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Effect of migraine on suicide mortality in young adults: a nationwide cohort study in South Korea

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ABSTRACT

Background Migraine is linked to increased suicidal behaviour, but its relationship with suicide mortality remains underexplored. In South Korea, suicide rates are among the highest in Organisation for Economic Co-operation and Development nations, particularly in young adults.

Objective To investigate the effect of migraine on suicide mortality in young Korean adults.

Methods Participants who underwent the Korean Health Examination from 2009 to 2012 were enrolled in this study and followed up until 2021. Participants aged 20–39 years (n=6 539 547) were categorised based on their migraine status. Cox proportional hazards regression models assessed the association between migraine and suicide mortality, adjusting for demographic factors, health behaviours and comorbidities.

Findings Among 6 539 547 participants, 113 681 (1.74%) had migraine (6620 (0.10%) with aura, 107 061 (1.64%) without aura). Over 11 years, there were 21 suicides (0.32%) in migraine with aura, 219 (0.20%) in migraine without aura and 13 040 (0.20%) in no migraine. All migraine was not linked to increased suicide risk (HR 1.07, 95% CI 0.94 to 1.21), but migraine with aura showed a higher risk (HR 1.61, 95% CI 1.05 to 2.47). Migraine without aura had no increased risk (HR 1.03, 95% CI 0.90 to 1.18). Depression modified the association across migraine subtypes.

Conclusion and implications Although all migraine and migraine without aura were not significantly associated with a higher suicide risk compared with that in the absence of migraine, migraine with aura was associated with a higher risk of suicide mortality. Depression significantly modified this relationship, showing different associations across migraine subtypes.

INTRODUCTION

Migraine is ranked as one of the top causes of global disability, affecting physical health and quality of life and mood.[1] The chronic pain and disruptions in daily life caused by migraine can lead to emotional distress and increase vulnerability to psychiatric conditions like depression, both of which are known risk factors for suicide.[2] As migraine affects people worldwide, understanding its impact on suicide has become increasingly important.

The association between migraine and suicidal behaviour has been suggested, underscoring the need for further investigation into this complex relationship. Although the correlation between

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WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Existing research suggested a potential link between migraine and suicidal behaviour, prompting further investigation due to limited exploration of actual suicide mortality.

WHAT THIS STUDY ADDS

⇒ This study identified that while migraine and migraine without aura were not associated with an increased risk of suicide compared with no migraine, migraine with aura was associated with a higher risk of suicide. Moreover, the presence of depression modified the impact of migraine on suicide risk, with distinct associations observed across migraine subtypes.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ These findings emphasise the importance of considering migraine subtypes and comorbid depression in suicide risk assessment. Clinicians should prioritise mental health evaluation in patients with migraine, particularly those with aura, to implement targeted interventions and prevent suicide mortality.

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migraine and an elevated propensity for suicidal ideation and attempts is supported by meta-analyses and systematic reviews,[3 4] there has been a lack of investigation regarding actual suicide mortality in patients with migraine.

Several factors contribute to the development of migraine, including genetic predisposition, hormonal fluctuations and environmental triggers such as stress and lifestyle factors.[5 6] Migraine is also closely linked to psychiatric comorbidities such as depression, anxiety and post-traumatic stress disorder, which can increase both the frequency and severity of migraine attacks.[2] In particular, migraine and depression have a bidirectional association, where each condition can exacerbate the other.[7] Furthermore, migraine with aura is associated with an increased risk of specific cardiovascular disorders, such as ischaemic stroke and myocardial infarction.[8] These factors could potentially modify the relationship between migraine and suicide, underscoring the need for careful consideration of these elements when investigating suicide mortality in patients with migraine.

In Korea, the National Health Examination, which is offered to all young adults over 19,

provides invaluable data on demographics and health profiles.[9] In addition, all Korean citizens automatically enrol in the National Health Insurance system, allowing researchers to use big data on healthcare claims.[10] Furthermore, every death and cause of death were registered with the Korean National Statistical Office. Youth suicide rates in Korea have significantly increased from the 1990s to 2017, with recent data showing continued rising trends during the COVID-19 pandemic.[11 12] Korea has consistently ranked highest in suicide rates among Organisation for Economic Co-operation and Development (OECD) countries.[13] This alarming trend emphasises the need for research into factors contributing to suicide mortality in young adults.

By combining these unique big datasets, we aimed to investigate the association between migraine and the risk of suicide mortality, considering migraine subtypes, potential confounders and effect modifiers.

METHODS
Data source
In South Korea, adults are required to undergo regular national health examinations, typically conducted every 2 years for the general population, with annual screenings available for individuals engaged in physical labour.[9] These assessments are documented in the Korean Health Examination (KHE) database, which contains a comprehensive array of information including routine medical tests, cancer screening, physical measurements, household income data and self-reported health surveys. The database includes information on age, weight, medical history (eg, diabetes mellitus, hypertension, dyslipidaemia, ischaemic heart disease and chronic kidney disease) and health-related behaviours such as alcohol consumption, smoking habits and regular physical activity.

The National Health Insurance Service (NHIS) programme offers medical services to the entire Korean population, resulting in a sizeable sample size exceeding 50 million individuals.[14] The NHIS database contains thorough records of all claims submitted under the National Health Insurance programme and classifies diagnoses using the International Classification of Diseases, Tenth Revision (ICD-10) codes.[15] The database includes comprehensive medical histories, documenting conditions such as diabetes mellitus, hypertension, dyslipidaemia, ischaemic heart disease and chronic kidney disease.

In South Korea, migraine is diagnosed by various physicians, including neurologists, based on patient-reported symptoms and clinical history. While the International Classification of Headache Disorders is commonly referenced, its use is not mandatory. Diagnoses are recorded in the healthcare system using ICD-10 codes: G43 for migraine and G431 for migraine with aura. Depression was identified using ICD-10 codes F32 (major depressive disorder, single episode) and F33 (major depressive disorder, recurrent), based on claims data, primarily capturing clinically diagnosed cases. Diabetes mellitus was defined as having a fasting glucose level of 126 mg/dL or higher, or being on diabetes medications with ICD-10 codes E11–E14. Hypertension was defined as having a systolic blood pressure of 140 mm Hg or higher, or a diastolic blood pressure of 90 mm Hg or higher, or being on hypertension medications with ICD-10 codes of I10–I13 or I15. Dyslipidaemia was defined as having a total cholesterol level of 240 mg/dL or higher, or being on dyslipidaemia medications with an ICD-10 code of E78. Chronic Kidney Disease was defined as having end-stage renal disease or estimated glomerular filtration rate less than 60 mL/min/1.73 m^2. In this study, body mass index (BMI) was categorised into

five levels according to the WHO classification criteria for Asian populations: underweight (BMI<18.5), normal range (18.5≤BMI<23), overweight (23≤BMI<25), class I obesity (25≤BMI<30) and class II obesity (BMI≥30).[16]

Outcome
The primary outcome of interest in this study was death by suicide, defined using data from the Korean National Statistical Office, which systematically registers all deaths in South Korea. The cause of death is classified by this office according to ICD-10 codes (X60–X84) to identify intentional self-harm cases, ensuring a consistent and standardised approach to capturing all suicide cases across the population during the study period.

Study population and design
To investigate the relationship between migraine and suicide, we merged data from the NHIS claims database based on the baseline demographics and health profiles documented in the KHE programme from 2009 to 2012. Information on various factors, such as age, sex, income, alcohol consumption, physical activity, presence of diabetes mellitus, hypertension, dyslipidaemia, chronic kidney disease and BMI, was collected.

Korea has consistently ranked highest in suicide rates among OECD countries, with a significant increase in youth suicide rates from 7.7 to 9.1 per 100 000 persons between 2017 and 2018.[13 17] Participants aged 20–39 were included from the KHE screening programme. Those with incomplete baseline data, typically due to missing self-reported health or demographic variables, were excluded to maintain the accuracy and validity of the analysis.

The enrolled participants were categorised based on their migraine status according to NHIS claims. Patients were defined as having migraine if they had at least one claim with the diagnosis code within the year preceding the date of examination. A diagnosis of migraine was established by identifying the ICD-10 code G43 and, specifically, G431 for migraine with aura. The main variable investigated was migraine, which was categorised into three groups: (1) no migraine, comprising individuals without a history of migraine diagnosis; (2) participants with migraine with aura, individuals diagnosed with the G431 code; and (3) participants with migraine without aura, participants diagnosed with migraine (ICD-10, G43), but excluding those with the G431 code.

Participants were followed from enrolment until suicide mortality, non-suicide mortality, emigration or the end of the follow-up period on 31 December 2021. Those who died from causes other than suicide and who emigrated to other countries (which is rare in Korea) were censored at that time.

Statistical analysis
The study calculated the incidence rate per 1000 person-years for each group and performed an HR analysis using Cox proportional hazards regression models. A 95% CI[18] was calculated for each factor. Continuous variables were presented as mean and SD and analysed using analysis of variance, whereas categorical variables were expressed as numbers and percentages and analysed using the χ^2 test. To address potential confounding variables, a multivariable model was constructed to adjust for baseline imbalances among groups. Covariates included sex, age, low income, smoking, drinking, regular exercise, obesity and depression, selected based on their established associations with both migraine and suicide risk.

Interaction analyses were conducted to identify potential effect modifiers, including sex, age, low income, smoking, drinking, regular exercise, obesity and depression. Additional factors potentially related to migraine with aura, such as stroke, ischaemic heart disease, epilepsy and anxiety disorder, were also examined. Stratified analyses were performed for each factor to evaluate its role as an effect modifier in the association between migraine and suicide, with separate assessments for all migraine, migraine without aura and migraine with aura.

RESULTS

Demographics and baseline characteristics

Of 6 891 401 individuals aged 20–39 who participated in the KHE from 2009 to 2012, complete data were available for 6 539 547 participants (94.9%). Among them, 113 681 (1.74%) were classified as migraineurs, including 6620 (0.10%) with migraine with aura and 107 061 (1.64%) with migraine without aura. Migraineurs were more likely to be female and have a lower socioeconomic status compared with non-migraineurs. They were also more likely to be non-smokers and non-drinkers but less likely to engage in regular exercise. Additionally, migraineurs had slightly lower rates of diabetes, hypertension, dyslipidaemia and chronic kidney disease. In terms of BMI, migraineurs had a higher proportion of individuals who were underweight or in the normal weight range, but a lower proportion of those who were overweight or obese (Table 1).

In our cohort, the all-cause mortality rate among participants without migraine included 42 044 (0.65%) deaths out of 6 425 866 individuals, while those with migraine showed 705 (0.62%) deaths among 113 681 individuals. Further analysis by migraine subtypes revealed 653 (0.61%) deaths among 107 061 individuals with migraine without aura and 52 (0.79%) deaths among 6620 individuals with migraine with aura (table 2). There were 21 (0.32%) suicides among those with migraine with aura, 219 (0.20%) suicides among those with migraine without aura and 13 040 (0.20%) suicides among those without migraine (figure 1).

Effect of migraine on risk of suicide

During the follow-up period, no significant association was observed between all migraine and the risk of suicide (unadjusted HR 1.05 (95% CI 0.92 to 1.19); table 2). This remained consistent after adjusting for variables including sex, age, income level, smoking status, alcohol consumption, regular exercise, obesity and depression (adjusted HR 1.07 (95% CI 0.94 to 1.21); table 2). When classified into migraine subtypes, individuals

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Table 1 Demographics and profiles of participants

	No migraine (n=6 425 866)	Migraine (n=113 681)	P value	Migraine without aura (n=107 061)	Migraine with aura (n=6620)	P value
Age, years			<0.001			0.045
20–29	2 697 419 (42.0%)	46 362 (40.8%)		43 584 (40.7%)	2778 (42.0%)	
30–39	3 728 447 (58.0%)	67 319 (59.2%)		63 477 (59.3%)	3842 (58.0%)	
Sex, male	3 843 758 (59.8%)	43 226 (38.0%)	<0.001	41 019 (38.3%)	2207 (33.3%)	<0.001
Low income	1 354 585 (21.1%)	29 973 (26.4%)	<0.001	28 169 (26.3%)	1804 (27.3%)	<0.001
Smoking			<0.001			<0.001
Non	3 503 505 (54.5%)	77 061 (67.8%)		72 353 (67.6%)	4708 (71.1%)	
Ex	669 780 (10.4%)	10 106 (8.9%)		9581 (9.0%)	525 (8.0%)	
Current	2 252 581 (35.1%)	26 514 (23.3%)		25 127 (23.5%)	1387 (21.0%)	
Drinking			<0.001			<0.001
Non	2 406 530 (37.5%)	55 197 (48.6%)		51 824 (48.4%)	3373 (51.0%)	
Mild	3 380 464 (52.6%)	50 294 (44.2%)		47 480 (44.4%)	2814 (42.5%)	
Moderate	638 872 (9.9%)	8190 (7.2%)		7757 (7.3%)	433 (6.5%)	
Regular exercise	827 624 (12.9%)	13 708 (12.1%)	<0.001	12 912 (12.1%)	796 (12.0%)	<0.001
Diabetes mellitus	124 827 (1.9%)	1974 (1.7%)	<0.001	1845 (1.7%)	129 (2.0%)	<0.001
Hypertension	474 504 (7.4%)	7894 (6.9%)	<0.001	7480 (7.0%)	414 (6.3%)	<0.001
Dyslipidaemia	438 502 (6.8%)	7505 (6.6%)	0.003	7115 (6.7%)	390 (5.9%)	<0.001
Chronic kidney disease	175 434 (2.7%)	2971 (2.6%)	0.017	2818 (2.6%)	153 (2.3%)	<0.001
Body mass index (kg/m²)			<0.001			<0.001
Underweight, BMI<18.5	483 902 (7.5%)	11 200 (9.9%)		10 486 (9.8%)	714 (10.8%)	
Normal, 18.5≤BMI<23	2 994 812 (46.6%)	57 134 (50.3%)		53 685 (50.1%)	3449 (52.1%)	
Overweight, 23≤BMI<25	1 238 723 (19.3%)	19 085 (16.8%)		18 019 (16.8%)	1066 (16.1%)	
Class I obesity, 25≤BMI<30	1 434 565 (22.3%)	21 617 (19.0%)		20 488 (19.1%)	1129 (17.1%)	
Class II obesity, BMI≥30	273 864 (4.3%)	4645 (4.1%)		4383 (4.1%)	262 (4.0%)	

Non-drinking: average daily alcohol consumption=0 g.
Mild drinking: men: 0 < average daily alcohol consumption <30 g; women: 0 < average daily alcohol consumption <20 g.
Moderate drinking: men: average daily alcohol consumption ≥30 g; women: average daily alcohol consumption ≥30 g.
Regular exercise: mid-term exercise ≥5 days or vigorous exercise ≥3 days in a week.
Diabetes mellitus: fasting glucose ≥126 or (patients on diabetes medication and having ICD-10 codes E11–E14).
Chronic kidney disease: eGFR<60 or end stage renal disease.
Hyperlipidaemia: SBP≥140 or DBP≥90 or (patients on hypertension medications and having ICD-10 codes I10–I13, I15).
Dyslipidaemia: TC≥240 or (patients on dyslipidaemia medications and having ICD-10 code E78).
. BMI, body mass index; DBP, diastolic blood pressure; eGFR, estimated glomerular filtration rate; ICD-10, International Classification of Diseases, Tenth Revision; n, number of patients; SBP, systolic blood pressure; TC, total cholesterol.

Table 2 Effect of migraine on the risk of suicide

Migraine status	n	All-cause death	SC death	Duration	IR, per 1000 PY	HR (95% CI) Unadjusted	Adjusted*
No migraine	6 425 866	42 044	13 040	72 809 027	0.18	1 (Ref)	1 (Ref)
All migraine	113 681	705	240	1 279 801	0.19	1.05 (0.92, 1.19)	1.07 (0.94, 1.21)
Migraine without aura	107 061	653	219	1 205 701	0.18	1.02 (0.89, 1.16)	1.03 (0.90, 1.18)
Migraine with aura	6620	52	21	74 101	0.28	1.60 (1.04, 2.45)	1.61 (1.05, 2.47)

*A multivariable model adjusted for sex, age, low income, smoking, drinking, regular exercise, obesity and depression.
IR, incidence rate; n, number of patients; PY, person-years; Ref, reference; SC, suicide.

with migraine with aura exhibited a significantly higher risk of suicide (unadjusted HR 1.60 (95% CI 1.04 to 2.45) and adjusted HR 1.61 (95% CI 1.05 to 2.47)) than those without migraine (table 2). Those with migraine without aura did not show a higher risk of suicide compared with no migraine (unadjusted HR 1.02 (95% CI 0.89 to 1.16), adjusted HR 1.03 (95% CI 0.90 to 1.18); table 2).

Subgroup analysis
Among the several variables tested, only depression significantly modified the relationship between migraine and suicide risk. Individuals with depression had a lower migraine-attributed relative risk of suicide (adjusted HR 0.77 (95% CI 0.56 to 1.06)) compared with individuals without depression (adjusted HR 1.15 (95% CI 1.00 to 1.32), p for interaction=0.0229) (figure 2). The effect modification by depression was differentially expressed in the migraine subtypes. The migraine-attributed relative risk of suicide was lowered by depression among individuals with migraine without aura (adjusted HR 0.69 (95% CI 0.48 to 0.97) in the presence of depression and adjusted HR 1.13 (95% CI 0.98 to 1.31) in the absence of depression; p for interaction=0.0289) (online supplemental figure A). The direction of effect modification changed in individuals with migraine with aura: the presence of depression led to a higher migraine-attributed relative risk of suicide (adjusted HR 1.86 (95% CI 0.88 to 3.92)) compared with that in the absence of depression (adjusted HR 1.49 (95% CI 0.88 to 2.51), p for interaction=0.0289) (online supplemental figure B).

On analysis by subgroup, sex, age, smoking, drinking, regular exercise, obesity, stroke, ischaemic heart disease, epilepsy and

anxiety disorders did not modify the effect of migraine on suicide risk (online supplemental figure A,B).

DISCUSSION
This nationwide population-based cohort study investigated the influence of migraine on the risk of suicide mortality in South Korean individuals aged 20–39. The key findings were as follows: (1) all migraine and migraine without aura were not associated with an increased risk of suicide compared with no migraine; (2) migraine with aura increased the risk of suicide; and (3) the presence of depression modified the effect of migraine on suicide risk, with a differential direction according to the migraine subtype.

Our study found no association between all migraine or migraine without aura and suicide risk compared with no migraine, addressing limitations of conflicting prior studies through a large, diverse population and extended follow-up period. Although some studies have explored the relationship between migraine and suicidal ideation or attempts, there is a notable lack of investigation of suicide itself as an outcome of migraine. Among the limited existing studies, Colman et al[18 19] conducted a small population-based health survey revealing a similar suicide risk between those with and without a history of migraine headache (adjusted HR 0.60 (95% CI 0.22 to 1.65)).[19] However, their study relied on subject recall for migraine diagnosis and had a heterogeneous age distribution among participants. Furthermore, Ilgen et al examined the data from the National Death Index and Department of Veterans Healthcare System treatment records, focusing on a 3-year follow-up period. They reported higher suicide risks among migraineurs compared with those in no migraine (unadjusted HR 1.68 (95% CI 1.28 to 2.20); adjusted HR 1.34 (95% CI 1.02 to 1.77)).[18] However, the short follow-up duration of 3 years and the specific population studied limit the generalisability of their findings. In contrast, our study benefits from a longer follow-up period of approximately 11 years and encompasses a diverse study population, which includes individuals aged 20–39 years nationwide with varied demographic backgrounds and health statuses. Our study is the largest to date, identifying 240 suicides among individuals with migraine, including 21 in the migraine with aura subgroup. This substantially exceeds prior studies, which reported 138 and six suicides in migraine groups without specifically examining migraine with aura. Additionally, while previous studies faced similar limitations with administrative databases, our study addresses these gaps by incorporating covariates such as income, smoking status, exercise habits and depression. The use of a nationwide population-based dataset enhances representativeness and provides more comprehensive insights into this rare outcome of suicide mortality. These aspects enhance the generalisability and robustness of the results.
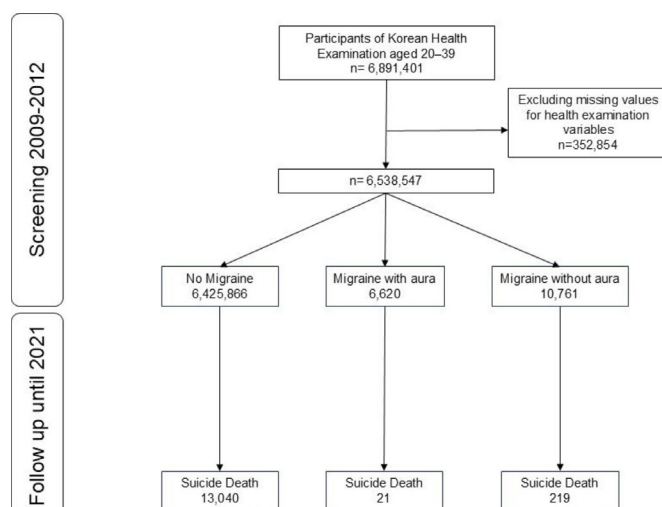
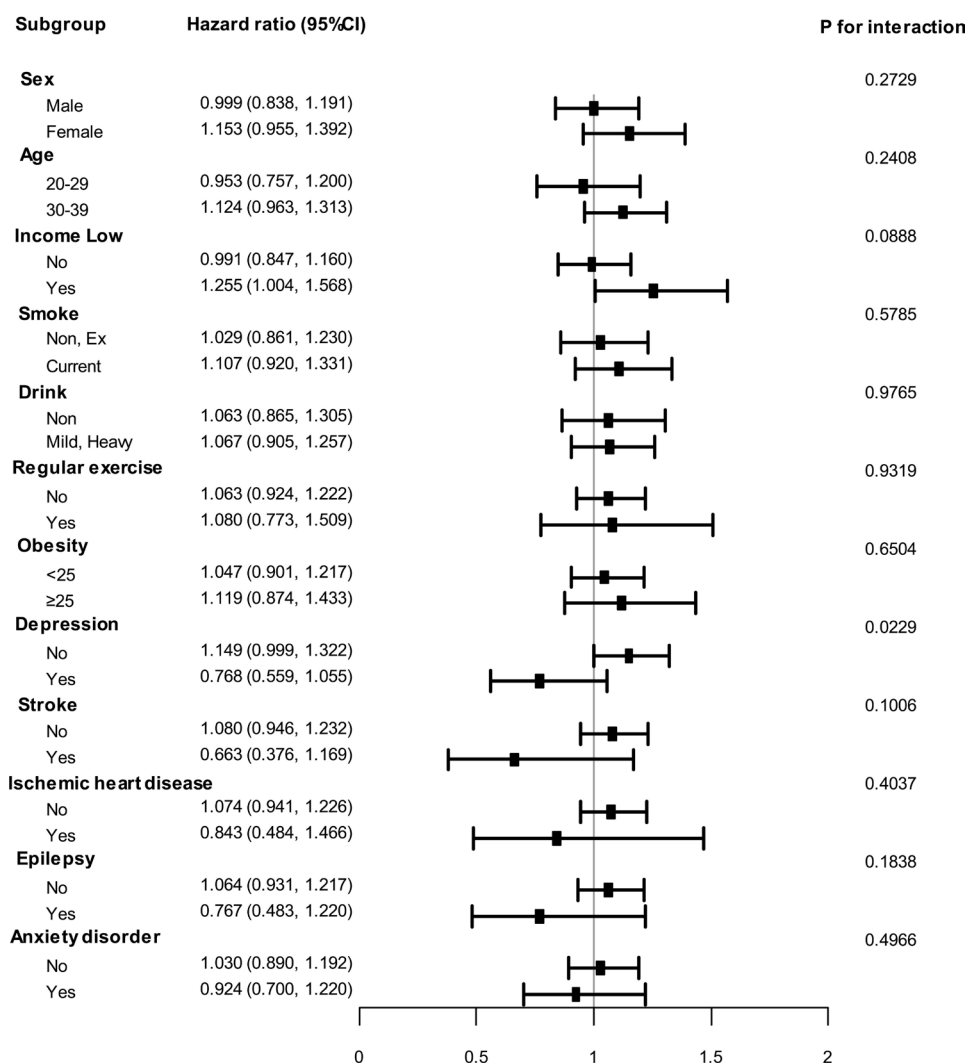**Figure 1** Flow chart of the study.

Figure 2 Risk of suicide in all migraine by subgroup. Among the variables tested, only depression significantly modified the effect of migraine on suicide risk. Individuals with depression exhibited a lower migraine-attributed relative risk of suicide (adjusted HR 0.77 (95% CI 0.56 to 1.06)) compared with individuals without depression (adjusted HR 1.15 (95% CI 1.00 to 1.32), p for interaction=0.0229).

Unlike migraine or migraine without aura, migraine with aura was associated with an elevated risk of suicide. Migraine with aura, characterised by recurrent unilateral sensory or visual symptoms followed by a headache, may be linked to elevated suicidality.[3 20] Lin *et al* found that migraine aura and depression severity predicted suicidal ideation among migraineurs, particularly in those experiencing high migraine frequency with aura.[20] In addition, Breslau observed increased rates of suicide attempts and ideation among young adults with migraine with aura,[21] whereas Wang *et al* reported that migraine with aura was linked to suicidal thoughts in adolescents.[22] However, these studies primarily focused on suicidal thoughts and attempts, using cross-sectional designs, limiting their relevance in understanding actual suicidal mortality outcomes. Observations specifically targeting suicidal mortality outcomes have not yet distinguished subgroups within migraine with aura.[18 19] However, our study has filled this gap by demonstrating an elevated risk of suicide mortality associated with aura. The pathophysiological mechanisms underlying the association between migraine with aura and elevated suicide risk may involve alterations in serotonin levels. Patients with migraine with aura exhibit lower plasma serotonin levels than those without aura and healthy controls.[23 24] This dysregulation

in serotonin levels may contribute to increased vulnerability to suicidal behaviours among individuals with migraine with aura.

Depression modified the association between migraine and suicide risk. Although depression is widely acknowledged as a major factor in suicide,[25 26] its presence reduces the relative risk of suicide attributed to all migraine compared with that in its absence. Differential effects were noted across migraine subtypes; notably, a decreased risk among those with migraine without aura and an increased risk among those with migraine with aura and depression. Consistent with our findings, one nationwide inpatient cohort study demonstrated that migraine was associated with a 0.8-fold decreased odds of suicidal behaviours under the presence of depression, whereas among hospitalisations without depression, migraine was linked to a 2.35-fold increased odds of suicidal behaviours.[27] Similarly, another study demonstrated a link between migraine and an increased likelihood of suicidal behaviour in their population, and the effect of migraine was significant in individuals without depression.[28] Taken together, the risk of suicide in patients with migraine and depression is mostly driven by depression, whereas migraine itself may carry a neutral (as shown in our study) or at least potential risk of suicide in those without depression. The fact that the increased

risk of suicide associated with migraine with aura reverted to a protective effect in our study suggests that migraine sufferers with diagnosed psychiatric disorders might be receiving effective care that mitigates their risk of suicide.

The strength of this study lies in its nationwide analysis, which investigated the impact of migraine on suicide mortality, leveraging a comprehensive dataset from the KHE, NHIS and the Korean National Statistical Office. This ensured a relatively unbiased population and provided valuable big data for analysis. We recognise that the number of deaths in the migraine with aura group is relatively small, particularly when examining suicide as an outcome, which is inherently rare. This small sample size can lead to statistical instability, as reflected in the wide CIs of the HRs. These wide intervals suggest potential variability in the results and increase the likelihood of type 2 error. Despite this, our analysis rejected the null hypothesis, indicating that the association we observed between migraine with aura and suicide mortality remains statistically significant. The large-scale nature of our dataset allowed us to detect these cases, offering insights that smaller studies may have missed.

This study had several limitations. First, migraine diagnosis relies on ICD codes, which may introduce the risk of inaccurate classification. In our study, the use of the G43 (migraine) code to define migraine yielded a prevalence of approximately 1.74%, which is significantly lower than the strictly defined migraine prevalence of around 6%.[29] Therefore, our study suggests the potential for underdiagnosing migraine, which is a phenomenon not limited to Korea but observed globally.[30] Further narrowing the definition of migraine beyond ICD codes poses a risk of bias in the research, as it could exacerbate the issue of underdiagnosis. Furthermore, G439 (unspecified migraine), included in the migraine without aura group, may involve the misclassification of cases of G431 (migraine with aura). This misclassification could introduce a conservative bias, potentially overestimating the suicide risk in the migraine without aura group while underestimating it in the migraine with aura group. Nevertheless, our findings show no significant association for migraine without aura, whereas the significant association observed for migraine with aura suggests that the increased suicide risk is likely robust and may even underestimate the true strength of the relationship. Additionally, the lack of detailed information on migraine severity, frequency and duration limits the depth of understanding of the relationship between migraine and suicide risk. This study is further limited by unaccounted covariates (familial problems, work-related problems, genetic predisposition, family history of mental illness and other factors) that were unavailable due to the limitations of a large-scale database; however, we aimed to strengthen the model's robustness by including key covariates such as income, smoking, drinking and depression. Moreover, the observational nature of the study prevents the establishment of causality, and residual confounding factors may still affect the results despite adjustments in the analysis. While our study focuses on the association between migraine and suicide mortality, it is limited by only examining completed suicides and not capturing suicidal ideation or attempts. This approach may exclude other critical aspects of suicidal behaviour, such as ideation and attempts, which differ by sex and other factors. However, our analysis showed no significant differences between males and females in the association between migraine and suicide risk (p for interaction=0.2729). Additionally, when including migraine subtypes, the interaction remained non-significant (p for interaction=0.5818). Finally, the generalisability of the findings may be restricted to the Korean population, and caution should be exercised when extrapolating the findings to other ethnic or cultural groups. Although the dataset offers valuable insights from a large-scale population, it included 6 539 547 participants aged 20–39 in 2012, representing 43.9% of this demographic group. As it primarily includes employed individuals covered by the National Health Insurance and excludes non-working groups such as students and homemakers, representativeness may be limited.

CONCLUSION AND IMPLICATIONS

Although all migraine and migraine without aura did not have an impact on suicidal risk, migraine with aura was associated with a higher risk of suicide mortality. The presence of depression significantly modified this relationship, with differing associations observed across migraine subtypes.

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