Received: 11 April 2022 | Accepted: 27 July 2022

DOI: 10.1111/jdv.18565

ORIGINAL ARTICLE

Increased risk of suicidality in patients with psoriasis: A Nationwide cohort study in Korea

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Abstract

Background: Psoriasis has a devastating psychological impact on patients' quality of life. However, the relationship between suicidality and psoriasis remains unclear.

Objective: This study analysed and compared the risk of suicidality (suicidal ideation, suicide attempt and completed suicide) between patients with psoriasis and the general population.

Methods: This nationwide, population-based, retrospective, cohort study analysed the Korean National Health Insurance Service claim data from 2005 to 2018.

Results: The study included 348,439 patients with psoriasis aged over 18 years and with age- and sex-matched controls. The risk of suicidality was higher in the psoriasis group than in the control group [adjusted hazard ratio (aHR) 1.21; 95% confidence interval (CI), 1.18–1.24]. The aHR of suicidality was higher in the psoriatic arthritis group (aHR, 1.46; 95% CI, 1.39–1.54) than in the psoriasis-alone group (aHR, 1.17; 95% CI, 1.13–1.20). However, the severity of psoriasis and suicidality showed no correlation (mild psoriasis group: aHR, 1.22; 95% CI, 1.18–1.25; moderate-to-severe psoriasis group: aHR, 1.16; 95% CI, 1.10–1.23).

Conclusion: Patients with psoriasis have an increased risk of suicidality. In particular, the presence of arthritis in patients had a more significant effect on the risk of suicidality.

INTRODUCTION

Psoriasis is a chronic immune-mediated disorder characterized by skin inflammation and multiple comorbidities,[1,2] including cardiovascular disease, and it can compromise the patient's quality of life.[1–5] Patients with psoriasis commonly experience stigmatization, poor self-esteem and social rejection because of their skin lesions.[6–9] Recent studies have reported an increased incidence of various psychiatric diseases, including anxiety and depressive disorder, among patients with psoriasis.[10–12]

Suicidality conceptually includes suicidal ideation (thoughts about death or engaging in behaviour to kill oneself), suicide attempt (self-harm with at least some intent to kill oneself) and completed suicide.[13] According to the World Health Organization, approximately 700,000 people commit suicide annually.[14] Suicide is also emerging as a serious social health problem in South Korea, which has one of the highest suicide rates among the Organization for Economic Co-operation and Development countries.[15] In 2019, suicide ranked first among the causes of death in those aged 10–39 years and second in those aged 40–59 years in South Korea.[16]

Sung Min Kim and Juhee Ahn equally contributed to the article.

Although a relationship has been suggested between psoriasis and suicidality, this remains unclear.[17] A recent systematic review and meta-analysis found an increased risk of suicidality in patients with psoriasis.[18] However, another systematic review found no significant association between suicidality and psoriasis.[19] These findings highlight the need for large-scale cohort studies on this relationship. Therefore, we conducted this nationwide, population-based, retrospective, cohort study to analyse psoriasis as an independent risk factor for suicidality by using Korean National Health Insurance Service (NHIS) claim data.

MATERIALS AND METHODS

The research protocol was reviewed by the institutional review board (IRB) of the Konkuk University Hospital and exempted from IRB approval (KUMC 2020-06-037).

Data source

We utilized the Korean NHIS claim database (NHIS-2022-1-085), which contains all medical treatment data for most citizens. These data are anonymized to protect individual privacy. Information on the cause of death was obtained from the MicroData Integrated Service by Statistics Korea (https://mdis.kostat.go.kr).[20]

Study population and design

This nationwide retrospective cohort study included patients aged ≥18 years newly diagnosed as having psoriasis or psoriatic arthritis [PsA, based on International Classification of Diseases Tenth Revision (ICD-10) codes: L40.x, M07.0, M07.1 M07.2, M07.3 and M09.0] at least twice in outpatient care or once in inpatient care between 1 January 2005 and 31 December 2017, during one or more years of follow-up. All patients with psoriasis were 1:1 age- and sex-matched to controls without psoriasis. The index date was the first diagnosis date of psoriasis for patients with psoriasis, and the same index date was considered for their matched controls. We excluded patients diagnosed as having psoriasis before 2005 and those with a history of suicidality before the index date.

Main exposure

Psoriasis was considered the main exposure. We also considered two subgroups: the PsA status and psoriasis severity. According to the PsA status, patients with psoriasis were divided into two groups: psoriasis alone and PsA. According to psoriasis severity, patients who had ever received treatment with systemic drugs [acitretin, cyclosporine, or methotrexate, phototherapy and biologics (adalimumab, etanercept, guselkumab, infliximab, ixekizumab, secukinumab or ustekinumab)] were categorized into the moderate-to-severe group, and those who received only topical or no systemic therapy were categorized into the mild group. For the controls, both main exposures were coded as the reference level.

Operational definition of outcomes

The study outcome was suicidality, defined as suicidal ideation, suicide attempts, or completed suicide. The first diagnosis date of any of these three events was considered the onset date. Suicidal ideation (ICD-10 code: R45.8) indicated an outpatient visit or inpatient stay for that reason. Death with intentional self-harm (ICD-10 codes: X60-X84), as recorded in Statistics Korea, was considered a completed suicide.[20] Intentional self-harm (ICD-10 codes: X60-X84), as well as other ICD-10 codes indirectly associated with suicide attempts, were included in the category suicide attempt (Table S1). This classification system was similar to that used in previous Korean studies.[21,22] Patients with psoriasis and their matched controls were followed until the outcome occurred, or were otherwise considered censored on the date of death from any other cause or on 31 December 2018.

Covariates

Unbiased estimation of the main exposure on the outcome required adjustment for potential confounders, namely age, sex and socioeconomic status. For age and sex, the observed values were considered. The socioeconomic status, household income, type of insurance, residential area and registered disability were considered.

Statistical analysis

Baseline characteristics between patients with and without psoriasis were compared using the *t*-test or analysis of variance for continuous variables, and the chi-square test for categorical variables. We calculated the incidence rate (IR) of psoriasis per 100,000 person-years and the confidence intervals (CIs) under the Poisson distribution assumption. Kaplan–Meier survival curves were generated, and significant differences were tested using the log-rank test. To estimate the proportional hazard of the PsA status and psoriasis severity on suicidality, we performed univariate and multivariate Cox proportional hazard regression analysis after adjusting for potential confounders. Subgroup analyses were also performed with each 1:1 matched population. The proportional hazard assumption was confirmed using Schoenfeld residual plots. In addition, to confirm the robustness of the analysis results against the definition of outcome, we carried out a sensitivity analysis after excluding all events within 6 months from the index date. All statistical

significance was tested at $\alpha = 0.05$, and $p < 0.05$ was considered significant. Statistical analysis was conducted using SAS Enterprise Guide (version 7.13; SAS Institute), R software (version 4.1.3; R project) and Rex (version 3.5.3; RexSoft).[23]

RESULTS

Descriptive statistics

We identified 348,439 patients with psoriasis and 348,439 matched controls. The patients with psoriasis included 39,492 and 308,947 patients with and without PsA, respectively. Their mean follow-up time was 5.87 years. Among them, 300,764 had mild psoriasis and 47,675 had moderate-to-severe psoriasis. Their baseline characteristics are shown in Table 1. The mean age of patients with psoriasis and their matched controls was 53.4 years. Covariates in patients with psoriasis significantly differed between the patients and controls, except for age and sex.

Analysis results of patients with psoriasis and controls

We compared the onset of suicidality between patients with psoriasis and controls using the log-rank test, which revealed an increased suicidality risk in patients with psoriasis (Figure 1a; $p < 0.001$). Crude IRs of suicidality in patients with psoriasis were calculated (440.2 vs. 538.1 patients per 100,000 person-years, respectively; Table 2). On Cox regression analysis, the adjusted hazard ratios (aHRs) of psoriasis on suicidality risk were significantly higher among patients than among the matched controls (aHR, 1.21; 95% CI, 1.18–1.24; Table 2). Table 2 also shows the significant increases in suicidal ideation (aHR, 1.22; 95% CI, 1.17–1.28) and suicide attempts (aHR, 1.22; 95% CI, 1.17–1.26) in the psoriasis group. However, no significant difference was found for completed suicides (aHR, 1.09; 95% CI, 0.99–1.21).

Analysis results of the PsA status

Figure 1b shows a comparison of the onset of suicidality according to PsA status. A significant difference was found for both PsA statuses in the log-rank test ($p < 0.001$). Table 3 shows the association analysis results for the PsA status. The PsA group had significantly higher IRs for suicidality than the controls (PsA group: aHR, 1.46; 95% CI, 1.39–1.54; psoriasis-alone group: aHR, 1.17; 95% CI, 1.13–1.20). Risk estimates of the PsA status on suicidal ideation were also significantly increased (PsA group: aHR, 1.57; 95% CI, 1.45–1.70; psoriasis-alone group: aHR, 1.15; 95% CI, 1.10–1.21). Risk estimates of suicide attempts were also higher in the PsA group (aHR, 1.43; 95% CI, 1.33–1.52) than those in the psoriasis-alone group (aHR, 1.18; 95% CI, 1.14–1.23; Table 3). For completed suicides, however, no significant results were obtained. All results related to PsA status are consistent with those from the corresponding subgroup analysis (Table S2).

Analysis results of psoriasis severity

Figure 1c shows a comparison of the onset age of suicidality according to psoriasis severity. A significant difference was found for both psoriasis severity statuses in the log-rank test ($p < 0.001$). Table 4 shows the analysis results for psoriasis severity. Risk estimates of suicidality were higher in the mild psoriasis group (aHR, 1.22; 95% CI, 1.18–1.25) and the moderate-to-severe psoriasis group (aHR, 1.16; 95% CI, 1.10–1.23) than those in the control group. The aHR of suicidal ideation in the mild group (aHR, 1.23; 95% CI, 1.17–1.29) and in the moderate-to-severe group (aHR, 1.19; 95% CI, 1.07–1.31) was slightly higher than that in the control group (Table 4). In suicide attempts, risk estimates were higher in the mild group (aHR, 1.23; 95% CI, 1.18–1.27) and the moderate-to-severe group (aHR, 1.15; 95% CI, 1.06–1.24) than those in the control group (Table 4). Risk estimates of completed suicides did not increase in the mild (aHR, 1.09; 95% CI, 0.98–1.22) and moderate-to-severe groups (aHR, 1.08; 95% CI, 0.87–1.33). The IRs of all suicidal outcomes and the corresponding estimates in the subgroup analyses showed similar trends to those of the corresponding aHRs (Tables 4 and S3).

Sensitivity analysis

We conducted the same analyses after excluding all events within 6 months after the index date and found that the general trend and significance were consistent with the results, including all events (Tables S4–S6). Subgroup analyses were also similar to those except for events within 6 months (Tables S7 and S8).

DISCUSSION

In this study, the psoriasis group had a higher risk of suicidality, including suicidal ideation and suicide attempts, than that in the control group, but no significant difference was observed between the two groups regarding incidences of completed suicides. Our results suggest an association between psoriasis and suicidality, similar to that observed in previous cohort studies.[12,24]

There exist conflicting study results regarding psoriasis and suicidality. Wu et al.[25] reported that the risk of depression increased in patients with psoriasis and PsA, but that of suicidal ideation and suicide attempt did not increase. Also, a nationwide cohort study in Taiwan reported no correlation between suicidal behaviour and psoriasis or PsA.[26] However, another nationwide study conducted in Taiwan regarding the mortality of patients with psoriasis reported an increased risk of death by

TABLE 1 Baseline characteristics of study population

Characteristics	Non-psoriasis control (*n* = 348,439)	Psoriasis (*n* = 348,439)	*p* Value[a]	Psoriasis alone (*n* = 308,947)	Psoriasis with arthritis (*n* = 39,492)	*p* Value[a]	Mild (*n* = 300,764)	Moderate-to-severe (*n* = 47,675)	*p* Value[a]
Age — *n* (%)			>0.99			**<0.001**			**<0.001**
18–40	70,371 (20.2%)	70,371 (20.2%)		67,103 (21.7%)	3268 (8.3%)		57,835 (19.2%)	12,536 (26.3%)	
41–64	193,720 (55.6%)	193,720 (55.6%)		171,345 (55.5%)	22,375 (56.7%)		166,748 (55.4%)	26,972 (56.6%)	
≥65	84,348 (24.2%)	84,348 (24.2%)		70,499 (22.8%)	13,849 (35.1%)		76,181 (25.3%)	8167 (17.1%)	
Sex — *n* (%)			>0.99			**<0.001**			**<0.001**
Male	183,808 (52.8%)	183,808 (52.8%)		169,906 (55.0%)	13,902 (35.2%)		156,698 (52.1%)	27,110 (56.9%)	
Female	164,631 (47.2%)	164,631 (47.2%)		139,041 (45.0%)	25,590 (64.8%)		144,066 (47.9%)	20,565 (43.1%)	
Income — Mean (*SD*), *n* (%)	3.3 (1.4)	3.3 (1.4)	**<0.001**	3.3 (1.4)	3.3 (1.5)	**<0.001**	3.3 (1.4)	3.3 (1.4)	**<0.001**
1 (lowest quintile)	54,564 (15.7%)	57,445 (16.5%)		50,237 (16.3%)	7208 (18.3%)		49,812 (16.6%)	7633 (16.0%)	
2 (second quintile)	50,170 (14.4%)	48,970 (14.1%)		43,501 (14.1%)	5469 (13.8%)		42,048 (14.0%)	6922 (14.5%)	
3 (middle quintile)	63,228 (18.1%)	62,029 (17.8%)		55,406 (17.9%)	6623 (16.8%)		53,104 (17.7%)	8925 (18.7%)	
4 (fourth quintile)	81,008 (23.2%)	80,783 (23.2%)		72,045 (23.3%)	8738 (22.1%)		69,381 (23.1%)	11,402 (23.9%)	
5 (top quintile)	99,469 (28.5%)	99,212 (28.5%)		87,758 (28.4%)	11,454 (29.0%)		86,419 (28.7%)	12,793 (26.8%)	
Employed type — *n* (%)			**<0.001**			**<0.001**			**<0.001**
Medicare	5265 (1.5%)	8955 (2.6%)		7719 (2.5%)	1236 (3.1%)		7930 (2.6%)	1025 (2.1%)	
Dependent on employed	106,915 (30.7%)	105,047 (30.1%)		88,998 (28.8%)	16,049 (40.6%)		92,598 (30.8%)	12,449 (26.1%)	
Dependent on self-employed	37,410 (10.7%)	136,587 (39.2%)		126,665 (41.0%)	9922 (25.1%)		31,951 (10.6%)	4730 (9.9%)	
Employed	139,245 (40.0%)	36,681 (10.5%)		31,294 (10.1%)	5387 (13.6%)		115,395 (38.4%)	21,192 (44.5%)	
Self-employed	59,604 (17.1%)	61,169 (17.6%)		54,271 (17.6%)	6898 (17.5%)		52,890 (17.6%)	8279 (17.4%)	
Residential area[b] — *n* (%)			**<0.001**			**<0.001**			**<0.001**
Metropolitan	67,693 (19.4%)	67,499 (19.4%)		62,186 (20.1%)	5313 (13.5%)		57,361 (19.1%)	10,138 (21.3%)	
Urban	89,801 (25.8%)	85,553 (24.6%)		75,213 (24.3%)	10,340 (26.2%)		72,122 (24.0%)	13,431 (28.2%)	
Rural	190,945 (54.8%)	195,387 (56.1%)		171,548 (55.5%)	23,839 (60.4%)		171,281 (56.9%)	24,106 (50.6%)	
Disability — *n* (%)			**<0.001**			**<0.001**			**<0.001**
No	323,078 (92.7%)	317,955 (91.3%)		282,796 (91.5%)	35,159 (89.0%)		273,655 (91.0%)	44,300 (92.9%)	
Yes	25,361 (7.3%)	30,484 (8.7%)		26,151 (8.5%)	4333 (11.0%)		27,109 (9.0%)	3375 (7.1%)	

Bold font presents statistical significance at α = 0.05.

Abbreviation: SD, standard deviation.

[a]Compared to non-psoriasis controls.

[b]Metropolitan (capital), urban (local government with a population > 1 million) and rural (elsewhere).

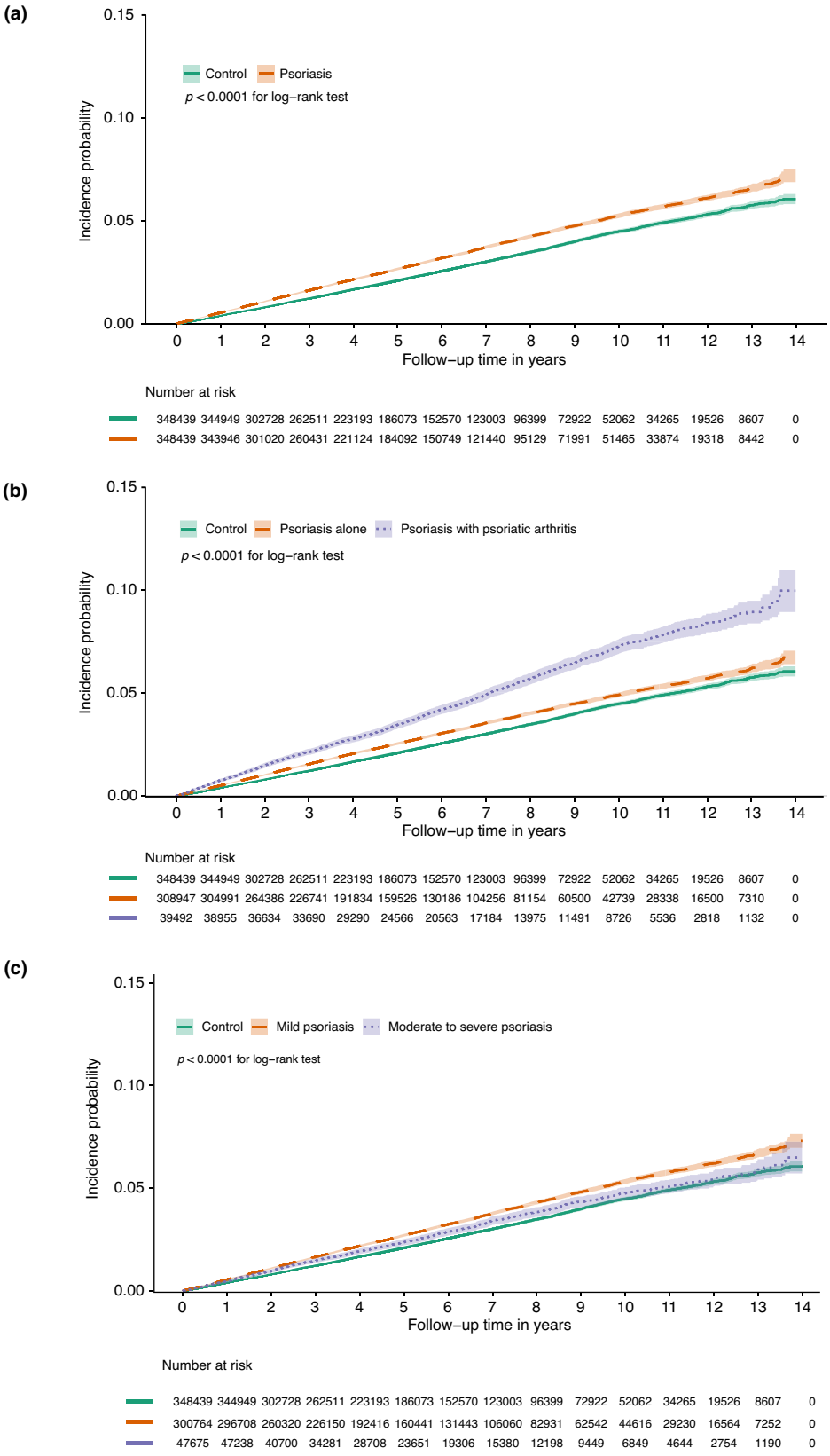

FIGURE 1 Kaplan–Meier curves of incidence probability for suicidality among patents with psoriasis. (a) Psoriasis group and control group. (b) Psoriatic arthritis group, psoriasis-alone group and control group. (c) Mild group, moderate-to-severe group and control group.

TABLE 2 Risk of suicidality in patients with psoriasis compared to that in controls without psoriasis

	No. of events	Person-years	IR (95% CI)[a]	Unadjusted HR (95% CI)	Adjusted HR (95% CI)[b]
Suicidality					
Non-psoriasis	9032	2,051,578	440.2 (431.2–449.4)	1.00	1.00
Psoriasis	10,954	2,035,722	538.1 (528.1–548.3)	1.22 (1.19–1.26)	1.21 (1.18–1.24)
Suicidal ideation					
Non-psoriasis	3140	2,070,972	151.6 (146.4–157.0)	1.00	1.00
Psoriasis	3826	2,060,008	185.7 (179.9–191.7)	1.23 (1.17–1.28)	1.22 (1.17–1.28)
Suicidal attempt					
Non-psoriasis	5407	2,062,499	262.2 (255.2–269.2)	1.00	1.00
Psoriasis	6631	2,049,143	323.6 (315.9–331.5)	1.23 (1.19–1.28)	1.22 (1.17–1.26)
Complete suicide					
Non-psoriasis	696	2,082,171	33.4 (31.0–36.0)	1.00	1.00
Psoriasis	765	2,073,803	36.9 (34.3–39.6)	1.10 (0.996–1.22)	1.09 (0.99–1.21)

Abbreviations: CI, confidence interval; HR, hazard ratio; IR, incidence rate per 10^5 person-years.

[a]Incidence rate is calculated for each treatment group and clinical outcome by dividing the number of events by person-years.

[b]Adjusted for age, sex, income level, employment type, residential area and disability.

TABLE 3 Risk of suicidality in patients with psoriasis according to the psoriatic arthritis status, compared to that in controls without psoriasis

	No. of events	Person-years	IR (95% CI)[a]	Unadjusted HR (95% CI)	Adjusted HR (95% CI)[b]
Suicidality					
Non-psoriasis	9032	2,051,578	440.2 (431.2–449.4)	1.00	1.00
Psoriasis alone	9025	1,771,420	509.5 (499.0–520.1)	1.16 (1.12–1.19)	1.17 (1.13–1.20)
Psoriatic arthritis	1929	264,302	729.8 (697.6–763.2)	1.66 (1.58–1.74)	1.46 (1.39–1.54)
Suicidal ideation					
Non-psoriasis	3140	2,070,972	151.6 (146.4–157.0)	1.00	1.00
Psoriasis alone	3016	1,791,528	168.3 (162.4–174.5)	1.11 (1.06–1.17)	1.15 (1.10–1.21)
Psoriatic arthritis	810	268,480	301.7 (281.3–323.2)	1.98 (1.83–2.14)	1.57 (1.45–1.70)
Suicidal attempt					
Non-psoriasis	5407	2,062,499	262.2 (255.2–269.2)	1.00	1.00
Psoriasis alone	5555	1,781,914	311.7 (303.6–320.1)	1.19 (1.15–1.23)	1.18 (1.14–1.23)
Psoriatic arthritis	1076	267,229	402.7 (378.9–427.4)	1.54 (1.44–1.64)	1.43 (1.33–1.52)
Complete suicide					
Non-psoriasis	696	2,082,171	33.4 (31.0–36.0)	1.00	1.00
Psoriasis alone	660	1,802,303	36.6 (33.9–39.5)	1.10 (0.99–1.22)	1.08 (0.97–1.20)
Psoriatic arthritis	105	271,499	38.7 (31.6–46.8)	1.15 (0.94–1.42)	1.17 (0.95–1.44)

Abbreviations: CI, confidence interval; HR, hazard ratio; IR, incidence rate per 10^5 person-years.

[a]Incidence rate is calculated for each treatment group and clinical outcome by dividing the number of events by person-years.

[b]Adjusted for age, sex, income level, employment type, residential area and disability.

intentional self-harm or suicide (standardized mortality ratio 1.21, 95% CI 1.03–1.40).[27] A study done in the U.K. showed an increased risk of self-harm (aHR 1.15, 95% CI 1.04–1.27) but decreased risk of suicide (aHR 0.59, 95% CI 0.41–0.85) regarding patients with psoriasis.[28] Similarly, Egeberg et al.[29] reported that the risk of suicide did not increase among mild or severe psoriasis patients. However, the risk of self-harm or suicide attempt did increase in the severe psoriasis patient group (incidence rate ratio 1.69, 95% CI 1.00–2.84).[29] A previous study of specific psychiatric and physical disorders, self-harm, and suicide reported an increased self-harm risk in patients with psoriasis (rate ratio 1.6, 95% CI 1.3–1.4).[30] Also, Pompili et al.[31] reported that patients with psoriasis had an increased risk of suicidal ideation compared to patients with other skin diseases (e.g. melanoma and allergy). As

TABLE 4 Risk of suicidality in patients with psoriasis according to psoriasis severity, compared to that in controls without psoriasis

	No. of events	Person-years	IR (95% CI)[a]	Unadjusted HR (95% CI)	Adjusted HR (95% CI)[b]
Suicidality					
Non-psoriasis	9032	2,051,578	440.2 (431.2–449.4)	1.00	1.00
Mild psoriasis	9648	1,765,682	546.4 (535.6–557.4)	1.24 (1.21–1.28)	1.22 (1.18–1.25)
Moderate-to-severe psoriasis	1306	270,040	483.6 (457.8–510.6)	1.10 (1.04–1.17)	1.16 (1.10–1.23)
Suicidal ideation					
Non-psoriasis	3140	2,070,972	151.6 (146.4–157.0)	1.00	1.00
Mild psoriasis	3384	1,787,059	189.4 (183.0–195.9)	1.25 (1.19–1.31)	1.23 (1.17–1.29)
Moderate-to-severe psoriasis	442	272,949	161.9 (147.2–177.8)	1.07 (0.97–1.18)	1.19 (1.07–1.31)
Suicidal attempt					
Non-psoriasis	5407	2,062,499	262.2 (255.2–269.2)	1.00	1.00
Mild psoriasis	5843	1,777,576	328.7 (320.3–337.2)	1.25 (1.21–1.30)	1.23 (1.18–1.27)
Moderate-to-severe psoriasis	788	271,567	290.2 (270.3–311.2)	1.11 (1.03–1.19)	1.15 (1.06–1.24)
Complete suicide					
Non-psoriasis	696	2,082,171	33.4 (31.0–36.0)	1.00	1.00
Mild psoriasis	670	1,799,292	37.2 (34.5–40.2)	1.11 (1.00–1.24)	1.09 (0.98–1.22)
Moderate-to-severe psoriasis	95	274,511	34.6 (28.0–42.3)	1.04 (0.84–1.28)	1.08 (0.87–1.33)

Abbreviations: CI, confidence interval; HR, hazard ratio; IR, incidence rate per 10^5 person-years.

[a]Incidence rate is calculated for each treatment group and clinical outcome by dividing the number of events by person-years.

[b]Adjusted for age, sex, income level, employment type, residential area and disability.

we can see, the causal relation between psoriasis and suicidality is not certain, but the possibility has consistently been insisted.

Recently, the inflammatory response has been suggested to contribute to the pathophysiology of suicide.[32,33] A previous meta-analysis showed that patients with suicidality had aberrant cytokine levels in their postmortem brain, blood and cerebrospinal fluid samples.[34] Furthermore, interleukin-17, a proinflammatory mediator associated with psoriasis, has been linked to major depressive disorder.[35] These findings suggest that the inflammatory response may affect the development of mental illness and suicidal behaviour in patients with psoriasis.

Suicidality is also associated with factors such as the socioeconomic status, family support, psychiatric disease and physical illness.[13] According to a previous nationwide cohort study, the proportion of employed and married patients with psoriasis was lower than that among matched controls.[36] Moreover, multiple comorbidities, including cardiometabolic, gastrointestinal and psychiatric diseases, have been linked to psoriasis.[37] Although clarifying a causal relationship is difficult, these psychosocial and physical burdens of psoriasis may contribute to the increased risk of suicidality.

In our study, the aHR of suicidality in the PsA group was higher than that in the psoriasis-alone group. In a previous questionnaire study, patients with PsA had a worse quality of life than did those with psoriasis-alone.[38] Moreover, patients with PsA had worse functional statuses than did those with psoriasis-alone,[39] and had higher rates of work disability (15%–39%) and unemployment (20%–50%).[40] McDonough et al.[41] found that depression and anxiety were more prevalent in patients with PsA (22.2% and 36.6%, respectively) than in those with psoriasis alone (9.6% and 24.4%; $p = 0.002$ and $p = 0.012$, respectively). Thus, PsA may have a significant impact on the patient's life and may be associated with the increased risk of suicidality.

We found that psoriasis severity had no important effect on suicidality. Kurd et al.[12] used a similar classification system, and reported a high risk of suicidality in patients with mild psoriasis (aHR, 1.44; 95% CI, 1.32–1.57), but not in those with severe psoriasis (aHR, 1.51; 95% CI, 0.92–2.49). The clinical severity of a disease may not always reflect its psychosocial effect in patients with psoriasis.[42–44] Moreover, the psychological effects of psoriasis are related to the location of the skin lesion, as well as the disease severity.[6,45,46] For example, skin lesions on highly visible body parts like the face and scalp can significantly decrease the patient's quality of life.[47,48] Additionally, lesions on the hand can limit the patient's work productivity,[49] and genital psoriasis can impair sexual activity.[50,51] In this study, owing to the limitations of insurance claim data, we used treatment history to classify disease severity. Therefore, patients with localized skin lesions who received only topical treatment without systemic treatment might have been categorized into the mild psoriasis group. Furthermore, patients with moderate-to-severe psoriasis had received systemic therapy; hence, they could be considered as the well-treated patient group. Improvements in skin lesions through appropriate management, including systemic therapy, can decrease psychiatric morbidities[52] and improve the quality of life of patients with psoriasis.[53–55]

While the risk of suicidal ideation and suicide attempts was higher in the psoriasis groups than in the control group,

no significant difference was observed in completed suicides. This result could be interpreted as an increase in non-fatal self-injury in patients with psoriasis, but no significant difference was observed in fatal self-harm causing death. Otherwise, some deaths due to suicide might be misclassified as deaths due to accidents or undetermined causes, and this could affect the study results.[56]

A strength of this study is its relatively large sample size. Additionally, suicidality was analysed by subdividing it into suicidal ideation, suicide attempts and completed suicides, while considering multiple confounders. However, certain limitations should be considered. First, the medical records of patients are unavailable in the NHIS database. Therefore, we could not identify clinical features such as the location and surface area of skin lesions, the number of joints involved (in patients with PsA) and subjective symptoms, such as pruritus or pain. Second, although we considered several confounders, other potential confounders may not have been controlled for, such as cultural factors, or family loss. Third, suicide attempts were defined using ICD-10 codes indicating a high suspicion of suicide attempts and intentional self-harm. Therefore, unintentional accidents and undetermined injuries might also have been included as suicide attempts. As an example, falls (ICD-10 codes: W13-19), which were used in our study, include suicide attempts by jumping from a high place as well as simple falls. In this study, the total incidence of intensive self-harm (ICD 10 codes: X60-84) in suicide attempts was only 64 (control group 27 and psoriasis group 37), which implied a poor use of intensive self-harm codes as suicide attempts in the Korean clinical setting. This might be because the Korean NHIS did not cover suicide attempts until recently.[21,57] Therefore, it is possible that physicians may not have assigned the correct intentional self-harm codes, despite noticing a patient's suicidal intention.[21] Fourth, generalizing these findings to other ethnicities would be difficult, because the estimated prevalence of psoriasis in the Korean population ranges from 0.44% to 0.45%,[58] which is lower than that in western countries (2.0–4.0%).[59] Fifth, most causes of death data from the Korean Statistical Information System used in our study are based on the ICD-10 codes stated on the physicians' death certificates. In this study, we could not use data on cause of death by coroners, police or forensic doctors. Therefore, there is a possibility for our study to under-report death by suicide.

In conclusion, the risk of suicidality, including suicidal ideation and suicide attempt, was increased in patients with psoriasis, and the risk of suicidality was higher in patients with psoriatic PsA than in those with psoriasis-alone. Moreover, psoriasis severity was not correlated with suicidality in this cohort study. Considering these associations between psoriasis and suicidality, dermatologists should assess the risk of suicidality among patients with psoriasis and consider proper psychological management.

ACKNOWLEDGEMENT
None.

FUNDING INFORMATION
This article has no funding source.

CONFLICT OF INTEREST
The authors have no conflict of interest to declare.

DATA AVAILABILITY STATEMENT
The data used in this study are provided by the Korean National Health Insurance Sharing Service (NHISS) and are available at https://nhiss.nhis.or.kr/ with the permission of the NHISS.

IRB APPROVAL STATUS
Reviewed by the institutional review board (IRB) of Konkuk University Hospital and exempted from IRB approval; #KUMC 2020-06-037.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Kim SM, Ahn J, Cho YA, Sung JY, Kim CY, Yu D-A, et al. Increased risk of suicidality in patients with psoriasis: A Nationwide cohort study in Korea. J Eur Acad Dermatol Venereol. 2022;00:1–10. https://doi.org/10.1111/jdv.18565