

# Differential characteristics and treatment of psoriasis patients by economic status in South Korea

## An analysis of the National Health Insurance Database

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### Abstract

Despite the enormous burden on patients with severe psoriasis, their utilization of medical care is not well understood in Korea.

To compare the characteristics and treatment patterns of psoriasis patients by economic status as well as to examine the factors influencing systemic treatments of psoriasis.

We conducted a descriptive cross-sectional study using National Health Insurance sample cohort data in 2015. Psoriasis patients were classified as either the “topical treatment only” or the “systemic treatment” group based on the types of treatment. Patients’ economic status was defined by the deciles of health insurance premium, which was determined based on income and assets. Multivariate logistic regression analysis was performed to examine the factors influencing systemic treatments of psoriasis.

We identified 6041 psoriasis patients; 39.5% were in the bottom 5 deciles of health insurance premium and 60.5% were in the top 5 deciles. Only 1.9% of the low economic status group and 4.0% of the high economic status group were treated with expensive biologics, although the difference was not statistically significant.

Overall, psoriasis patients with higher economic status had a lower likelihood of receiving systemic treatments but had a higher probability of being treated with expensive biologics.

**Abbreviations:** CI = confidence interval, NHIS = National Health Insurance Service, OR = odds ratio, Q = quantiles.

**Keywords:** biologics, income level, psoriasis, treatment type

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## 1. Introduction

The worldwide prevalence of psoriasis in adults varied from 0.9% in the United States to 8.5% in Norway.<sup>[1]</sup> The prevalence of psoriasis in Korea has increased from 0.47% in 2006 to 0.62% in 2015 but remains lower than in other developed nations.<sup>[2]</sup> Psoriasis is a common chronic immune-mediated disease of the skin and the joints.<sup>[3]</sup> In recent years, it has become clear that psoriasis is not limited to the skin, and that it is a systemic inflammatory disease associated with a number of comorbidities, including psoriatic arthritis, cardiovascular disease, and metabolic syndrome.<sup>[4]</sup> Psoriasis is also an independent risk factor for mortality.<sup>[5]</sup> After controlling for demographics and comorbidities, psoriasis patients had a higher mortality risk than those without psoriasis.<sup>[6]</sup> Moreover, since psoriasis is associated with multiple comorbidities, inadequate treatments can lead to a worsening of comorbidities and excess mortality.<sup>[7]</sup> There is evidence that patients with severe psoriasis are at an increased risk of death from a variety of causes with cardiovascular disease being the most common etiology.<sup>[8]</sup>

Psoriasis may adversely affect the financial situations of the patients and vice versa. A study conducted in the United States showed that the probability of low income was significantly greater among patients with severe psoriasis than those with mild psoriasis.<sup>[9]</sup> Although tumor necrosis factor- $\alpha$  inhibitors (etanercept, infliximab, and adalimumab) and an IL-12/23 inhibitor (ustekinumab) are currently available in Korea for psoriasis treatment, the high costs of these biologic agents pose a major hurdle for access.<sup>[10]</sup> Psoriasis patients often have to bear high out-

of-pocket costs. Among patients with moderate-to-severe psoriasis visiting a teaching hospital in Korea that received ustekinumab, economic burden was the most influential factor affecting treatment continuity.<sup>[11]</sup> According to a 2016 survey, 66% of all patients with psoriasis in Korea discontinued treatments; the discontinuation rate increased to 80% among patients with severe psoriasis.<sup>[12]</sup> To reduce the undue financial burden on patients with psoriasis, Korea introduced a measure in June 2017 to allow patients with severe psoriasis to pay a lower out-of-pocket cost.<sup>[13]</sup> Nonetheless, psoriasis treatment remains a cause for huge economic burden for many patients with severe psoriasis.<sup>[14]</sup>

Despite the enormous burden on patients with severe psoriasis, their utilization of medical care is not well understood in Korea. Therefore, this study aimed to analyze the characteristics and treatment patterns of psoriasis patients by economic status. This study also investigated the factors influencing systemic treatments of psoriasis.

## 2. Methods

### 2.1. Database

We used claims data from the National Health Insurance Service (NHIS) - National Sample Cohort 2.0 database. The NHIS created the database to facilitate research for the prevention and treatment of diseases, promotion of health, establishment of health care policies, and improvement of health care quality. The sample cohort represents the entire Korean population and it is possible to extract a number of demographic variables, such as sex, age, income level, and area of residence from the data.<sup>[15]</sup> Qualification data provide the patient's coverage status at the end of the calendar year, indicating whether the patient is a beneficiary of the National Health Insurance or Medical Aid. The database contains information on health insurance premiums (in 10-quantiles [Q]), detailed medical records, health examinations, and medical institutions.

### 2.2. Study subjects

Our study subjects were all patients who had a diagnosis of psoriasis (L40) between January 1 and December 31, 2015. To extract all patients with psoriasis, we considered the disease code that was recorded as a primary or secondary diagnosis in the NHIS sample cohort data. We excluded the beneficiaries of Medical Aid from the analysis, because they were responsible for very small co-payments. We extracted information on comorbidities for the identified patients. Diagnoses were coded according to the 10th revision of the International Classification of Diseases-10.

### 2.3. Categorization of psoriasis patients by treatment type

The current treatment guidelines recommend topical agents for mild psoriasis, and phototherapy, traditional oral systemic immunosuppressant agents (e.g., methotrexate), or biologics (i.e., tumor necrosis factor- $\alpha$  inhibitors) for moderate-to-severe psoriasis.<sup>[16-19]</sup> Based on the types of treatment, we classified patients as those treated with topical agents only ("topical treatment only" group) or those treated with phototherapy, traditional systemic agents, and biologics as a monotherapy or in combination ("systemic treatment" group).

### 2.4. Statistical analysis

We described the patient characteristics, such as sex, area of residence, type of health insurance, comorbidity, and status of systemic treatments, by income level. The area of residence was categorized as Seoul, other metropolitan cities, and provinces. There are 2 types of the National Health Insurance: 1 for the employees of the governments and corporations and the other for the self-employed. The insurance premium level is determined differently depending on the insurance type. The premium is based on salaries for the employees and on combined income and assets for the self-employed. For these reasons, the insurance premium level is a reasonable indicator of the patient's economic status. Based on insurance premiums, we classified patients into bottom 5 deciles (Q1-Q5) and top 5 deciles (Q6-Q10) and compared the types of treatment used between the 2 groups. Within each economic status group, patient characteristics were compared between the topical treatment only group and the systemic treatment group. The Chi-squared test was used to check whether there was a significant difference between groups for all categorical data ( $P$ -value  $< .05$ ).

Multivariate logistic regression analyses were performed to identify the factors influencing systemic treatments for all patients and only those with the employee insurance. Independent variables included sex, region, health insurance premium level, and comorbidity. We calculated odds ratios (ORs) and 95% confidence intervals (CIs) for all variables. All statistical analyses were performed using SAS software (Release 9.4, SAS Institute Inc., Cary, NC). The study protocol was approved by the Sungkyunkwan University Institutional Review Board (IRB No. 2018-06-011).

## 3. Results

There were 6402 patients with psoriasis among the 2015 NHIS sample cohort ( $n=1061,141$ ) (Fig. 1). We excluded 361 beneficiaries of Medical Aid from the analysis. The remaining 6041 patients were categorized into 2385 paying a low premium (Q1-Q5) and 3656 paying a high premium (Q6-Q10). The low premium group was comprised of 2091 patients treated with topical agents only and 294 receiving systemic treatments. The high premium group was comprised of 3241 patients treated with topical agents only and 415 receiving systemic treatments.

There were more males than females for all treatment types and premium groups, except in patients receiving topical treatments only in the low premium group (Table 1). The prevalence of dyslipidemia (Q1-Q5: 39.5% vs 30.2%,  $P < .05$ ; Q6-Q10: 45.8% vs 32.9%,  $P < .05$ ) and psoriatic arthritis (Q1-Q5: 1.7% vs 0.5%,  $P < .05$ ; Q6-Q10: 3.4% vs 0.4%,  $P < .05$ ) was significantly higher in patients receiving systemic treatments than in those receiving topical treatment only in both premium groups.

Most patients with psoriasis did not receive systemic treatments regardless of premium levels (Table 2). There was no significant difference in the overall treatment status between the low and high premium levels. However, when the patients receiving systemic treatments were examined, a greater proportion of patients received methotrexate in the high premium group than in the low premium group (Q6-Q10: 14.3% vs Q1-Q5: 9.1%,  $P < .05$ ). Also, the proportion of psoriasis patients who were prescribed biologics in the high premium group (4.0%) was

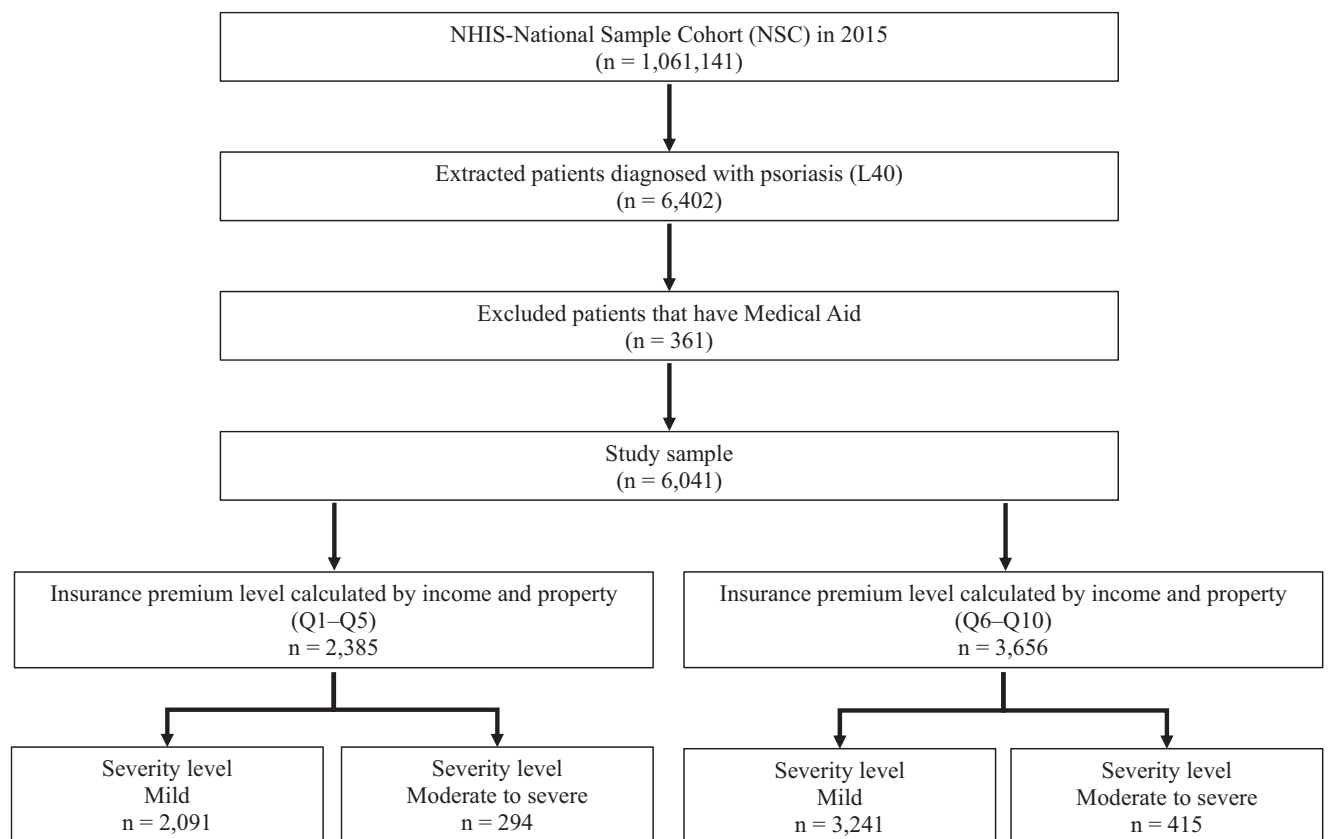


Figure 1. Study flow chart.

approximately 2times that in the low premium group (1.9%), although the difference was not statistically significant.

The results of the multivariate logistic regression analysis for all patients revealed that patients paying a high premium had a lower likelihood of receiving systemic treatments, although the

relationship was not statistically significant (Table 3). Females were less likely to receive systemic treatments than males (OR = 0.765; 95% CI, 0.650–0.901). Patients in provinces had a lower likelihood of receiving systemic treatments than those in Seoul (OR = 0.776; 95% CI, 0.635–0.949). Patients with dyslipidemia

Table 1

Comparison of characteristics of psoriasis patients by insurance premium level and disease severity in 2015.

Variable	Lower insurance premium level		P-value	Higher insurance premium level		P-value
	Topical treatment only (n = 2091)	Systemic treatment (n = 294)		Topical treatment only (n = 3241)	Systemic treatment (n = 415)	
Sex–no. (%)						
Male	1064 (50.9)	174 (59.2)	.01	1902 (58.7)	264 (63.6)	.049
Female	1027 (49.1)	120 (40.8)		1339 (41.3)	151 (36.4)	
Area of residence–no. (%)						
Seoul	374 (17.9)	66 (22.4)	.13	634 (19.6)	94 (22.7)	.17
Other metropolitan city	478 (22.9)	69 (23.5)		787 (24.3)	107 (25.8)	
Province	1239 (59.3)	159 (54.1)		1820 (56.2)	214 (51.6)	
National Health Insurance type–no. (%)						
Self-employed	611 (29.2)	95 (32.3)	.028	1005 (31.0)	140 (33.7)	.26
Employee	1480 (70.8)	199 (67.7)		2236 (69.0)	275 (66.3)	
Comorbidity–no. (%)						
Dyslipidemia	631 (30.2)	116 (39.5)	.001	1067 (32.9)	190 (45.8)	.001
Hypertension	526 (25.2)	71 (24.1)	.71	873 (26.9)	120 (28.9)	.39
Diabetes mellitus	303 (14.5)	48 (16.3)	.41	478 (14.7)	71 (17.1)	.21
Cardiovascular diseases	149 (7.1)	23 (7.8)	.67	265 (8.2)	43 (10.4)	.13
Cerebral infarction	47 (2.2)	9 (3.1)	.39	95 (2.9)	12 (2.9)	.96
Psoriatic arthritis	11 (0.5)	5 (1.7)	.02	13 (0.4)	14 (3.4)	.001
Crohn disease	3 (0.1)	0 (0)	.52	3 (0.1)	0 (0)	.54

**Table 2**  
Types of treatment prescribed for psoriasis by insurance premium level in 2015.

Variable	Low level of insurance premium (n=2385)	High level of insurance premium (n=3656)	P-value
Type of systemic treatment–no. (%)			
Oral systemic agents			
Cyclosporine	132 (42.9)	176 (39.3)	.45
Acitretin	142 (46.1)	190 (42.4)	.45
Methotrexate	28 (9.1)	64 (14.3)	.04
Biologics	6 (1.9)	18 (4.0)	.12
Total	308 (100.0)	448 (100.0)	
Treatment status–no. (%)			
No treatment or topical treatment	2091 (87.7)	3241 (88.6)	.69
One type of systemic treatment	282 (11.8)	385 (10.5)	.14
Two types of systemic treatment	10 (0.4)	27 (0.7)	.12
Three types of systemic treatment	2 (0.1)	3 (0.1)	.98
Total	2385 (100.0)	3656 (100.0)	

and psoriatic arthritis were more likely to receive systemic treatments than those without dyslipidemia (OR=1.812; 95% CI, 1.479–2.194) and psoriatic arthritis (OR=5.169; 95% CI, 2.791–9.572). In contrast, patients with hypertension were less likely to receive systemic treatments than those without hypertension (OR=0.766; 95% CI, 0.619–0.948).

Males comprised 59.5% of employees paying a high insurance premium and 50.9% of employees paying a low premium ( $P=.001$ ) (Table 4). The prevalence of dyslipidemia (33.8% vs 30.4%,  $P<.05$ ), hypertension (26.5% vs 23.6%,  $P<.05$ ), and cardiovascular diseases (9.0% vs 6.8%,  $P<.05$ ) was higher in employees paying a high insurance premium than in those paying a low premium. The results of the multivariate logistic regression analysis for employees showed that females were less likely to receive systemic treatments than males (OR=0.791; 95% CI, 0.65–0.901) (Table 5). Patients in provinces had a lower likelihood of receiving systemic treatments than those in Seoul

(OR=0.814; 95% CI, 0.635–0.949). The odds of receiving systemic treatments were increased by the comorbidity of dyslipidemia (OR=2.087; 95% CI, 1.653–2.634) and psoriatic arthritis (OR=3.369; 95% CI, 1.466–7.743) but decreased by hypertension (OR=0.678; 95% CI, 0.520–0.884).

#### 4. Discussion

Psoriasis requires appropriate treatment according to the disease severity,<sup>[2]</sup> and it is important to continue treatment without interruption,<sup>[20,21]</sup> while considering dose tapering by decreasing dosage or increasing the interval between doses.<sup>[22]</sup> However, there is concern that patients' characteristics, such as their economic status, influence the quality and continuity of treatment in Korea.<sup>[12]</sup> Therefore, using the NHIS cohort sample data in 2015, we analyzed the characteristics of psoriasis patients and the types of treatment by economic status, which was measured by the health insurance premium level.

We showed that women had lower odds of receiving systemic treatments than men. Studies in Sweden and Japan reported that women have a significantly lower incidence of severe psoriasis than men.<sup>[23,24]</sup> This may explain why women received more topical treatments than men,<sup>[25]</sup> whereas men were more likely to receive systemic treatments.<sup>[26,27]</sup>

We found no significant difference in the overall treatment patterns by health insurance premium level. However, it is noteworthy that the proportion of psoriasis patients in the high premium group who were prescribed biologics was approximately 2 times that in the low premium group, although the difference was not statistically significant. The disparity may be due to the high costs of biologics. A previous study reported that psoriasis patients treated with expensive biologics had high discontinuation rates primarily due to the costs.<sup>[11]</sup> In June 2017, Korea introduced a policy to reduce the cost of biologics for patients with severe psoriasis.<sup>[28]</sup> As the policy takes effect, the difference in the use of biologics between high premium and low premium groups may decrease gradually.

In our analysis, patients with high economic status may have had easy access to expensive systemic treatments such as biologics. Similar results were reported in the United States and Italy, where psoriasis patients with high income had greater access to biological treatments.<sup>[29,30]</sup> Patients with low-income subsidies had 30% higher odds of receiving biologics than those without the subsidies in the United States.<sup>[29]</sup> Patients with a high income occupation

**Table 3**  
Multivariate logistic regression for systemic treatments in psoriasis patients in 2015\*.

Variable	Adjusted OR (95% CI)
Sex	
Male	1
Female	0.765 (0.650–0.901)
Area of residence	
Seoul	1
Other metropolitan city	0.890 (0.706–1.123)
Province	0.776 (0.635–0.949)
Insurance premium level	
Q1–Q2	1
Q3–Q4	1.040 (0.783–1.382)
Q5–Q6	1.164 (0.894–1.606)
Q7–Q8	0.894 (0.578–1.383)
Q9–Q10	0.789 (0.512–1.216)
Comorbidity	
Dyslipidemia	1.812 (1.479–2.194)
Hypertension	0.766 (0.619–0.948)
Cardiovascular disease	1.047 (0.775–1.414)
Diabetes mellitus	0.937 (0.734–1.197)
Cerebral infarction	0.989 (0.611–1.602)
Psoriatic arthritis	5.169 (2.791–9.572)

\* Adjusted for the National Health Insurance type (e.g., self-employed or employee).

CI = confidence interval, OR = odds ratio.

**Table 4****Comparison of the characteristics of psoriasis patients with employee health insurance by insurance premium level in 2015.**

Variable	Low level of insurance premium (n = 1679)	High level of insurance premium (n = 2511)	P-value
Sex--no. (%)			
Male	855 (50.9)	1,494 (59.5)	.001
Female	824 (49.1)	1017 (40.5)	
Distribution of area--no. (%)			
Seoul	311 (18.5)	508 (20.2)	.37
Other metropolitan city	383 (22.8)	628 (25.0)	
Province	985 (58.7)	1375 (54.8)	
Disease severity			
Topical treatment only	1480 (88.1)	2236 (89.0)	.37
Systemic treatment	199 (11.9)	275 (11.0)	
Comorbidity			
Dyslipidemia	510 (30.4)	849 (33.8)	.02
Hypertension	397 (23.6)	665 (26.5)	.04
Diabetes mellitus	237 (14.1)	386 (15.4)	.26
Cardiovascular diseases	114 (6.8)	225 (9.0)	.01
Cerebral infarction	33 (2.0)	67 (2.7)	.14
Psoriatic arthritis	9 (0.5)	17 (0.7)	.57
Crohn disease	3 (0.2)	3 (0.1)	.62

were more likely to receive a biologic prescription than those holding a low income occupation in Italy.<sup>[30]</sup>

A few previous studies suggested the economic status of psoriasis patients could affect their treatment patterns, although the studies did not directly evaluate the causality between income level and treatment pattern.<sup>[29,30]</sup> In this context, the present study offers the following strengths. First, this study showed that the treatment patterns for psoriasis differed by the economic status of patients. In addition, this study determined several patient characteristics, including economic status, that were associated with the odds of receiving expensive systemic treatments. Our findings will inform the development of policies for the adequate treatment of psoriasis in Korea facing increasing

economic burden from psoriasis. Extending insurance coverage to effective systemic treatments for lower out-of-pocket costs can enhance psoriasis patients' access to adequate treatments.

Despite these strengths, our results should be interpreted with caution because our study was based on a small number of psoriasis patients treated with biologics. Nonetheless, our findings would advance the understanding of general treatment patterns for psoriasis patients that differed by economic status. Future research using up-to-date data from a larger sample is needed to confirm the relationship between treatment patterns and the economic status of psoriasis patients.

Overall, psoriasis patients with higher economic status had a lower likelihood of receiving systemic treatments. However, psoriasis patients with higher economic status were more likely to be administered with expensive treatments like biologics. It may be necessary to extend insurance coverage for costly systemic treatments in the vulnerable patient population.

**Table 5****Multivariate logistic regression for having systemic treatment in psoriasis patients with employee health insurance in 2015.**

Variable	Adjusted OR (95% CI)
Sex	
Male	1
Female	0.791 (0.650–0.901)
Area of residence	
Seoul	1
Other metropolitan city	0.823 (0.706–1.123)
Province	0.814 (0.635–0.949)
Insurance premium level	
Q1–Q2	1
Q3–Q4	0.982 (0.694–1.389)
Q5–Q6	1.338 (0.913–1.961)
Q7–Q8	1.240 (0.728–2.112)
Q9–Q10	1.117 (0.659–1.893)
Comorbidity	
Dyslipidemia	2.087 (1.653–2.634)
Hypertension	0.678 (0.520–0.884)
Cardiovascular diseases	0.943 (0.651–1.366)
Diabetes mellitus	0.953 (0.708–1.282)
Cerebral infarction	0.967 (0.515–1.816)
Psoriatic arthritis	3.369 (1.466–7.743)

CI = confidence interval, OR = odds ratio.

### Author contributions

**Conceptualization:** Dongmun Ha, Inmyung Song, Ju-Young Shin.

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**Funding acquisition:** Ju-Young Shin.

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**Project administration:** Inmyung Song.

**Software:** Yoonsoo Chun.

**Supervision:** Ju-Young Shin.

**Validation:** Dongmun Ha.

**Writing – original draft:** Dongmun Ha.

**Writing – review & editing:** Inmyung Song, Ju-Young Shin.

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