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Suicide Rates and Subgroups With Elevated Suicide Risk Among Patients With Psychiatric Disorders: A Nationwide Cohort Study in Korea

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ABSTRACT

Background: Despite the distinctly high risk of suicide among patients with psychiatric disorders, little is known regarding the nationwide rates and risk factors for suicide among individual subgroups of patients with psychiatric disorders. This study aimed to assess differences in suicide rates and identify risk factors for suicide across multiple psychiatric diseases using data from a nationally representative cohort in Korea.
Methods: Six groups of incident patients with psychiatric disorders, namely those with drug use disorder (DUD), alcohol use disorder (AUD), schizophrenia (SCZ), bipolar disorder (BD), depressive disorder (DD), or other affective disorders (OADs), were extracted from the National Health Information Database and followed up. Suicide rates and risk factors were then determined for each disease group.
Results: Patients with psychiatric disorders had higher suicide rates than did the general population, with standardized mortality ratios (SMRs) ranging from 2.5 to 16.6. In particular, patients with DUD showed markedly higher suicide rate (584.0 per 100,000 person-years [PYs]; SMR, 16.6) than did patients with affective disorders, including DD (119.8 per 100,000 PYs; SMR, 3.1). AUD, DUD, SCZ, and BD showed lower male/female suicide rate ratios (1.1–1.4) than did depressive and OADs (2.2–2.4). Old age increased the risk for suicide among those with DUD and OADs, while medical aid recipients exhibited the lowest suicide risk among those with the AUD and SCZ. Male sex and the presence of multiple psychiatric comorbidities were consistently identified as suicide risk factors across mental illness subgroups.
Conclusion: The current study observed substantial variations in suicide rates and risk factors across psychiatric disorders and patient characteristics, which have significant implications for suicide prevention strategies.

Keywords: Suicide; Risk Factors; Mental Disorders; Cohort Studies; Suicide Prevention

INTRODUCTION

Suicide is a growing public health concern worldwide, particularly in Northeast Asia countries such as South Korea (hereafter referred to as Korea).[1] Notably, Korea has

in the study design, data collection, analysis, interpretation of data, report writing, and decision to submit the paper for publication.

Disclosure

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: Lim J. Data curation: Kang J. Formal analysis: Kang J, Lim J. Funding acquisition: Lim J. Methodology: Lim J. Visualization: Kang J. Writing - original draft: Kang J, Lee J. Writing - review & editing: Lim J, Lee J, Shin JY.

experienced the highest suicide rate among all Organization for Economic Co-operation and Development countries from 2003 to 2020.[2] In response, the Korean government has been implementing a national suicide prevention plan since 2004; however, these endeavors have failed to remarkably reduce suicide rates, particularly among male individuals in Korea.[3]

Suicide prevention strategies place the highest priority on patients with psychiatric disorders due to the high risk of suicide in this population.[4,5] Some studies have reported that at least 90% of individuals who die by suicide have a mental illness,[6,7] and that several patients visit psychiatric outpatient clinics before suicide death.[8,9] This emphasizes the importance of suicide risk identification among patients with psychiatric disorders in clinical settings and a comprehensive understanding of suicide risk and risk factors according to each psychiatric disorder.

Despite the substantial body of evidence on this matter, introducing recent descriptive analyses using large national cohorts is imperative considering the inconsistencies in previous results and scarcity of nationwide studies. For example, a meta-study reported a pooled odds ratio (OR) of 1.49 for suicide in patients with drug use disorder (DUD),[10] however, a strikingly higher suicide risk had been observed among those with DUD or alcohol use disorder (AUD) than among the general population in a study involving a psychiatric hospital in Italy (standardized mortality ratio [SMR], 47.6)[11] and in another study involving a Swedish national cohort (crude hazard ratio [HR], 16.25),[12] emphasizing the need for further epidemiologic studies. Additionally, to the best of our knowledge, no recent study has investigated the suicide mortality rate among patients with schizophrenia (SCZ), bipolar disorder (BD), and depressive disorder (DD) using national-level cohort, despite meta-analysis results based largely on long-standing research reporting substantially high suicide risk among such patients.[13,14]

A majority of previous studies have focused on identifying risk factors for suicidal behavior rather than suicide deaths among patients with psychiatric disorders.[15-19] Hence, surprisingly few studies have assessed risk factors for suicide deaths in each distinct psychiatric group using national-level data.[20,21] Furthermore, to the best of our knowledge, no cohort study has yet assessed differences in suicide risk factors across each psychiatric disorder.

To address these research gaps, we conducted a large cohort study based on national health insurance data in Korea. In particular, we aimed to compare suicide mortality rates and disease-specific risk factors across multiple psychiatric disorders, including DUD, AUD, SCZ, BD, DD, and other affective disorders (OADs) throughout Korea.

METHODS

Study population

Incident patients newly diagnosed with one of six mental disorders were identified from the National Health Information Database (NHIS-2019-1-009), a public database of medical claims within the Korean National Health Insurance system. We selected participants aged 15 or older who had used health care services twice or more for six mental disorders from 2007 to 2010 but not from 2002 to 2006. The utilization of health care services for the specific metal disorder was determined by the following Korean Standard Classification of Disease (KCD) codes: DUD—F11 (mental and behavioural disorders due to use of opioids), F12 (mental and behavioural disorders due to use of cannabinoids), F13 (mental and

behavioural disorders due to use of sedatives or hypnotics), F14 (mental and behavioural disorders due to use of cocaine), F15 (mental and behavioural disorders due to use of other stimulants, including caffeine), F16 (mental and behavioural disorders due to use of hallucinogens), F18 (mental and behavioural disorders due to use of volatile solvents), or F19 (mental and behavioural disorders due to multiple drug use and use of other psychoactive substances), AUD—F10 (mental and behavioural disorders due to use of alcohol), SCZ—F20 (schizophrenia), BD—F31 (bipolar affective disorder), DD—F32 (depressive episode) or F33 (recurrent depressive disorder), OADs—F30 (manic episode), F34 (persistent mood [affective] disorders), F38 (other mood [affective] disorders), or F39 (unspecified mood [affective] disorder). In total, this study included 5,287 patients with DUD, 121,250 with AUD, 102,540 with SCZ, 96,336 with BD, 1,235,465 with DD, and 376,621 with OADs.

Measures

The study population was followed up until December 31, 2017. The index time was the date of first diagnosis, whereas the outcome event was death by suicide. A death was considered as a suicide if the cause of death was intentional self-harm (KCD codes: X60–X84) in the National Statistics Organization database. Suicide hazard was assessed according to age group (in 10-year intervals), income level, and residence area (metropolitan or rural areas) at the time of enrollment. Income level was stratified based on whether participants were eligible for medical aid or national health insurance. The national health insurance group was then subclassified into low-, middle–low-, middle–high-, or high-income groups using quartiles based on the patients' premium costs. Additionally, the Charlson Comorbidity Index (CCI) score was calculated as an indicator of multi-comorbidity, using Quan's method[22] and comorbidity with other psychiatric disorders was evaluated. Comorbidity variables were determined from each patient's diagnoses 2 years before to 1 year after initial diagnosis of a psychiatric disorder. The number of comorbid mental illnesses was determined based on 11 psychiatric disorders, as described in the **Supplementary Data 1**.

Statistical analysis

Annual suicide rates and associated 95% confidence intervals (CIs) were calculated using a generalized linear model based on the Poisson distribution (PROC GENMOD Statement in SAS version 9.4; SAS Institute, Cary, NC, USA). SMRs with 95% CI were calculated using SAS PROC STDRATE procedure in SAS 9.4. The SMR was defined as the ratio of observed suicide deaths to the number of suicide deaths that would be expected if each mental disorder group experienced the average annual age-specific suicide rate for the male and female Korean populations in 2007–2017. The suicide rates of Korean population were calculated by dividing the number of suicide deaths in 5-year age interval by the number of people in that age group registered with the National Population Register, which was downloaded from the Korean Statistical Information Service (https://kosis.kr/eng/). Suicide HRs were determined using the Cox proportional hazard model, with Efron's tie-handling method. All data processing and statistical analyses were performed with SAS version 9.4, with the cutoff for statistical significance being as set at 0.05.

Ethics statement

This study was approved by the Institutional Review Board of Eulji University (EU2019-25). The committee waived the requirement for written informed consent given our use of secondary data with no personal information.

RESULTS

Annual suicide rates varied according to diagnosis and sex (**Table 1**). Across all diagnosis groups, suicide rates were higher in males than in females, whereas SMRs were larger in females than in males. Patients with DUD showed the highest suicide rates (584.0 per 100,000 person-years [PYs]; SMR, 16.6), followed by those with AUD (321.1 per 100,000 PYs; SMR, 9.3), SCZ (308.1 per 100,000 PYs; SMR, 9.0), and BD (285.1 per 100,000 PYs; SMR, 8.1). In contrast, those with DD (119.8 per 100,000 PYs; SMR, 3.1) or OADs (97.2 per 100,000 PYs; SMR, 2.5) had relatively lower suicide rates than did those with other psychiatric disorders, although suicide rates for both groups were still higher than those for the general population. Patients with AUD, DUD, SCZ, and BD had lower male/female suicide rate ratios (M/F ratios) (range, 1.1 to 1.4) than did those with DD and OADs (range, 2.2 to 2.4).

Variations in suicide HRs were also observed among the groups after adjusting for age, sex, income level, residence area, CCI score, and psychiatric disorder comorbidity, showing similarities with the crude results (**Tables 2** and **3**, **Fig. 1**). In DUD and OADs, patients diagnosed at age 65 or older showed higher suicide rates. Conversely, the 15–24 and 25–34 onset-age groups exhibited higher suicide hazards in the AUD and SCZ groups, respectively. BD and DD demonstrated lower suicide rates in the 75 years and older onset-age group, with similar suicide rates by age in the remaining groups. Both crude and adjusted suicide HRs were higher in males than in females across all six psychiatric disorders. After adjustment, patients with AUD (adjusted HR, 0.78; 95% CI, 0.69–0.88) and SCZ (adjusted HR, 0.63; 95% CI, 0.55–0.72) in the medical aid group had significantly lower suicide risk than did those in the low-income group (**Supplementary Table 1**). Residence area and CCI score were not associated with suicide risk in most disorders, whereas the presence of psychiatric comorbidity was significantly associated with a higher suicide risk. For example, the adjusted suicide hazard for OADs patients having three or more psychiatric comorbidities was 5.36 (95% CI, 4.81–5.97) times that for patients without psychiatric comorbidities.

Table 1. Annual suicide rate per 100,000 person-years, SMR for suicide, and M/F ratio of suicide rate

Sex	Psychiatric disorder	Total	Suicide	Suicide rate (95% CI)	SMR (95% CI)	M/F ratio[a]
Total	Drug use disorder	5,287	239	584.0 (511.0–657.0)	16.6 (11.6–18.7)	1.4
	Alcohol use disorder	121,250	3,048	321.1 (309.9–332.7)	9.3 (9.0–9.6)	1.1
	Schizophrenia	102,540	2,493	308.1 (396.2–320.4)	9.0 (8.6–9.3)	1.3
	Bipolar disorder	96,336	2,160	285.1 (273.3–297.4)	8.1 (7.8–8.5)	1.4
	Depressive disorder	1,235,465	12,270	119.8 (117.6–121.9)	3.1 (3.0–3.1)	2.4
	Other affective disorders	376,621	3,071	97.2 (93.8–100.7)	2.5 (2.4–2.6)	2.2
Male	Drug use disorder	2,686	137	657.0 (547.5–766.5)	13.9 (11.6–16.2)	-
	Alcohol use disorder	95,948	2,420	328.2 (315.4–341.6)	6.3 (6.1–6.6)	-
	Schizophrenia	48,951	1,349	353.2 (334.9–365.0)	7.8 (7.4–8.2)	-
	Bipolar disorder	39,817	1,055	345.6 (325.4–365.0)	7.3 (6.8–7.7)	-
	Depressive disorder	437,786	6,761	193.8 (189.2–198.5)	3.4 (3.4–3.5)	-
	Other affective disorders	129,483	1,622	153.2 (145.9–160.8)	2.8 (2.6–2.9)	-
Female	Drug use disorder	2,601	102	474.5 (401.5–584.0)	22.1 (17.8–26.4)	-
	Alcohol use disorder	25,302	628	296.1 (273.8–320.2)	14.9 (13.7–18.7)	-
	Schizophrenia	53,589	1,144	267.7 (252.6–283.6)	12.0 (11.3–12.7)	-
	Bipolar disorder	56,519	1,105	244.3 (230.3–259.2)	11.0 (10.3–11.6)	-
	Depressive disorder	797,679	5,509	81.5 (79.4–83.7)	3.6 (3.5–3.7)	-
	Other affective disorders	247,138	1,449	68.9 (65.5–72.6)	3.1 (2.9–3.2)	-

SMR = standardized mortality ratio, M/F ratio = male-to-female ratio, CI = confidence interval.
[a]M/F ratio of annual suicide rate.

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Table 2. Crude suicide HRs and their 95% CIs for the sociodemographic and comorbidity characteristics in patients with drug use disorder, alcohol use disorder, and schizophrenia

Characteristics	Drug use disorder		Alcohol use disorder		Schizophrenia	
	No. (%)	HR (95% CI)	No. (%)	HR (95% CI)	No. (%)	HR (95% CI)
Age (baseline), yr						
15–24	468 (8.9)	Reference	2,304 (1.9)	Reference	12,426 (12.1)	Reference
25–34	951 (18.0)	1.34 (0.73–2.48)	12,249 (10.1)	0.82 (0.64–1.05)	15,095 (14.7)	1.16 (1.02–1.32)
35–44	1,158 (21.9)	1.76 (0.99–3.16)	29,041 (24.0)	0.85 (0.68–1.08)	18,921 (18.5)	0.92 (0.81–1.04)
45–54	1,023 (19.3)	1.55 (0.85–2.83)	38,934 (32.1)	0.84 (0.67–1.06)	19,278 (18.8)	0.82 (0.72–0.94)
55–64	541 (10.2)	1.68 (0.87–3.23)	21,382 (17.6)	0.73 (0.57–0.92)	12,127 (11.8)	0.73 (0.62–0.85)
65–74	630 (11.9)	1.89 (1.00–3.57)	12,972 (10.7)	0.78 (0.61–1.00)	11,939 (11.6)	0.58 (0.48–0.69)
≥ 75	516 (9.8)	2.64 (1.39–5.02)	4,368 (3.6)	0.75 (0.54–1.04)	12,754 (12.4)	0.29 (0.22–0.37)
Sex						
Male	2,686 (50.8)	Reference	95,948 (79.1)	Reference	48,951 (47.7)	Reference
Female	2,601 (49.2)	0.75 (0.58–0.96)	25,302 (20.9)	0.91 (0.84–1.00)	53,589 (52.3)	0.76 (0.70–0.82)
Income level (baseline)						
Low[a]	1,008 (19.1)	Reference	25,552 (21.1)	Reference	17,074 (16.7)	Reference
Medical aid	849 (16.1)	0.96 (0.64–1.43)	19,283 (15.9)	0.85 (0.75–0.95)	24,110 (23.5)	0.58 (0.51–0.66)
Middle–low	1,006 (19.0)	0.66 (0.43–1.00)	26,328 (21.7)	0.97 (0.88–1.08)	16,424 (16.0)	0.92 (0.81–1.05)
Middle–high	1,074 (20.3)	0.84 (0.57–1.23)	24,546 (20.2)	0.86 (0.77–0.95)	17,953 (17.5)	0.96 (0.85–1.09)
High	1,350 (25.5)	0.82 (0.57–1.19)	25,541 (21.1)	0.74 (0.67–0.83)	26,979 (26.3)	0.93 (0.83–1.04)
Residence area (baseline)						
Seoul/metropolitan cities	2,349 (44.4)	Reference	46,644 (38.5)	Reference	43,031 (42.0)	Reference
Others	2,938 (55.6)	1.08 (0.83–1.39)	74,600 (61.5)	1.13 (1.05–1.22)	59,489 (58.0)	0.98 (0.90–1.06)
CCI score						
0	880 (16.6)	Reference	18,134 (15.0)	Reference	28,784 (28.1)	Reference
1–6	3,809 (72.0)	1.52 (1.03–2.25)	92,467 (76.3)	1.25 (1.13–1.40)	63,958 (62.4)	0.91 (0.84–0.99)
≥ 7	598 (11.3)	2.08 (1.25–3.46)	10,649 (8.8)	1.29 (1.10–1.51)	9,798 (9.6)	0.83 (0.67–1.03)
Psychiatric comorbidity						
0	621 (11.7)	Reference	31,479 (26.0)	Reference	17,830 (17.4)	Reference
1–2	2,450 (46.3)	1.43 (0.92–2.23)	68,861 (56.8)	1.33 (1.21–1.46)	53,284 (52.0)	1.21 (1.08–1.35)
≥ 3	2,216 (41.9)	2.17 (1.41–3.33)	20,910 (17.2)	2.12 (1.90–2.36)	31,426 (30.6)	1.63 (1.45–1.82)

HR = hazard ratio, CI = confidence interval.
[a]We set the low-income group based on the national health insurance as the reference given that they showed the highest risk of suicide.

DISCUSSION

Using data from a nationwide cohort study, the current study found that individuals suffering from any of the six psychiatric disorders investigated herein had a higher risk of suicide than did those in the general population. In particular, incident patients with DUD had a markedly higher suicide risk, with male sex and psychiatric comorbidity having been consistently identified as suicide risk factors across psychiatric disorders. The suicide risk according to age and income level varied according to psychiatric disorder, whereas residence area and CCI score showed no association with suicide risk for most of the psychiatric disorders analyzed.

Across all subgroups, the current study revealed that suicide rates in patients with psychiatric disorders, which ranged from 2.5 to 16.6 SMRs, were higher than those in the general population. Among them, patients with affective disorders, including DD, showed relatively lower suicide rates than did individuals with other disorders. These findings are consistent with a previous study at a general hospital in Korea, which found that suicide rates were lower in patients with DD (SMR, 5.69) than in those with psychotic disorders (SMR, 13.03).[23] A previous study conducted at a mood disorder center in Italy also showed the highest risk of suicide in DUD (SMR, 47.6), followed by BD (SMR, 10.7) and major depressive disorder (SMR, 4.2) which is consistent with our findings regarding the order of the suicide risk.[11] Overall, the current study showed that the suicide risk in patients with AUD, SCZ, and BD

Table 3. Crude suicide HRs and their 95% CIs for sociodemographic and comorbidity characteristics in patients with bipolar disorder, depressive disorder, and other affective disorders

Characteristics	Bipolar disorder		Depressive disorder		Other affective disorders	
	No. (%)	HR (95% CI)	No. (%)	HR (95% CI)	No. (%)	HR (95% CI)
Age (baseline), yr						
15–24	12,941 (13.4)	Reference	87,673 (7.1)	Reference	22,295 (5.9)	Reference
25–34	14,613 (15.2)	1.19 (1.03–1.39)	119,729 (9.7)	1.05 (0.83–1.33)	34,729 (9.2)	1.49 (1.23–1.80)
35–44	15,989 (16.6)	1.29 (1.12–1.50)	174,947 (14.2)	1.17 (0.93–1.48)	55,904 (14.8)	1.04 (0.87–1.26)
45–54	15,998 (16.6)	1.25 (1.08–1.45)	254,197 (20.6)	1.31 (1.04–1.65)	82,649 (21.9)	1.11 (0.93–1.33)
55–64	11,485 (11.9)	1.13 (0.95–1.33)	216,105 (17.5)	1.00 (0.76–1.32)	71,305 (18.9)	1.04 (0.86–1.24)
65–74	13,035 (13.5)	0.99 (0.83–1.17)	233,813 (18.9)	0.78 (0.58–1.04)	73,348 (19.5)	1.54 (1.29–1.83)
≥ 75	12,275 (12.7)	0.42 (0.32–0.54)	149,001 (12.1)	0.40 (0.26–0.63)	36,391 (9.7)	1.94 (1.61–2.34)
Sex						
Male	39,817 (41.3)	Reference	437,786 (35.4)	Reference	129,483 (34.4)	Reference
Female	56,519 (58.7)	0.71 (0.65–0.77)	797,679 (64.6)	0.69 (0.60–0.80)	247,138 (65.6)	0.45 (0.42–0.49)
Income level (baseline)						
Low[a]	15,183 (15.8)	Reference	206,394 (16.7)	Reference	62,968 (16.7)	Reference
Medical aid	10,860 (11.3)	0.96 (0.82–1.13)	123,572 (10.0)	0.94 (0.69–1.28)	30,479 (8.1)	1.37 (1.20–1.56)
Middle-low	16,914 (17.6)	0.93 (0.80–1.07)	230,929 (18.7)	0.90 (0.71–1.15)	71,362 (18.9)	0.85 (0.76–0.96)
Middle-high	20,321 (21.1)	0.96 (0.84–1.10)	275,468 (22.3)	0.95 (0.76–1.20)	85,744 (22.8)	0.95 (0.85–1.06)
High	33,058 (34.3)	0.92 (0.81–1.05)	399,102 (32.3)	0.95 (0.77–1.17)	126,068 (33.5)	0.83 (0.74–0.92)
Residence area (baseline)						
Seoul/metropolitan cities	41,405 (43.0)	Reference	486,920 (39.4)	Reference	144,127 (38.3)	Reference
Others	54,931 (57.0)	0.96 (0.88–1.05)	748,537 (60.6)	0.99 (0.86–1.15)	232,494 (61.7)	1.01 (0.94–1.09)
CCI score						
0	19,632 (20.4)	Reference	254,882 (20.6)	Reference	76,197 (20.2)	Reference
1–6	66,956 (69.5)	1.01 (0.92–1.11)	913,268 (73.9)	0.97 (0.83–1.13)	284,611 (75.6)	1.09 (0.99–1.19)
≥ 7	9,748 (10.1)	0.81 (0.64–1.02)	67,315 (5.4)	0.70 (0.45–1.08)	15,813 (4.2)	1.77 (1.50–2.09)
Psychiatric comorbidity						
0	11,491 (11.9)	Reference	460,268 (37.3)	Reference	139,726 (37.1)	Reference
1–2	61,283 (63.6)	1.63 (1.35–1.97)	665,842 (53.9)	1.10 (0.90–1.34)	181,983 (48.3)	2.12 (1.92–2.34)
≥ 3	23,562 (24.5)	2.30 (1.91–2.78)	109,355 (8.9)	1.15 (0.92–1.44)	54,912 (14.6)	4.99 (4.50–5.53)

HR = hazard ratio, CI = confidence interval.
[a]We set the low-income group based on the national health insurance as the reference given that they showed the highest risk of suicide.

was comparable to that reported in previous studies; however, our findings for DUD and DD differed substantially from those presented in previous meta-analysis studies.

Although an existing meta-analysis[10] found a relatively low suicide risk associated with DUD (OR, 1.49), a Swedish national cohort study revealed that the suicide risk of patients with DUD or AUD (crude HR, 16.25) was very similar to that reported herein (SMR, 16.6).[12] Given that most epidemiologic studies used in the meta-analysis study had examined the association between suicide mortality and comorbid DUD in patients with other psychiatric disorders, including SCZ, BD, and DD, the results cannot reflect a comparison in the suicide risk between DUD patients and the general population. Our findings support the drastically higher suicide risk among patients with DUD previously observed in several countries, highlighting the critical need to prioritize the establishment of patient care and suicide prevention systems directed at these individuals.

Several meta-analyses based on older observational studies have revealed that patients with DD had 13.4 to 19.7 times higher suicide risk than the general population worldwide.[13,14,24] However, two recent single-hospital observational studies have reported that patients with DD had suicide SMRs of approximately 5.0, which was similar to that observed in the current study.[11,23] We posit that the suicide rate among patients with DD has decreased in recent years perhaps due to the improved social awareness in recent decades, which has increased the diagnosis and treatment of patients with relatively mild depressive symptoms. In addition, variations in DD diagnoses

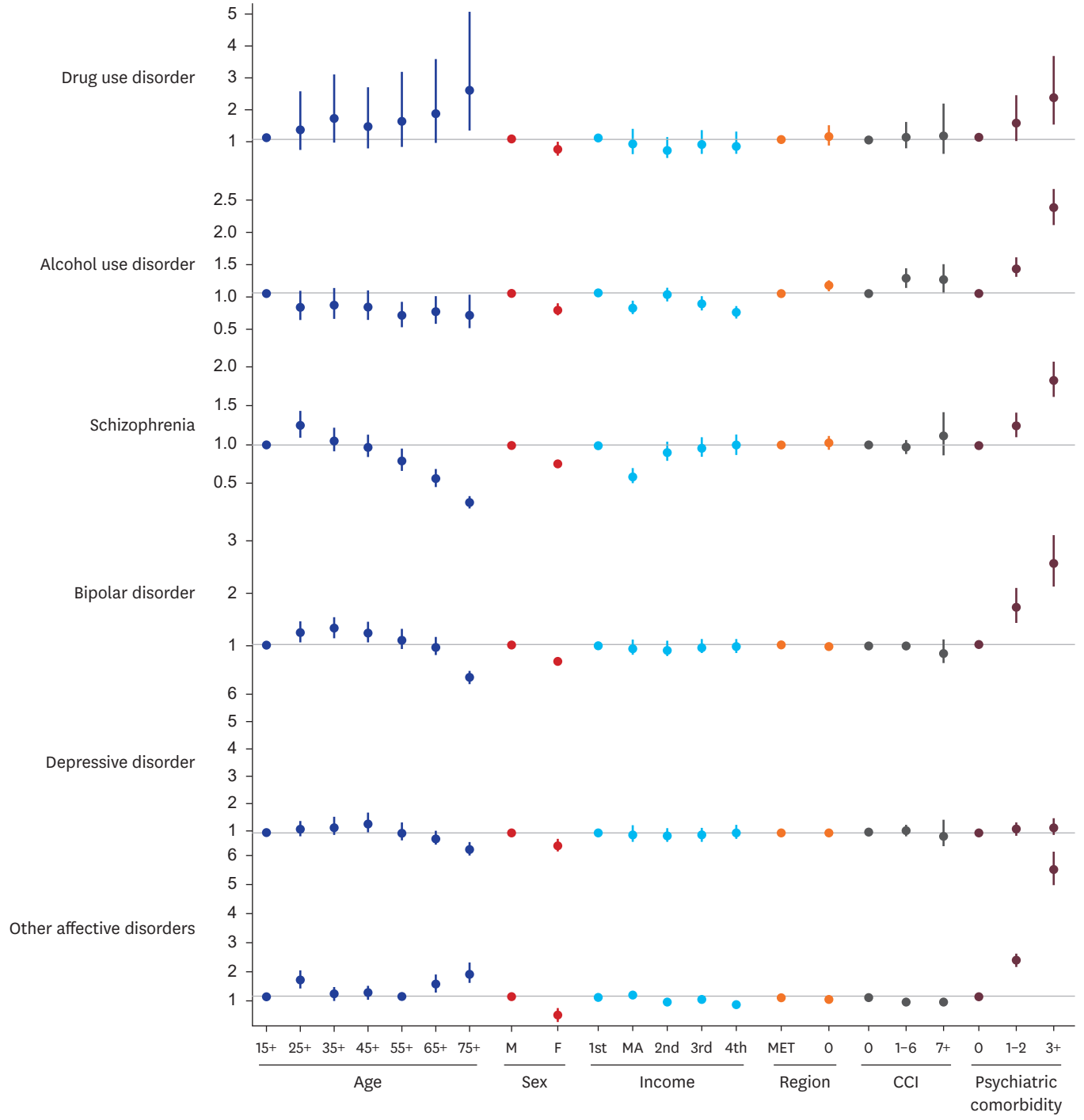

Fig. 1. Suicide hazard ratio according to age, sex, income level, residence area, CCI score, and psychiatric comorbidities among patients with drug use disorder, alcohol use disorder, schizophrenia, bipolar disorder, depressive disorder, and other affective disorder after adjusting for age, sex, income level, residence area, CCI score, and psychiatric comorbidity.
CCI = Charlson Comorbidity Index, M = male, F = female, MA = medical aid group, MET = metropolitan area, O = area other than metropolitan area.

across countries may be attributed to differences in their respective medical systems, including their national insurance systems. We further posit that the broad access to mental health care provided at a low cost to patients made possible by the Korean National Health Insurance system may have improved the outcomes of patients with treatable DD and OADs in our study.

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The current study further found that although the suicide rate was higher in male patients, the SMR for suicide was higher in female patients. It results in a smaller sex-based difference in suicide risk among patients with psychiatric disorders compared to the general population, in line with previous studies.[11,25] We found that patients with AUD, DUD, SCZ, and BD had higher suicide rates but lower M/F ratios than did those with DD and OADs. Given that our study was based on health insurance data, our results may be explained by the fact that females generally use healthcare services more than males, assuming comparable health status.[26] Thus, females with DD or OADs could be more likely to proactively use psychiatric healthcare services at earlier stages of their disorders. In contrast, patients with AUD, DUD, SCZ, and BD may be diagnosed at similar stages regardless of sex, resulting in little difference in suicide risk according to sex. In fact, a study based on Korean health insurance data revealed a higher prevalence of DD among women than among men,[27] but a study using telephone interviews found that the prevalence of depressive mood disorder was comparable in men and women (20.4% and 21.5%, respectively).[28] In contrast, studies based on national health insurance data and telephone interview in Korea revealed that men and women had a similar prevalence of SCZ.[29,30] Our results support the need for national efforts to raise awareness regarding the benefits of psychiatric treatment, particularly among men, even for relatively mild conditions of affective disorders.

Among the general Korean population, older people have shown a significantly elevated suicide risk,[31,32] which may be attributed to social isolation, physical illness, and poor financial status.[32] However, the current study found that older people were less likely to die by suicide than were young and middle-aged adults based on the age of onset of AUD, SCZ, BD, and DD. Our findings showed that CCI scores, which primarily represent comorbid physical illness, and income level did not affect suicide risk in patients with psychiatric disorders, which may partially explain the lack of a difference in suicide vulnerability between older adults with psychiatric illness and the general population in Korea.

In particular, we found that the risk of suicide was higher among patients diagnosed with AUD or SCZ during adolescence or early adulthood. A Taiwanese national cohort study reported that patients diagnosed with AUD during their youth and middle age exhibited a significantly elevated risk of suicide, in line with our results.[15] The suicide risk among Medicare patients with SCZ in the United States was highest in the 18–34 age group.[33] In contrast, in a Swedish population-based case-control study, age more than 30 at onset of symptom was associated with a higher suicide risk in patients with SCZ of the same age.[34] Our findings may be derived from the fact that early-onset patients must be younger than late-onset patients. Given the inevitable relationship between early onset and younger age, our findings, when combined with previous research, support that adolescent and early adult patients with AUD and SCZ are at high risk for suicide.

Although the suicide risk in the general Korean population increases linearly with a decreased in household income,[2,35] as noted earlier, this pattern was not found in patients with psychiatric disorders, consistent with previous results in patients with SCZ and other chronic psychotic disorders.[36] The current study found that among patients with AUD and SCZ, those in the medical aid group showed the lowest suicide. Our results therefore suggest that economic affluence has a protective effect against suicide in the general population but not in people with psychiatric disorders. Medical aid patients can access healthcare services without financial burden and are also more likely to receive other welfare benefits, such as livelihood, which may exert preventive effects against suicide in those with AUD and

SCZ. These findings suggest that improving access to the welfare system for patients with psychiatric disorders is an important component of suicide prevention strategies aside form therapeutic intervention.

Unsurprisingly, the current study found that the presence of more than one psychiatric condition was identified as a strong risk factor for suicide among patients with psychiatric disorders, consistent with previous results.[24,37,38] On the other hand, CCI scores showed no association with suicide. Although poor physical health is a well-known risk factor for suicide in the general population,[39,40] a Taiwan national cohort study found no positive association between CCI scores and suicide death in patients with AUD.[21] Expanding on this, the current study found that comorbid physical illnesses did not increase suicide risk in patients with psychiatric disorders, suggesting an antagonistic interaction between mental and physical illnesses in increasing the risk of suicide. One possible explanation is the competing risks due to the inability of non-suicidal death related to physical illnesses and suicide death related to mental illnesses to occur simultaneously.[21]

Considering the several methodologic limitations of the current study, caution is required in the interpretation of our results. First, psychiatric disorders were measured based on the KCD code listed in the health insurance claims data rather than on screening or diagnostic instruments. Consequently, our study has limitations to the diagnostic accuracy of participants, as KCD codes are sometimes assigned to prescribe medications that are not actually diagnosed. Second, despite the presence of comorbid psychiatric diagnoses among patients within the six groups, the main comorbid disorder for each group was not assessed, thereby limiting the full identification of the characteristics for each patient subgroup. Finally, KCD codes X60–X84 in the National Statistics Organization database may not complete reflect the amount of suicide deaths due to the possibility that an undetermined death (KCD code: Y10–Y34) could be a suicide, the low autopsy rates, and the social stigma of suicide deaths in Korea. Despite these shortcomings, this has been the first nationwide study to evaluate suicide risk factors across multiple subgroups of psychiatric disorders.

In conclusion, the current study observed a large variation in suicide rates across psychiatric disorders, ranging from 97.2 to 584.0 per 100,000 PYs. Notably, patients with drug or AUDs or psychoses had a much higher suicide risk than did those with affective disorders. Male sex and the presence of multiple psychiatric comorbidities were consistently identified as risk factors for suicide across all psychiatric disorders studied. However, among groups with a higher suicide rate, little difference in suicide risk was observed between males and females. These findings suggest that clinicians can better assess suicide risk based on specific patient characteristics and mental health disorders. In addition, the current study found differences in the distribution of suicide risk between the general population and patients with psychiatric disorders depending on age, income, and physical comorbidity, implying that the process and triggers of suicide may differ in these two populations.

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SUPPLEMENTARY MATERIALS

Supplementary Data 1

Supplementary description of the categorization of mental disorder

Supplementary Table 1

Adjusted suicide hazard ratio* according to the characteristics among patients with psychiatric disorders, presented in **Fig. 1**

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