Economic and Comorbidity Burden of Prurigo Nodularis and Drivers of Higher Healthcare Costs in the US: A Retrospective Analysis of Claims Data of Patients Diagnosed between 2017 and 2022

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OBJECTIVE

- Describe treatment utilization among patients with prurigo nodularis (PN)
- Compare comorbidity incidence and healthcare costs among patients with PN versus matched controls
- Characterize and identify drivers of patients with PN having high healthcare costs

INTRODUCTION

- PN is chronic neuroimmune skin disease characterized by debilitating itch and disfiguring nodules.[1] Prevalence estimates for PN in the US range from 36.7 to 148.3 per 100,000 people.[2]
- The pathophysiology of PN is poorly understood and involves complex interactions between the immune and nervous systems and tissue remodeling pathways.[1]
- Current treatment for PN involves management of symptoms, including topical corticosteroids, systemic corticosteroids, systemic immunosuppressants, and more recently biologic therapies.
- Current data examining treatment utilization , comorbidity burden, and healthcare costs in the real-world is needed.

METHODS

DATA SOURCES

- This retrospective analysis utilized US administrative claims data from the Merative MarketScan® Commercial and Medicare Database from January 1, 2016 – June 30, 2023, which includes employer and health plan-sourced medical and outpatient pharmacy claims **(Figure 1).**
- All data analyses were conducted using SAS version 9 (SAS Inc., Cary, NC) and R Statistical Software (R Core Team, 2024).
- Inclusion criteria for patient selection are listed in **Figure 2**.

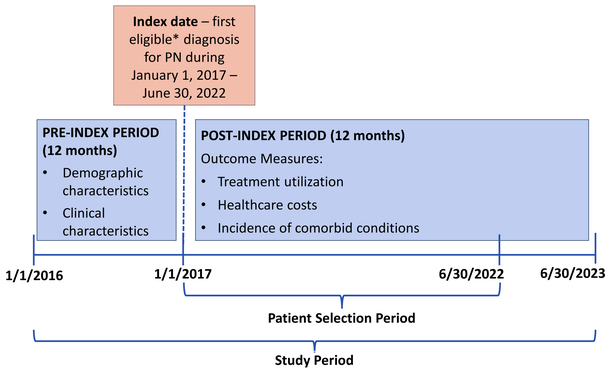
OUTCOMES

- PN treatment utilization during the post-index period (PN cohort and high-cost subcohort).
- Incidence of comorbidities in the post-index period (PN and matched control cohorts, high-cost subcohort).
- All-cause healthcare costs (overall and by service category) in the post-index period (PN and matched control cohorts, high-cost subcohort).
- Costs were calculated using paid amounts of adjudicated claims, including insurer and health plan payments, as well as patient cost-sharing in the form of copayment, deductible, and coinsurance. All costs were adjusted to 2022 dollars using the medical care component of the Consumer Price Index.
- Characteristics (demographic and clinical) of patients with high all-cause costs were described in the pre- and post-index periods.

STATISTICAL ANALYSIS

- A combination of direct [baseline demographics (age, sex, plan type, payer, region, index year)] and propensity score [Charlson Comorbidity index (CCI) components and atopic or relevant dermatologic conditions] methodology was used to match the PN cohort 1:3 to controls; if a patients did not have 3 matches, they were excluded from matched analyses. The balance between the two cohorts post matching was evaluated using standardized mean differences , with an a priori threshold of ≤10% to indicate balance.
- Drivers of high all-cause costs were identified using a multivariate logistic regression model that included demographic and pre-index comorbid conditions.

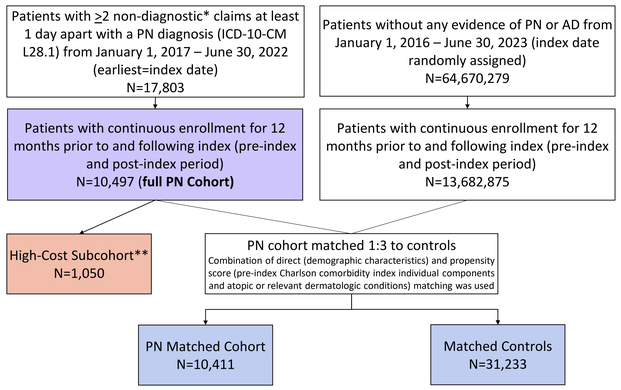
Figure 1. Study Design Overview



*Eligible diagnosis includes at least two non-diagnostic claims at least 1 day apart with an ICD-10-CM diagnosis code for PN
PN: prurigo nodularis

RESULTS

Figure 2. Patient Selection



*Non-diagnostic claims are claims that are not for lab tests, radiology, or other diagnostic procedures (i.e., claims more likely to be used to rule-out a condition)
** High-cost cohort is a subset of the full PN cohort defined as patients who have total healthcare costs above the 90th percentile
AD: atopic dermatitis; PN: prurigo nodularis; ICD-10-CM: international classification of diseases 10th clinical modification

- Mean age of PN cohort was 53.8 [SD 15.9] years, 55% were female, and the average CCI score was 1.0 [SD 1.6]. (**Table 1**)
- After matching the PN cohort and controls were well balanced on most demographic and clinical characteristics measured pre-index. (**Table 1**)
- There were 1,050 patients identified as having high all-cause healthcare costs.
- Patients with high-costs were older (mean age 57.6 [SD 13.1]) and had a higher CCI score (2.4 [SD 2.5] compared with the overall PN cohort.

Table 1. Patient Characteristics

	PN Cohort N =10,411		Matched Controls N =31,233		
	N/Mean	%/SD	N/Mean	%/SD	SMD[1]
Age (Mean, SD)	53.8	15.9	53.8	16.3	0.002
Median	56.0		56.0		
Sex (N, %)					
Male	4,639	44.6%	13,917	44.6%	0.000
Female	5,772	55.4%	17,316	55.4%	0.000
Index year (N, %)					
2017	3,394	32.6%	10,182	32.6%	0.000
2018	1,849	17.8%	5,547	17.8%	0.000
2019	1,896	18.2%	5,688	18.2%	0.000
2020	1,488	14.3%	4,464	14.3%	0.000
2021	1,462	14.0%	4,386	14.0%	0.000
2022	322	3.1%	966	3.1%	0.000
Charlson Comorbidity Index (Mean, SD)	1.0	1.6	1.1	1.7	0.073
Myocardial infarction (N, %)	167	1.6%	497	1.6%	0.001
Congestive heart failure (N, %)	387	3.7%	1,231	3.9%	0.011
Peripheral vascular disease (N, %)	413	4.0%	1,368	4.4%	0.020
Cerebrovascular disease (N, %)	345	3.3%	1,266	4.1%	0.039
Chronic pulmonary disease (N, %)	1,576	15.1%	4,562	14.6%	0.015
Dementia (N, %)	131	1.3%	407	1.3%	0.004
Diabetes (mild to moderate) (N, %)	1,879	18.1%	6,034	19.3%	0.033
Diabetes with chronic complications (N, %)	796	7.7%	2,447	7.8%	0.007
Chronic renal disease (N, %)	683	6.6%	2,127	6.8%	0.010
Hemiplegia or paraplegia (N, %)	40	0.4%	174	0.6%	0.026
Mild liver disease (various cirrhosis) (N, %)	392	3.8%	1,140	3.7%	0.006
Moderate or severe liver disease (N, %)	41	0.4%	99	0.3%	0.012
Peptic ulcer disease (N, %)	76	0.7%	290	0.9%	0.022
Rheumatologic disease (N, %)	360	3.5%	1,124	3.6%	0.008
Metastatic solid tumor (N, %)	53	0.5%	229	0.7%	0.028
Any other malignancy (N, %)	662	6.4%	2,351	7.5%	0.046
HIV (N, %)	57	0.6%	148	0.5%	0.011
Atopic and other comorbid conditions (N, %)					
Actinic keratoses	1,154	11.1%	3,628	11.6%	0.017
Acute sinusitis	1,238	11.9%	4,031	12.9%	0.031
Allergic eye disease	433	4.2%	943	3.0%	0.061
Allergic contact dermatitis	377	3.6%	765	2.5%	0.068
Allergic rhinitis	1,323	12.7%	2,924	9.4%	0.107
Asthma	959	9.2%	2,513	8.1%	0.041
Eosinophilic esophagitis	15	0.1%	55	0.2%	0.010
Food allergy	97	0.9%	203	0.7%	0.032
Neurotic excoriation	50	0.5%	6	0.0%	0.092
Seborrheic dermatitis	529	5.1%	865	2.8%	0.119
Urticaria	261	2.5%	542	1.7%	0.053
Xerosis cutis	453	4.4%	769	2.5%	0.104

[1] SMD; standardized mean difference

- Among patients with PN, 10% were treated with topical therapy only, 79% received systemic therapy, and 11% received no treatment (**Figure 3A**). There were fewer patients in the high-cost cohort with no treatment compared with the full PN cohort (3% vs. 11%; **Figure 3B**).
- The most common treatments were topical corticosteroids (55%), corticosteroid injections (44%), antidepressants (38%), oral corticosteroids (27%), and benzodiazepines (22%) (**Figure 4**).

Figure 3. PN Treatment Utilization in the 12-Months Following First Diagnosis of PN During January 1, 2017 - June 30, 2022

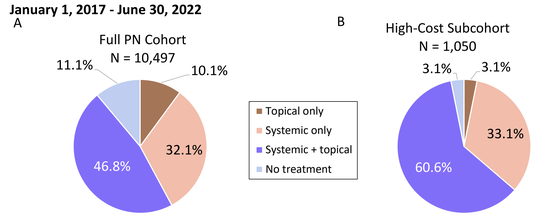
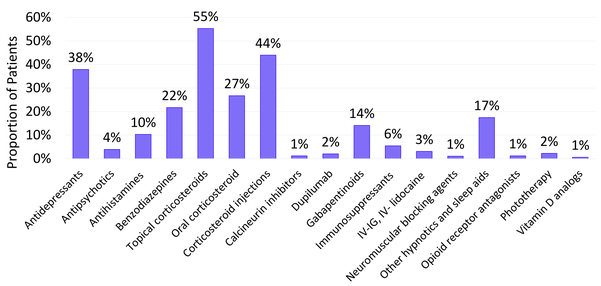


Figure 4. PN Treatment Utilization, by Class, in the 12-Months Following First Diagnosis of PN During January 1, 2017 - June 30, 2022)



Use of cannabinoids, topical ketamine, neurokinin-1 receptor antagonists, psoralens, topical capsaicin, thalidomide, and lenalidomide was also measured but the proportion of patients was <1% for each of these treatments

- In the 12-month post-index period (following the first PN diagnosis in the study period) patients with PN (versus matched controls) were significantly (p<0.001) more likely to have been newly diagnosed with an atopic or other relevant dermatologic condition, attention deficit disorder, autism, COPD, infection, autoimmune disease, metabolic or cardiovascular disease, mental health condition, or sleep disorder (**Table 2**).

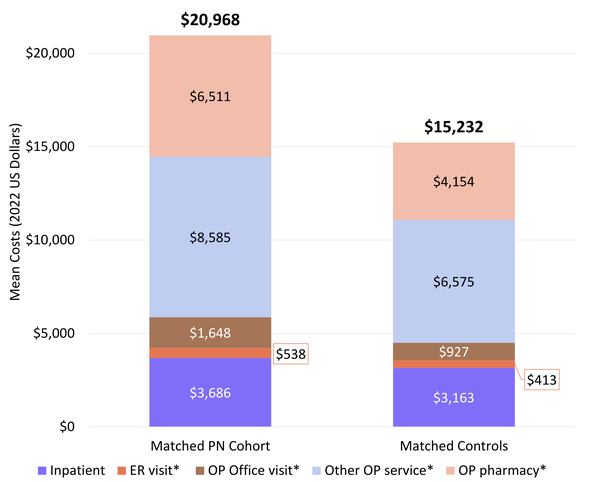
Table 2. Incidence of Comorbid Conditions among PN Cohort and Matched Controls in the 12-Months Following First Diagnosis of PN During January 1, 2017 - June 30, 2022

	Matched PN Cohort N = 10,411 N (%)	Matched Controls N = 31,233 N (%)	p-value	High-Cost Subcohort N = 1,050 N (%)
Atopic dermatitis	842 (8.7%)	0 (0.0%)	NA	95 (9.8%)
Atopic or other relevant dermatologic conditions[1]	2,328 (36.7%)	2,731 (12.9%)	<0.001	241 (44.5%)
Attention deficit disorder	97 (1.0%)	176 (0.6%)	<0.001	7 (0.7%)
Autism spectrum disorder	13 (0.1%)	19 (0.1%)	0.041	2 (0.2%)
Autoimmune disease	549 (6.0%)	633 (2.2%)	<0.001	83 (12.8%)
COPD	167 (1.7%)	383 (1.3%)	0.003	41 (4.4%)
End stage renal disease	20 (0.2%)	52 (0.2%)	0.581	14 (1.4%)
Epilepsy	27 (0.3%)	91 (0.3%)	0.597	8 (0.8%)
Infections, cutaneous	1,044 (11.2%)	729 (2.4%)	<0.001	129 (14.4%)
Infections, extra-cutaneous	2,071 (40.9%)	5,334 (28.9%)	<0.001	180 (54.1%)
Metabolic/cardiovascular disease	789 (14.8%)	1,930 (11.3%)	<0.001	83 (28.4%)
Any mental health condition	965 (13.3%)	2,297 (9.1%)	<0.001	136 (22.2%)
Anxiety	800 (9.7%)	1,851 (6.8%)	<0.001	115 (15.2%)
Bipolar	49 (0.5%)	98 (0.3%)	<0.018	12 (1.2%)
Depression	653 (7.5%)	1,173 (4.2%)	<0.001	123 (15.2%)
Eating disorder	18 (0.2%)	41 (0.1%)	<0.324	3 (0.3%)
Schizophrenia	6 (0.1%)	23 (0.1%)	0.591	1 (0.1%)
Substance abuse/dependence	179 (1.8%)	385 (1.3%)	<0.001	52 (5.3%)
Suicidal ideation/self-harm	29 (0.3%)	55 (0.2%)	0.043	7 (0.7%)
Other mood disorder	119 (1.2%)	217 (0.7)	<0.001	17 (1.7%)
Sleep disorder[2]	727 (8.8%)	1,603 (5.9%)	<0.001	109 (15.9%)
Any evidence of sleep disorder[3]	1,191 (15.9%)	1,796 (6.8%)	<0.001	138 (24.3%)

[1] Does not include AD or prurigo nodularis
[2] Sleep disorders were identified by ICD-10-CM diagnosis codes
[3] Any evidence of sleep disorder was identified using ICD-10-CM diagnosis codes or NDC codes for hydroxyzine or doxepin

- Compared with controls, patients with PN had significantly higher healthcare costs (mean $20,968 [SD $55,294] vs. $15,232 [SD $43,914]). Primary drivers of the cost difference were outpatient services and pharmacy costs (**Figure 5**).
- Patients in the high-cost cohort had total healthcare costs of $116,239 (SD $140,128) comprised of outpatient services costs (45%), inpatient services (27%), and pharmacy prescriptions (28%).
- Results from the multivariate logistic regression model (results not shown) found that patients with PN with high healthcare costs had increased odds (p<0.05) of having many chronic conditions (i.e., renal disease, malignancy, cardiovascular disease, type 2 diabetes) as well as many PN-related comorbid conditions (i.e., other autoimmune disease, infections, anxiety, depression, sleep disorders).

Figure 5. All-Cause Healthcare Costs among PN Cohort and Matched Controls in the 12-Months Following First Diagnosis of PN During the Study Period (January 1, 2017 through June 30, 2022)



*p-value is <0.001 between PN cohort and matched controls. ER, emergency room; OP, outpatient

LIMITATIONS

- Results of this analysis may not be generalizable to patients with types of health insurance other than commercial, or employer sponsored Medicare (e.g., Medicaid) or those without health insurance.
- The MarketScan Research Databases rely on administrative claims data which are subject to data coding limitations and data entry error resulting in potential misclassification of variables.
- There may be systematic differences between the PN cohort and the controls that could account for some of the differences found in healthcare costs. While some characteristics were controlled for through matching, adjustment was limited to those characteristics that could be measured using administrative claims.

CONCLUSIONS

- Treatment patterns show many patients with PN are receiving treatment for the mental health symptoms of PN, but more patients could potentially benefit from available systemic treatment options that target autoimmune or anti-inflammatory aspects of the disease.
- Patients with PN had significantly higher incidence of comorbidities compared to matched controls, warranting more effective measures to address the health burden in this patient population.
- Patients with PN had significantly higher healthcare cost than matched controls, with an overall difference of $5,736 per patient. Drivers of high healthcare costs included higher prevalence of comorbid disease in the pre-index period.

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2. Stander S, Augustin M, Berger T, et al. Prevalence of prurigo nodularis in the United States of America: A retrospective database analysis. JAAD international. 2021;2:28-30.