric disorders using a nationwide population-based database. Despite diverse efforts to reduce suicide, the 30 days suicide rate of patients with psychiatric disorders after discharge has failed to decrease between 2010 and 2018. These findings recommend early interventions after discharge and improve transitions from inpatient to outpatient mental health care. Moreover, intensive interventions are urgently needed for patient groups who may be more vulnerable to suicide.

# CRediT authorship contribution statement

SE Che and KH Kim designed the study and wrote the manuscript. YG Gwon, B Sim, and K Yun did the acquisition of data analyses and managed the literature searches. JY Lee and HJ Lee contributed to analysis and interpretation of the data. KH Kim had final responsibility for the decision to submit for publication.

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#### **Conflict of interest**

The authors declare that they have no competing interests.

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