

Association of Physician Specialty With Psoriatic Arthritis Treatment and Costs

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Psoriatic arthritis is a chronic inflammatory musculoskeletal disease prevalent in approximately 0.06% to 0.25% of the US population¹ and in about 1 in 3 patients with psoriasis.^{2,3} The heterogeneity of disease in these patients often leads to the need for specialists to manage the disease manifestations, including polyarticular arthritis, psoriasis, enthesitis, dactylitis, and spondylitis. With estimated annual total medical plus pharmacy costs of \$28,676 per person,⁴ psoriatic arthritis needs to be closely managed by the physician. Pharmacologic treatment options have expanded in recent years and include oral agents tofacitinib and apremilast, tumor necrosis factor inhibitors, and newer biologics.⁵ Despite the complexity of the disease and the medications used to treat it, a recent study found that 58% of a cohort of patients with newly diagnosed psoriatic arthritis treated in the United States were initially treated with methotrexate. Of these, only one-third (34%) of those who initiated methotrexate monotherapy persisted on their treatment at the end of the first year.⁴ Although methotrexate has dominated as a first treatment choice in psoriatic arthritis in the past, consistent with the 2015 Group for Research and Assessment of Psoriasis and Psoriatic Arthritis (GRAPPA) guidelines,⁶ the 2018 American College of Rheumatology/National Psoriasis Foundation (ACR/NPF) guidelines for the treatment of psoriatic arthritis recommend the use of tumor necrosis factor inhibitors over other medications for patients who recently received a diagnosis.⁵

Although psoriatic arthritis is a predominantly a rheumatic disease, both joint and skin involvement are key to diagnosing it. Thus, a variety of provider specialists may be responsible for diagnosis and treatment decisions, including rheumatologists, dermatologists, primary care providers, and other specialists. Survey studies including DISCONNECT⁷ and the United States subset of the Multinational Assessment of Psoriasis and Psoriatic Arthritis (MAPP) survey³ have reported differences in attitudes and treatment choices for psoriatic arthritis across provider specialties in the United States. Among veterans with psoriatic arthritis, those treated by rheumatologists were more likely to receive a treatment (either oral small molecule or biologic) than those seen by a nonrheumatologist.⁸ Although these studies' findings suggest that provider specialty may be associated

ABSTRACT

OBJECTIVES: To describe current psoriatic arthritis treatment and costs by provider specialty using real-world claims data.

STUDY DESIGN: Observational, retrospective cohort study of patients in the IBM MarketScan Commercial and supplemental Medicare databases.

METHODS: Eligible patients had newly diagnosed psoriatic arthritis with 12 months of continuous enrollment pre- and post index date for their initial claim. Patients were assigned to 1 of 5 provider specialty cohorts. During the 1-year follow-up period, we collected psoriatic arthritis treatment agent and regimen type and total annual medical and health care costs. We used multivariate regression models to determine the conditional associations of provider specialty with costs.

RESULTS: A total of 2132 patients with incident psoriatic arthritis qualified. Most providers were rheumatologists (n = 1365; 64%). Rheumatologists commonly prescribed oral small molecules (methotrexate, 56.3% of prescriptions; sulfasalazine, 8.6%; apremilast, 7.0%) as the index therapy, whereas 23.8% of prescriptions were for tumor necrosis factor inhibitors (adalimumab, 14.2%; etanercept, 7.9%; and infliximab, 1.7%). Compared with other specialists, dermatologists prescribed biologics and other specialty drugs more frequently—adalimumab (32.7%), apremilast (14.3%), etanercept (11.6%), and ustekinumab (8.8%)—and methotrexate less frequently (30.6%). The greatest unadjusted median health care costs were observed among dermatologists (\$45,548) compared with rheumatologists (\$30,411), primary care physicians (\$29,927), rheumatologists/dermatologists (\$27,393), and other specialists (\$27,774). However, after adjusting for patient-level factors, multivariate regression analyses found that provider specialty was not associated with higher health care costs.

CONCLUSIONS: In patients with newly diagnosed psoriatic arthritis, physician specialty was associated with different medication choices but not costs.

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with different management and treatment strategies of patients with psoriatic arthritis, there is little real-world evidence describing these differences and their result on health care expenditure. If differences exist in the cost of managing psoriatic arthritis by provider type, it would be important for payers to understand this and how it may affect outcomes. This observational, retrospective study of data from a commercial claims database was designed to describe current psoriatic arthritis treatment patterns and health care costs among patients with newly diagnosed psoriatic arthritis as a function of the specialty of the treating provider.

METHODS

Study Design

This was an observational, retrospective cohort study of patients in the United States using claims data spanning January 2013 to March 2018.

Databases

The IBM MarketScan Commercial and supplemental Medicare databases provide access to medical and prescription drug claims for privately insured individuals, including individuals 65 years and older with Medicare supplemental coverage. The databases provide detailed cost, use, and outcomes data for health care services delivered in both inpatient and outpatient settings. The medical claims are linked to outpatient prescription drug claims and person-level enrollment data through the use of unique enrollee identifiers. All database records are deidentified and fully compliant with US patient confidentiality requirements, including the Health Insurance Portability and Accountability Act of 1996. Because the study collected only deidentified patient records and did not involve the collection, use, or transmittal of individually identifiable data, institutional review board approval to conduct this study was not necessary.

Patient Eligibility Criteria

Eligible study participants were 18 years or older and had at least 1 inpatient or at least 2 outpatient nondiagnostic medical claims for psoriatic arthritis treatment within 90 days of one another with a diagnosis of psoriatic arthritis between January 1, 2014, and March 31, 2017. The date of the earliest observed claim for psoriatic arthritis was the index diagnosis date; no diagnoses for psoriatic arthritis were permitted in the preindex period. Patients were excluded from this study if they had a claim from baseline through follow-up with a diagnosis of rheumatoid arthritis, ankylosing spondylitis, Crohn disease, ulcerative colitis, juvenile idiopathic arthritis, tuberculosis, hepatitis B, hepatitis C, HIV/AIDS, or any malignancy. Participants had at least 12 months of preindex continuous enrollment and at

TAKEAWAY POINTS

- ▶ Psoriatic arthritis, a heterogeneous disease, was treated in this cohort by a variety of specialists, the majority of whom were rheumatologists (64% of all provider specialties).
- ▶ Rheumatologists were more likely to prescribe methotrexate as a first treatment, whereas dermatologists were more likely to prescribe etanercept, adalimumab, apremilast, and ustekinumab than other specialists.
- ▶ Health care costs varied by provider specialty; however, after adjustment for patient-level factors, provider specialty was not significantly associated with higher health care costs.
- ▶ These findings provide real-world evidence showing that treatment choices for psoriatic arthritis vary depending on the specialty of the treating physician.

least 12 months of postindex continuous enrollment. The index treatment was an approved claim between 30 days prior to and 90 days after the index diagnosis date; patients must not have had a pharmacologic treatment for psoriatic arthritis during the first 335 days of the preindex period.

Assignment to Physician Specialty Cohort

Patients meeting eligibility criteria were assigned to 1 of 5 specialty cohorts based on the provider specialty listed on psoriatic arthritis claims appearing in the time preceding the index prescription date. The preceding 14 days were examined for oral small molecule medications and the preceding 30 days for biologic/newer medications. The following hierarchy was used in cases in which multiple physician specialties were observed: rheumatology and dermatology (ie, those who were double certified), rheumatology, dermatology, and primary care. Provider specialists who did not fit in these categories were assigned to a fifth cohort labeled “other physician specialty.” This hierarchy was based on the specialist types most relevant for patients with psoriatic arthritis. Because psoriatic arthritis is a rheumatologic disease, rheumatologists with or without dermatology certification were considered the most appropriate providers for these patients. Because psoriatic arthritis often develops in those already being treated by dermatologists for psoriasis, dermatologists were deemed the second most appropriate provider type. Some patients may be seen and treated by their primary care providers without being referred to a specialist; therefore, these providers were deemed the third most appropriate. Finally, those falling outside these categories were grouped together as other.

Study Outcomes

For pharmacologic treatments, study outcomes included the index treatment drug and regimen type (monotherapy or combination). We analyzed utilization and costs for all medical and health care services during the 12 months post medication index. Annual total medical costs included inpatient and outpatient costs (emergency department, outpatient hospital, office visits, infusion, and other outpatient services, not including outpatient pharmacy costs). Annual total health care costs included medical costs and all outpatient pharmacy costs. Health care costs were calculated based on paid amounts of adjudicated claims, including insurer

TABLE 1. Patient Attrition

	Patients, n (%)
Patients in IBM MarketScan Commercial and supplemental Medicare databases with ≥ 1 inpatient or ≥ 2 distinct outpatient claims (nondiagnostic) for psoriatic arthritis between January 1, 2014, and March 31, 2018 (date of earliest observed claim for psoriatic arthritis is the index diagnosis date)	49,616 (100.0)
Aged ≥ 18 years at index diagnosis date	49,091 (98.9)
No evidence of psoriatic arthritis diagnosis in preindex diagnosis period	25,901 (52.2)
No evidence of pharmacologic treatment for psoriatic arthritis during first 335 days of preindex diagnosis period	19,661 (39.6)
No evidence of diagnosis meeting exclusion criteria	14,097 (28.4)
≥ 12 months continuous enrollment and pharmacy benefits before index diagnosis date	5722 (11.5)
≥ 12 months continuous enrollment after index diagnosis date	4183 (8.4)
Valid index provider specialty	4135 (8.3)
A claim for psoriatic arthritis treatment within 30 days prior through 90 days after the index diagnosis	2132 (4.3)

and health plan payments and patient cost sharing in the form of co-payment, deductible, and coinsurance. All costs were adjusted for inflation using the medical care component of the Consumer Price Index and were standardized to 2018 US\$.

Variables

Demographic characteristics, including age, sex, insurance type, health plan type, and geographic region, were collected at the diagnosis index date. Clinical characteristics, including Deyo-Charlson Comorbidity Index⁹ score, the frequency of chronic comorbidities (psoriasis, diabetes [prediabetes, type 1, type 2], depression, anxiety, cardiovascular disease), the frequency of the most common medication classes (such as analgesics, anti-inflammatory agents, or psychotherapeutics), and health care utilization and costs, were collected during a 1-year pre- and postindex period. During the 1-year follow-up period, additional data were collected for psoriatic arthritis treatments and regimen type, as well as their associated costs.

Statistical Analysis

Descriptive analyses summarized demographic characteristics, baseline characteristics, and outcomes by provider specialty and summarized medication prescribed using mean and SD, median, or frequency and percentage as appropriate. We assessed the association between provider specialties and outcomes using separate multivariable linear regression models with log-transformed costs adjusting for provider specialty, provider switching, baseline age, gender, Deyo-Charlson Comorbidity Index score, insurance type, geographic region, index year, diagnosing physician specialty, baseline health care expenditures, and index medication. Sensitivity

analyses evaluated separate 2-level (patient and provider) multilevel linear regression models with log-transformed total health care or medical costs as a function of index provider specialty and confounding factors.

Role of the Funder

Amgen Inc, the funder of the study, designed this study and interpreted the data in collaboration with the non-Amgen authors. The authors at IBM analyzed the data in the IBM MarketScan Commercial and supplemental Medicare databases. The Amgen and non-Amgen authors provided joint approval to submit this manuscript for publication.

RESULTS

Patients

A total of 2132 patients qualified for the study and were included in the analysis (Table 1). Patients with psoriatic arthritis were most commonly prescribed their first treatment by a rheumatologist (n = 1365; 64%), followed by a primary care provider (n = 198; 9%) and a dermatologist (n = 147; 7%). Only 16 patients (< 1%) were treated by a double board-certified rheumatology/dermatology specialist; reporting on these data will be minimal. The remaining 406 (19%) patients were treated by other physician types and were assigned to the "other provider" category. This category consisted of 20 different specialties, with the most common specialty being internal medicine.

The demographics and baseline characteristics of patients were generally similar across provider specialties (Table 2). The mean age of patients at the index treatment date was 48.6 years, and just more than half (53.5%) were female. During the 12-month preindex period, the 3 most common comorbid clinical conditions were psoriasis (47.4%), cardiovascular disease (22.3%), and diabetes (18.0%). Overall, the most common medications during the 12-month preindex period were nonsteroidal anti-inflammatory agents (50.8%). The mean baseline total all-cause health care costs for patients treated for psoriatic arthritis were \$11,485; these costs were similar across provider specialties.

Treatment Outcomes

Nearly all patients received monotherapy (98.5%) as a first treatment for psoriatic arthritis. Index treatment by provider specialty is shown in Figure 1. Overall, for all specialties combined, most patients received oral small molecules, of which the most widely prescribed was methotrexate (53.6% of prescriptions), followed by sulfasalazine (8.2%) and apremilast (7.5%). Approximately one-fourth of patients were prescribed tumor necrosis factor inhibitors (adalimumab [15.2%], etanercept [8.5%], and infliximab [1.6%]). When comparing the prescription patterns by provider specialty, rheumatologists most commonly prescribed oral small molecules (methotrexate, 56.3%; sulfasalazine, 8.6%; apremilast, 7.0%), whereas 23.8% of prescriptions were for tumor necrosis factor inhibitors (adalimumab, 14.2%; etanercept, 7.9%; and infliximab, 1.7%).

TABLE 2. Baseline Demographics and Patient Characteristics

	All specialties (n = 2132)	Rheumatologist (n = 1365)	Dermatologist (n = 147)	Primary care (n = 198)	Rheumatologist/ dermatologist (n = 16)	Other* (n = 406)
Women, n (%)	1140 (53.5)	745 (54.6)	69 (46.9)	112 (56.6)	8 (50)	206 (50.7)
Mean (SD) age in years	48.6 (11.3)	48.4 (11.2)	47.1 (11.5)	50.9 (12.0)	50.7 (9.0)	48.7 (11.4)
Payer type, n (%)						
Commercial	2011 (94.3)	1300 (95.2)	142 (96.6)	176 (88.9)	15 (93.8)	378 (93.1)
Medicare	121 (5.7)	65 (4.8)	5 (3.4)	22 (11.1)	1 (6.3)	28 (6.9)
Geographic region, n (%)						
Northeast	450 (21.1)	313 (22.9)	21 (14.3)	25 (12.6)	4 (25.0)	87 (21.4)
North Central	421 (19.7)	211 (15.5)	32 (21.8)	39 (19.7)	3 (18.8)	136 (33.5)
South	960 (45.0)	664 (48.6)	76 (51.7)	87 (43.9)	6 (37.5)	127 (31.3)
West	294 (13.8)	171 (12.5)	17 (11.6)	47 (23.7)	3 (18.8)	56 (13.8)
Unknown	7 (0.3)	6 (0.4)	1 (0.7)	0	0	0
Population density, n (%)						
Urban	1843 (86.4)	1187 (87)	119 (81)	163 (82.3)	16 (100)	358 (88.2)
Rural	282 (13.2)	172 (12.6)	27 (18.4)	35 (17.7)	0	48 (11.8)
Unknown	7 (0.3)	6 (0.4)	1 (0.7)	0	0	0
Mean (SD) Deyo-Charlson Comorbidity Index score	0.4 (0.8)	0.4 (0.8)	0.4 (0.9)	0.5 (0.9)	0.3 (0.8)	0.3 (0.8)
Comorbidities, n (%)						
Psoriasis	1011 (47.4)	652 (47.8)	80 (54.4)	95 (48.0)	8 (50.0)	176 (43.3)
Diabetes	383 (18.0)	244 (17.9)	35 (23.8)	36 (18.2)	3 (18.8)	65 (16.0)
Prediabetes	92 (4.3)	59 (4.3)	11 (7.5)	6 (3.0)	2 (12.5)	14 (3.4)
Type 1	27 (1.3)	19 (1.4)	3 (2.0)	2 (1.0)	0	3 (0.7)
Type 2	306 (14.4)	196 (14.4)	27 (18.4)	31 (15.7)	1 (6.3)	51 (12.6)
Depression	265 (12.4)	157 (11.5)	21 (14.3)	25 (12.6)	2 (12.5)	60 (14.8)
Anxiety	288 (13.5)	194 (14.2)	19 (12.9)	23 (11.6)	2 (12.5)	50 (12.3)
Cardiovascular disease	476 (22.3)	299 (21.9)	35 (23.8)	55 (27.8)	2 (12.5)	85 (20.9)
Most common medication classes, n (%)						
Nonsteroidal anti-inflammatory agents	1084 (50.8)	723 (53.0)	52 (35.4)	94 (47.5)	5 (31.3)	210 (51.7)
Anti-inflammatory agents not elsewhere classified	1079 (50.6)	691 (50.6)	82 (55.8)	109 (55.1)	8 (50.0)	189 (46.6)
Corticosteroids and combinations	892 (41.8)	578 (42.3)	42 (28.6)	100 (50.5)	5 (31.3)	167 (41.1)
Opiate agonists	729 (34.2)	453 (33.2)	53 (36.1)	86 (43.4)	3 (18.8)	134 (33.0)
Antidepressants	688 (32.3)	437 (32.0)	50 (34.0)	71 (35.9)	4 (25.0)	126 (31.0)
Mean (SD) baseline total all-cause health care costs during 12-month preindex period	\$11,485 (\$21,467)	\$11,705 (\$22,279)	\$9854 (\$15,110)	\$14,452 (\$27,807)	\$4944 (\$4593)	\$10,144 (\$16,878)

*Includes 20 different specialties, the most common of which was internal medicine.

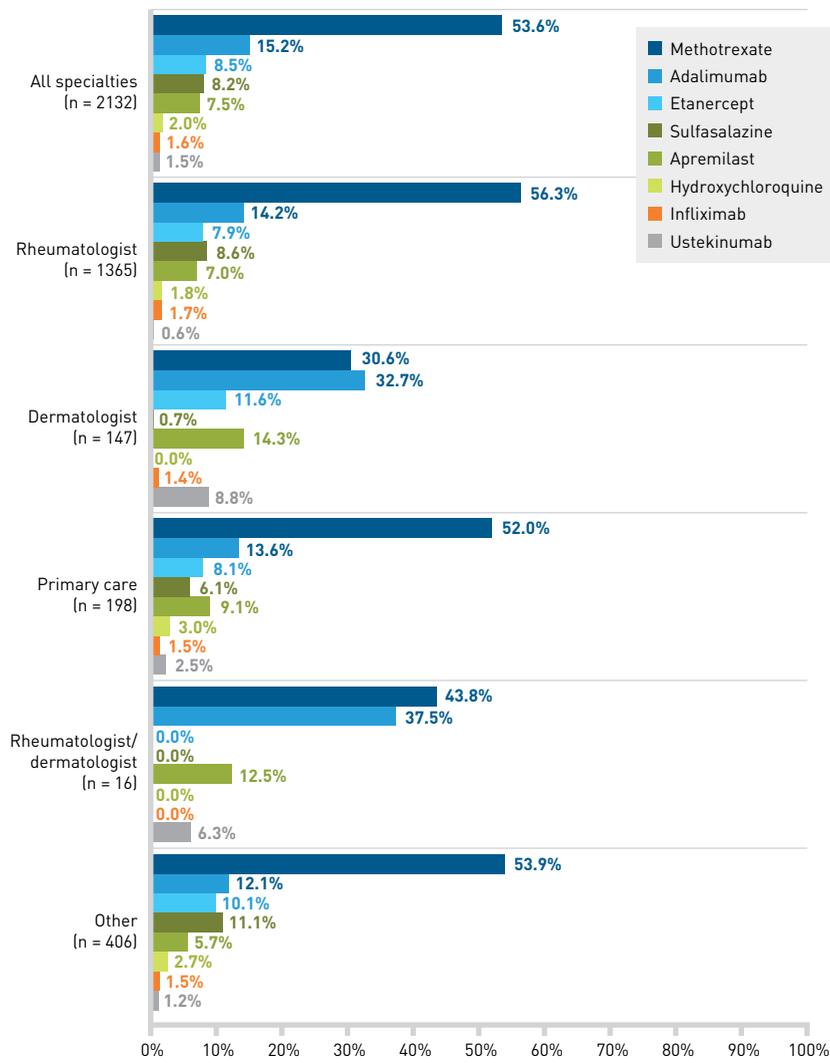
Dermatologists prescribed biologics and other specialty drugs more frequently—adalimumab (32.7%), apremilast (14.3%), etanercept (11.6%), and ustekinumab (8.8%)—and methotrexate less frequently (30.6%) than the other specialists.

Index medication persistence rates were similar among patients treated by dermatologists (37.4%), rheumatologists (38.2%), and primary care providers (37.9%), but the rate of medication switching was lower among patients treated by dermatologists (28.6%) compared with those treated by rheumatologists and primary care providers (40.9% and 39.4%, respectively).

Cost Outcomes

Provider specialties had a wide variation in unadjusted annual total medical and health care costs for patients treated for psoriatic arthritis, as indicated by the medians and interquartile ranges (**Figure 2**). The highest median health care cost was observed among dermatologists (\$45,548) compared with rheumatologists (\$30,411), primary care physicians (\$29,927), and other specialists (\$27,774). Mean (SD) health care costs were \$46,616 (\$30,438) for dermatologists, \$34,505 (\$32,027) for rheumatologists, \$34,028 (\$30,365) for primary care physicians, and \$32,562 (\$30,225) for

FIGURE 1. Percentage of Prescriptions by Provider Specialty



other specialists. Total median medical costs for patients treated for psoriatic arthritis were more similar and had less variation within each provider specialty (Figure 2). Mean (SD) medical costs were \$11,513 (\$22,693) for rheumatologists, \$9102 (\$15,042) for dermatologists, \$10,677 (\$21,979) for primary care physicians, and \$11,639 (\$21,398) for other specialists.

Multivariate Regression Analyses

Results of multivariate analyses examining the associations between physician specialty and both medical and health care costs after adjusting for demographic and baseline characteristics and index medications are presented in Table 3. Provider specialty was not associated with differences in either medical or health care costs. For medical costs during the postindex period, several factors were statistically significant with increasing costs. These factors include

older age, female sex, baseline health care costs, diabetes, depression, cardiovascular disease, geographical regions, and index provider switch. Provider specialty compared with a rheumatologist and the choice of medication (etanercept, adalimumab, and apremilast) compared with methotrexate were not associated with increased medical costs.

For total health care costs during the postindex period, the treatment choices of etanercept, adalimumab, and apremilast compared with methotrexate were all associated with higher costs (all $P \leq .001$). Other significant covariates included rural designation (compared with urban), some comorbid conditions (depression, psoriasis, diabetes), and baseline health care costs. Importantly, provider specialty was not associated with higher health care costs at follow-up after adjusting for observable patient characteristics. However, switching index provider was associated with higher health care costs.

Sensitivity Analyses

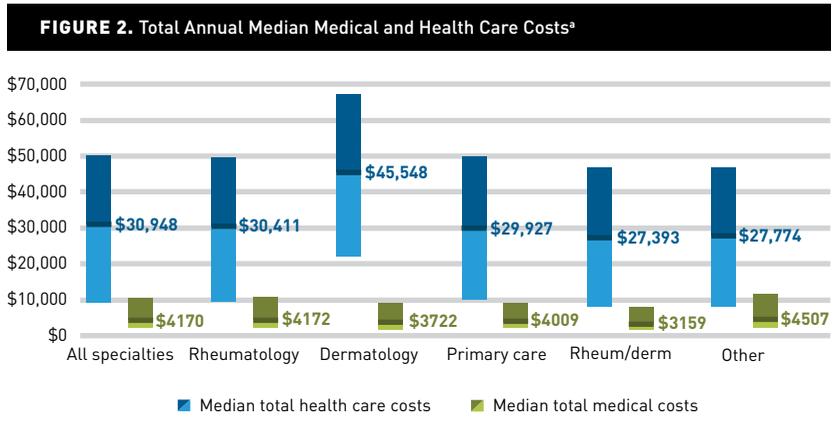
To evaluate the robustness of our multivariate results, we tested several assumptions about the data. Clusters of patients may have been treated by the same health care provider (eg, one rheumatologist treating a cluster of patients with psoriatic arthritis), and this could have affected the results. To evaluate this, we generated a multilevel model clustering on provider specialties and accounting for intraclass correlation among patients nested within providers (eAppendix Table 1A [eAppendix available at ajmc.com]). Most providers (85% of 524 providers) saw only 1 patient in the sample, and the intraclass correlation was near zero for all linear multilevel models, suggesting that among the approximately 15% of providers who saw multiple patients, patient outcomes were not highly correlated with each other. Additionally, analyses using a combination of zip code and provider specialty as a proxy for provider identifier (ID) (eAppendix Table 1B) produced nearly identical results to the models that ignore intraprovider correlation entirely (ie, main regression models). Further, it appears that studying only those patients with explicit IDs (ie, provider IDs) may induce biased results on some outcomes (eAppendix Table 2). For instance, in the analysis of total medical costs, the results from the entire study population produced different results from analogous models of the subset with valid provider IDs, suggesting that provider ID may not be missing at random. Specifically, some coefficients differ in magnitude and/or direction, and some significant trends in the

subset models are no longer significant when evaluating the entire study population. In other models, however, including total health care costs, all variations of the multilevel models are relatively consistent as it concerns the primary exposure variable (provider specialty). Given these 2 characteristics of the sample, low intraclass correlation and the bias introduced by including only those patients with explicit IDs, we concluded that the results from the main model specifications are robust regardless of clustering or patient ID assumptions.

DISCUSSION

In this retrospective cohort study of patients with newly diagnosed psoriatic arthritis within a commercial claims database in the United States, providers prescribed methotrexate most often as the first medication for the treatment of psoriatic arthritis. Methotrexate represented just more than half of all prescriptions overall (53.6%), whereas tumor necrosis factor inhibitors represented approximately one-fourth (25.3%) of first treatments prescribed for psoriatic arthritis. Dermatologists most often prescribed adalimumab, followed by methotrexate, then etanercept. Compared with other specialists, dermatologists were more likely to prescribe adalimumab, etanercept, apremilast, and ustekinumab. Dermatologists, who represented just 7% of the provider specialists, made treatment decisions more in line with the 2018 ACR/NPF guidelines.⁵ This finding regarding patients who obtained their first treatment for psoriatic arthritis from a dermatologist may reflect that these patients had severe skin disease or other unobservable characteristics not captured in claims data.

The data in this analysis provide insights into clinical practice patterns across physician specialties, showing prescribing patterns consistent with the 2015 GRAPPA guidelines for most specialists, except for dermatologists. These 2015 guidelines recommend oral small molecules and tumor necrosis factor inhibitors as first-line treatments, with the suggestion that methotrexate could be tried first.⁶ In contrast, the more recent 2018 ACR/NPF guidelines⁵ for the treatment of psoriatic arthritis conditionally recommend the use of tumor necrosis factor inhibitors over oral small molecules as a first



Rheum/derm, double board-certified rheumatologist/dermatologist.

*Annual total medical costs included inpatient and outpatient costs (emergency department, outpatient hospital, office visits, infusions, and other outpatient services, not including outpatient pharmacy costs). Annual total health care costs included medical costs and all outpatient pharmacy costs. Edges of boxplots represent the interquartile ranges, and lines represent the medians.

TABLE 3. Multivariate Regression Analyses: Medical Costs and Health Care Costs*

Factor	Total study population (n = 2004)				
	Medical costs		Health care costs		
	Ratio of geometric means (95% CI)	P	Ratio of geometric means (95% CI)	P	
Intercept	2695 (2084-3485)	<.001	12,730 (11,368-14,254)	<.001	
Index provider: dermatologist vs rheumatologist	0.83 (0.68-1.01)	.0557	1.16 (0.97-1.38)	.1657	
Index provider: other vs rheumatologist	0.99 (0.87-1.12)	.7872	0.99 (0.88-1.11)	.6324	
Index provider: primary care physician vs rheumatologist	0.85 (0.71-1.01)	.0778	0.97 (0.83-1.14)	.9991	
Index provider switch	1.28 (1.05-1.57)	.0411	2.19 (1.82-2.62)	<.001	
Age	1.01 (1.00-1.01)	.0003	1.00 (0.95-1.05)	.6384	
Sex: male vs female	0.79 (0.71-0.87)	<.001	0.97 (0.89-1.06)	.5215	
Region: Northeast vs South	1.25 (1.10-1.42)	<.001	1.00 (0.89-1.12)	.9732	
Region: North Central vs South	1.17 (1.02-1.34)	.0213	0.91 (0.81-1.03)	.2195	
Region: West vs South	1.19 (1.02-1.39)	.0210	0.89 (0.77-1.02)	.1730	
Rural vs urban	0.89 (0.77-1.03)	.1163	0.86 (0.76-0.98)	.0344	
Baseline health care costs	1.30 (1.24-1.37)	<.001	1.18 (1.12-1.24)	<.001	
Psoriasis	1.06 (0.96-1.17)	.2081	1.08 (0.99-1.18)	.0424	
Diabetes	1.25 (1.09-1.42)	.0011	1.31 (1.17-1.48)	<.001	
Depression	1.24 (1.06-1.44)	.0064	1.22 (1.06-1.40)	.0040	
Anxiety	1.10 (0.95-1.28)	.1841	1.03 (0.90-1.18)	.4976	
Cardiovascular disease	1.18 (1.04-1.34)	.0090	1.09 (0.97-1.22)	.1351	
Index medication: etanercept vs methotrexate	0.95 (0.79-1.14)	.4900	3.43 (2.92-4.03)	<.001	
Index medication: adalimumab vs methotrexate	1.15 (0.99-1.33)	.0710	3.61 (3.17-4.12)	<.001	
Index medication: apremilast vs methotrexate	0.93 (0.77-1.13)	.3776	2.26 (1.90-2.68)	<.001	
Index medication: other vs methotrexate	1.44 (1.25-1.65)	<.001	1.27 (1.12-1.44)	.0021	

treatment for psoriatic arthritis. As these guidelines were published after the time frame for our study, physician prescribing behavior may be expected to change. Future research will be required to determine the adherence of providers to these new recommendations. Although the DISCONNECT⁷ and United States MAPP survey³ studies had suggested differences in treatment choices for psoriatic arthritis based on physician specialty, the current study has extended these findings by identifying provider specialty differences through real-world claims data and calculating their association with costs.

We observed substantial variation in pharmacologic treatment and total health care costs within and across physician specialties, with dermatologists prescribing a higher frequency of newer medications relative to methotrexate. Although the unadjusted cost outcomes show higher spending by patients treated by dermatologists, our multivariate analysis shows that this higher spending is explained by differences in patient characteristics, not by the type of provider. Although the current study found no evidence of a statistically significant relationship between provider specialty and costs, we believe that there may be unobserved variable bias in the specific patients treated by different specialties. That is, there may be unobserved patient or health system characteristics that cause some providers to see a specific kind of patient. This idea may be supported by our finding that provider switching, regardless of other baseline characteristics, was associated with higher costs and may reflect the switch to a specialist. Future real-world studies are needed to better understand how first therapy affects both patient outcomes and health care costs.

Limitations

This study was limited to individuals with commercial health coverage or private Medicare supplemental coverage in the United States; results may not be generalizable to patients with psoriatic arthritis with other types of insurance or without health insurance coverage. Misclassification of psoriatic arthritis is possible because patients were identified through administrative claims data instead of medical records; these data are subject to data coding limitations and data entry error. However, we tried to minimize this risk by employing methodology recommended by Lee et al¹⁰ and used 2 codes for psoriatic arthritis and a therapy. This strategy leads to a higher positive predictive value for a true diagnosis of psoriatic arthritis. Although not flawless, our patient classification algorithm minimized the likelihood of misclassification of patients in our sample. The rheumatologist/dermatologist group had a low sample size; therefore, observations for this group are likely not generalizable. There may be unobserved variable selection bias by provider specialty, as patient characteristics and disease features may differ across provider specialties. For example, patients with less severe disease may be more likely to be treated by a primary care provider, whereas those with more severe disease may be referred to a specialist or may seek out a specialist themselves. As claims data do not capture disease severity, we could not address its influence on our results.

Because psoriatic arthritis can be a progressive disease, treatment selection may have important implications for patient outcomes. Further research is necessary to determine the basis for these differences in treatment choice and costs and to evaluate the implications for outcomes in patients over the long term. Future analyses may examine the relationships between patients and physician specialty and their association with disease activity outcomes of interest.

CONCLUSIONS

In this retrospective cohort study of patients prescribed treatment for newly diagnosed psoriatic arthritis, we found that various physician specialties prescribed different initial treatments for their patients. In our study, psoriatic arthritis was treated by a variety of specialists, most of whom were rheumatologists.

Dermatologists were more likely than other specialists to initially prescribe adalimumab, etanercept, apremilast, and ustekinumab in the era before (2014 to 2018), but consistent with, the 2018 ACR/NPF guidelines. Other provider types, including the predominant physician specialist type in the study, rheumatologists, were more likely to prescribe methotrexate as the initial treatment for psoriatic arthritis. We found variation in prescription patterns and costs within each specialty, as well as variation in health care costs between specialties. Payers concerned about differential health care costs across specialist types, particularly for rheumatologists and dermatologists, may want to consider that different patients may require different treatments depending on their specific disease manifestations. ■

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REFERENCES

- Ogdie A, Weiss P. The epidemiology of psoriatic arthritis. *Rheum Dis Clin North Am*. 2015;41(4):545-568. doi:10.1016/j.rdc.2015.07.001
- Jönsson B, Ström O, Eisman JA, et al. Cost-effectiveness of denosumab for the treatment of postmenopausal osteoporosis. *Osteoporos Int*. 2011;22(3):967-982. doi:10.1007/s00198-010-1424-x

3. Lebwohl MG, Kavanaugh A, Armstrong AW, Van Voorhees AS. US perspectives in the management of psoriasis and psoriatic arthritis: patient and physician results from the population-based Multinational Assessment of Psoriasis and Psoriatic Arthritis (MAPP) survey. *Am J Clin Dermatol*. 2016;17(1):87-97. doi:10.1007/s40257-015-0169-x
4. Maksabedian EJ, Tkacz J, Lopez-Gonzalez L, Higgins K, Ogdie A, Stolshek B. Psoriatic arthritis treatment patterns and costs among pharmacologic treatment-naïve patients. *Am J Manag Care*. 2020;26(8):e252-e257. doi:10.37765/ajmc.2020.44075
5. Singh JA, Guyatt G, Ogdie A, et al. Special article: 2018 American College of Rheumatology/National Psoriasis Foundation guideline for the treatment of psoriatic arthritis. *Arthritis Care Res (Hoboken)*. 2019;71(1):2-29. doi:10.1002/acr.23789
6. Coates LC, Kavanaugh A, Mease PJ, et al. Group for Research and Assessment of Psoriasis and Psoriatic Arthritis 2015 treatment recommendations for psoriatic arthritis. *Arthritis Rheumatol*. 2016;68(5):1060-1071. doi:10.1002/art.39573
7. Husni ME, Fernandez A, Hauber B, et al. Comparison of US patient, rheumatologist, and dermatologist perceptions of psoriatic disease symptoms: results from the DISCONNECT study. *Arthritis Res Ther*. 2018;20(1):102. doi:10.1186/s13075-018-1601-4
8. Walsh JA, Pei S, Penmetza GK, et al. Treatment patterns with disease-modifying antirheumatic drugs in U.S. veterans with newly diagnosed rheumatoid arthritis, psoriatic arthritis, or ankylosing spondylitis. *J Manag Care Spec Pharm*. 2019;25(11):1218-1228. doi:10.18553/jmcp.2019.25.11.1218
9. Deyo RA, Cherkin DC, Ciol MA. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *J Clin Epidemiol*. 1992;45(6):613-619. doi:10.1016/0895-4356(92)90133-8
10. Lee H, Ford JA, Jin Y, et al. Validation of claims-based algorithms for psoriatic arthritis. *Pharmacoepidemiol Drug Saf*. 2020;29(4):404-408. doi:10.1002/pds.4950

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eAppendix

eAppendix Table 1A. Multilevel Model Multivariate Regression Analyses for Medical and Health Care Costs Clustered on Provider ID

Factor	Clustered on Provider ID (n = 655)			
	Medical Costs		Health Care Costs	
	Ratio of Geometric Means (95% CI)	P-value	Ratio of Geometric Means (95% CI)	P-value
Intercept	4835 (3917, 5968)	≤ 0.001	13568 (11222, 16403)	≤ 0.001
Index Provider: Dermatologist vs. Rheumatologist	1.03 (0.75, 1.43)		1.22 (0.91, 1.64)	
Index Provider: Other vs. Rheumatologist	1.01 (0.79, 1.29)		0.90 (0.72, 1.13)	
Index Provider: Primary Care Physician vs. Rheumatologist	0.84 (0.60, 1.19)		1.13 (0.83, 1.55)	
Age	1.08 (0.98, 1.19)		0.98 (0.90, 1.07)	
Sex: Male vs. Female	0.71 (0.59, 0.85)	≤ 0.001	1.05 (0.90, 1.24)	
Region: Northeast vs. South	1.21 (0.94, 1.56)		1.00 (0.80, 1.26)	
Region: North Central vs. South	1.17 (0.91, 1.50)		0.88 (0.70, 1.11)	
Region: West vs. South	1.23 (0.96, 1.58)		0.90 (0.72, 1.12)	
Rural vs. Urban	0.65 (0.49, 0.86)	≤ 0.01	0.79 (0.61, 1.01)	
Baseline health care costs	1.24 (1.14, 1.35)	≤ 0.001	1.16 (1.07, 1.25)	≤ 0.001
Psoriasis	1.04 (0.87, 1.25)		1.13 (0.96, 1.33)	
Diabetes	1.02 (0.81, 1.29)		1.16 (0.94, 1.43)	
Depression	1.14 (0.85, 1.53)		1.09 (0.84, 1.42)	
Anxiety	1.20 (0.89, 1.60)		1.37 (1.06, 1.78)	≤ 0.05
Cardiovascular Disease	1.20 (0.95, 1.51)		0.95 (0.77, 1.17)	
Index Medication: Etanercept vs. Methotrexate	1.01 (0.72, 1.41)		3.36 (2.48, 4.54)	≤ 0.001
Index Medication: Adalimumab vs. Methotrexate	1.20 (0.94, 1.53)		3.83 (3.08, 4.76)	≤ 0.001
Index Medication: Apremilast vs. Methotrexate	0.79 (0.55, 1.12)		1.94 (1.42, 2.66)	≤ 0.001
Index Medication: Other vs. Methotrexate	1.29 (1.00, 1.67)	≤ 0.05	1.36 (1.09, 1.71)	≤ 0.01

CI, confidence interval; Non significant P-values (>0.05) are not listed.

eAppendix Table 1B. Multilevel Model Multivariate Regression Analyses for Medical and Health Care Costs Clustered on Zip Code and Provider ID

Factor	Clustered on Zip Code and Provider Specialty (n = 2001)			
	Medical Costs		Health Care Costs	
	Ratio of Geometric Means (95% CI)	P-value	Ratio of Geometric Means (95% CI)	P-value
Intercept	4246 (3744, 4816)	≤ 0.001	13271 (11822, 14897)	≤ 0.001
Index Provider: Dermatologist vs. Rheumatologist	0.83 (0.68, 1.00)		1.13 (0.95, 1.36)	
Index Provider: Other vs. Rheumatologist	0.98 (0.86, 1.12)		0.97 (0.86, 1.09)	
Index Provider: Primary Care Physician vs. Rheumatologist	0.85 (0.72, 1.02)		1.00 (0.86, 1.18)	
Age	1.11 (1.05, 1.17)	≤ 0.001	0.99 (0.94, 1.04)	
Sex: Male vs. Female	0.79 (0.71, 0.87)	≤ 0.001	0.97 (0.89, 1.06)	
Region: Northeast vs. South	1.25 (1.10, 1.42)	≤ 0.001	1.01 (0.89, 1.13)	
Region: North Central vs. South	1.17 (1.02, 1.34)	≤ 0.05	0.93 (0.82, 1.05)	
Region: West vs. South	1.19 (1.02, 1.39)	≤ 0.05	0.90 (0.78, 1.04)	
Rural vs. Urban	0.89 (0.77, 1.03)		0.87 (0.76, 0.99)	≤ 0.05
Baseline health care costs	1.30 (1.24, 1.38)	≤ 0.001	1.18 (1.13, 1.24)	≤ 0.001
Psoriasis	1.06 (0.96, 1.18)		1.09 (1.00, 1.20)	
Diabetes	1.25 (1.09, 1.42)	≤ 0.01	1.31 (1.16, 1.49)	≤ 0.001
Depression	1.24 (1.06, 1.45)	≤ 0.01	1.24 (1.07, 1.43)	≤ 0.01
Anxiety	1.10 (0.95, 1.28)		1.05 (0.91, 1.20)	
Cardiovascular Disease	1.19 (1.04, 1.35)	≤ 0.01	1.09 (0.97, 1.23)	
Index Medication: Etanercept vs. Methotrexate	0.94 (0.79, 1.13)		3.31 (2.81, 3.91)	≤ 0.001
Index Medication: Adalimumab vs. Methotrexate	1.15 (0.99, 1.33)		3.56 (3.12, 4.07)	≤ 0.001
Index Medication: Apremilast vs. Methotrexate	0.92 (0.76, 1.11)		2.16 (1.81, 2.57)	≤ 0.001
Index Medication: Other vs. Methotrexate	1.43 (1.24, 1.64)	≤ 0.001	1.23 (1.08, 1.40)	≤ 0.01

CI, confidence interval; Non significant P-values (>0.05) are not listed.

eAppendix Table 2. Multivariate Regression Analyses for Medical and Health Care Costs for the Subset of Patients with a Valid Provider ID

Factor	Valid Provider ID (n = 655)			
	Medical Costs		Health Care costs	
	Ratio of Geometric Means (95% CI)	P-value	Ratio of Geometric Means (95% CI)	P-value
Intercept	3430 (2174, 5413)	≤ 0.001	13593 (11269, 16396)	≤ 0.001
Index Provider: Dermatologist vs. Rheumatologist	1.03 (0.75, 1.43)		1.22 (0.91, 1.63)	
Index Provider: Other vs. Rheumatologist	0.84 (0.60, 1.19)		0.90 (0.72, 1.12)	
Index Provider: Primary Care Physician vs. Rheumatologist	1.01 (0.79, 1.29)		1.12 (0.82, 1.53)	
Age	1.01 (1.00, 1.02)		0.99 (0.91, 1.07)	
Sex: Male vs. Female	0.71 (0.59, 0.85)	≤ 0.001	1.05 (0.89, 1.23)	
Region: Northeast vs. South	1.21 (0.94, 1.56)		1.00 (0.80, 1.25)	
Region: North Central vs. South	1.17 (0.91, 1.50)		0.88 (0.71, 1.10)	
Region: West vs. South	1.23 (0.97, 1.57)		0.90 (0.72, 1.12)	
Rural vs. Urban	0.65 (0.49, 0.86)	≤ 0.01	0.79 (0.62, 1.01)	
Baseline health care costs	1.24 (1.14, 1.35)	≤ 0.001	1.16 (1.08, 1.25)	≤ 0.001
Psoriasis	1.04 (0.87, 1.25)		1.14 (0.97, 1.34)	
Diabetes	1.02 (0.81, 1.29)		1.16 (0.94, 1.42)	
Depression	1.14 (0.85, 1.52)		1.09 (0.84, 1.41)	
Anxiety	1.20 (0.90, 1.60)		1.35 (1.05, 1.75)	≤ 0.05
Cardiovascular Disease	1.20 (0.95, 1.51)		0.95 (0.77, 1.16)	
Index Medication: Etanercept vs. Methotrexate	1.01 (0.72, 1.41)		3.40 (2.53, 4.58)	≤ 0.001
Index Medication: Adalimumab vs. Methotrexate	1.20 (0.95, 1.53)		3.86 (3.11, 4.78)	≤ 0.001
Index Medication: Apremilast vs. Methotrexate	0.79 (0.56, 1.11)		1.96 (1.44, 2.67)	≤ 0.001
Index Medication: Other vs. Methotrexate	1.29 (1.01, 1.66)	≤ 0.05	1.37 (1.09, 1.71)	≤ 0.01

CI, confidence interval; Non significant P-values (>0.05) are not listed.