Real-world biologic and apremilast treatment patterns in patients with psoriasis and psoriatic arthritis

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Abstract

Purpose: Real-world treatment patterns among psoriasis patients with and without psoriatic arthritis (PsA) newly initiating treatment with a biologic or apremilast were assessed.

Methods: MarketScan claims data from adults with psoriasis and ≥1 new prescription for secukinumab, adalimumab, ustekinumab, etanercept, or apremilast from January 1, 2015, to August 31, 2018, were assessed for adherence, switching, and combination therapy by index medication and PsA diagnosis.

Results: At treatment initiation, 22.0%–45.7% of patients had PsA. Over 24 months, discontinuation rates were high (34.4%–54.6%) overall and higher in patients with versus without PsA (all P<0.05 except secukinumab). Adherence was poor (16.8%–34.8%); switching and combination therapy were common.

Conclusion: Treatment patterns varied, with better outcomes in PsA patients receiving anti-tumor necrosis factor versus anti-IL17/IL12/23 agents.

Keywords: claims data, combination therapy, persistence, psoriasis, psoriatic arthritis, switching, treatment adherence

Introduction

Psoriasis is a chronic inflammatory skin disease with an autoimmune pathogenesis and a worldwide prevalence of approximately 2% [1]. The primary manifestations of psoriasis are dermatological, with the most prevalent type—plaque psoriasis, seen in 90% of patients—involving sharply demarcated, erythematous, pruritic plaques covered in silver scales [2]. Owing to the immune dysregulation and inflammation, psoriasis is associated with a range of comorbidities [3,4]. One of the most common comorbidities is psoriatic arthritis (PsA), which develops in up to 40% of patients with plaque psoriasis [5-7]. Psoriatic arthritis is an inflammatory musculoskeletal disease that presents with pain and swelling of the joints, which can progress to joint damage and long-term disability [8,9]. As a result of the combined skin and joint involvement, psoriasis patients with PsA experience increased morbidity and comorbidity, lower quality of life, higher healthcare costs, and increased mortality rates compared with patients with psoriasis alone [3,10-12].

Patients with more severe psoriasis and/or PsA require systemic therapy. The treatment choice for these patients will depend on the clinical domains involved (e.g., peripheral arthritis, axial disease, enthesitis, dactylitis, skin disease, nail disease), disease severity, and comorbidities present [2,13-15]. Patients have traditionally received conventional systemic immunomodulators, such as methotrexate, acitretin, and cyclosporine. However, over the past decade, the treatment landscape has been revolutionized by the advent of biologic therapies (e.g., anti-tumor necrosis factor [TNF] agents and

antibodies that target interleukin [IL]-12/23, IL17, IL17R, or IL23) and novel small molecule therapies such as the phosphodiesterase-4 inhibitor apremilast [4,16]. Compared with conventional treatments, these newer agents have improved clinical outcomes, productivity, and quality of life among patients with psoriasis and PsA [17].

Despite their improved efficacy, with each of these therapies, some patients will not respond well or will lose their initial response over time [2,4]. These therapies can also be limited by the risk of developing adverse events, as well as by patient dissatisfaction with inconvenient administration methods or the need for frequent dosing [4,18]. Consequently, patients with moderate-to-severe psoriasis and PsA often cycle through many treatment options over the course of their lives, with high rates of discontinuation, dose escalation, switching to alternative therapies, and augmentation with additional therapies [4,18-20].

Both psoriasis and PsA are chronic incurable conditions and most patients will require long-term treatment. However, long-term real-world treatment patterns with the newer systemic therapies are not well characterized in either psoriasis or PsA. The majority of studies to date have only considered the first 12 months after treatment initiation [18-21]. For these reasons, we recently completed analyses of real-world biologics and apremilast treatment patterns in patients with moderate-to-severe psoriasis overall, as well as in subgroups of patients with and without comorbid metabolic syndrome, over a 24-month study period [22,23]. In both studies, rates of discontinuation, switching, and re-initiation of the index medication were high and increased over the duration of the investigation, indicating that maintaining disease control on long-term therapy is challenging for many patients with psoriasis, especially those with metabolic syndrome [22,23]. However, differences in outcomes in patients with moderate-to-severe psoriasis with versus without comorbid PsA remain unexplored. In addition, therapeutic options are expanding rapidly, with no clinical guideline established for selecting the optimal treatment for a particular patient [18,21]. Therefore, determining long-term usage patterns in real-world patients with psoriasis with or without comorbid PsA is crucial for understanding how patients actually access and use these treatments.

The current study aimed to examine the 24-month treatment patterns—including treatment adherence, non-persistence, discontinuation, switching, and use of combination therapy—among U.S. patients with psoriasis newly initiating secukinumab, adalimumab, ustekinumab, etanercept, or apremilast, stratified by diagnosis of comorbid PsA (yes or no).

Methods

Data source

This retrospective cohort study used administrative healthcare claims data from the IBM MarketScan Commercial and Medicare Supplemental databases, two large, geographically distributed U.S. data sources. The data consist of complete longitudinal records of inpatient services, outpatient services, and prescription drug claims for commercially insured and Medicare-eligible patients covered under a variety of health plans. Claims include International Classification of Diseases, Ninth/Tenth Revision, Clinical Modification (ICD-9/10-CM) diagnosis codes, dates of service, places of service, and all adjudicated payment information. All database records are de-identified and fully compliant with U.S. patient confidentiality requirements set forth in the Health Insurance Portability and Accountability Act regarding the determination and documentation of statistically de-identified data; therefore, Institutional Review Board approval was not necessary for this study.

Sample selection

Patients aged ≥18 years with at least one non-diagnostic claim coded for psoriasis since 2011 (ICD-9-CM code 696.1; ICD-10-CM code L40.0–L40.4) and at least one prescription claim coded for secukinumab, adalimumab, ustekinumab, etanercept, or apremilast between January 1, 2015, and August 31, 2018, were eligible for inclusion. The index date was defined as the date of the first prescription for a study drug (the index treatment). To ensure that we only included new users of the

index treatment, patients were required to have continuous enrollment with medical and pharmacy benefits for the 12-month pre-index period and no claim for the index treatment during this period. Eligible patients also had to have continuous enrollment over the 24-month post-index period. Patients with a diagnosis of human immunodeficiency virus infection (ICD-9-CM codes 042, 079.53, and V08; ICD-10-CM codes B20, B97.35, and Z21) or cancer (ICD-9-CM codes 140.x-238.x; ICD-10-CM codes C00.x-D47.x) at any time during the 12-month pre-index period were excluded.

Included patients were divided into five mutually exclusive treatment cohorts, one for each index drug. Within each treatment cohort, patients were stratified into two subgroups: those with a diagnosis of PsA (ICD-9-CM code 696.0; ICD-10-CM code L40.5x) during the 12-month pre-index period and those without PsA.

Patient characteristics and outcomes

Patient characteristics related to demographics—including age and sex—were assessed on the index date. Clinical characteristics including comorbid conditions (e.g., anxiety, coronary heart disease, depression, diabetes, hyperlipidemia, hypertension, obesity, and rheumatoid arthritis) and medications (e.g., antidepressants, cardiovascular drugs, methotrexate, other biologics, systemic corticosteroids, and topical corticosteroids) were assessed during the 12-month pre-index period.

Study outcomes included adherence, non-persistence, discontinuation, switching, and use of combination therapy. All outcomes were assessed from index to 12-, 18-, and 24-month follow-up and were compared between patients with and without PsA. Treatment adherence was measured in terms of the proportion of days covered (PDC); patients were considered to be treatment adherent when PDC was ≥0.8 [24]. All other treatment pattern outcomes were assessed relative to treatment gaps, defined as the number of days between exhaustion of the previous days' supply and the next claim for the index medication. Treatment gaps of four weeks for etanercept and apremilast, 8 weeks for adalimumab, 10 weeks for secukinumab, and 18 weeks for ustekinumab were considered permissible based on the literature [18] and expert opinion. Non-persistence was defined as a treatment gap longer than the permissible gap for the index medication. Discontinuation was defined as a treatment gap longer than the permissible gap with no subsequent claim for the index medication during follow-up.

For patients with a biologic or apremilast as the index medication, switching was defined as a subsequent claim at any time for a different study biologic or a subsequent claim following a treatment gap for an oral systemic therapy or apremilast (when the index medication was a biologic). Use of combination therapy was defined for patients on a biologic treatment as a subsequent claim for apremilast or another oral systemic therapy during biologic treatment and for patients on apremilast as a subsequent claim for another oral systemic therapy during apremilast treatment. Other systemic oral therapies included 6-mercaptopurine, acitretin, azathioprine, cyclosporine, dexamethasone, hydroxyurea, isotretinoin capsules, leflunomide, methylprednisolone, methoxsalen, methotrexate, mycophenolate mofetil, prednisone, sulfasalazine, tacrolimus, and thioguanine.

Statistical analyses

All patient characteristics and outcomes were examined descriptively using means and standard deviations for continuous variables and frequencies and percentages for categorical variables. Statistical differences were explored between the PsA and no PsA subgroups within each index treatment cohort. Continuous variables were evaluated using *t*-tests and categorical variables were evaluated using Z-tests or chi-squared tests; a P value <0.05 was considered statistically significant. Descriptive analyses were conducted using SAS version 9.04.

Results

Patient characteristics

A total of 7773 patients were included in the analyses. Among these patients, 275 received secukinumab, 2684 received adalimumab, 910 received ustekinumab, 1063 received etanercept, and 2841 received apremilast. Overall, 35.3% of the secukinumab cohort, 35.1% of the adalimumab

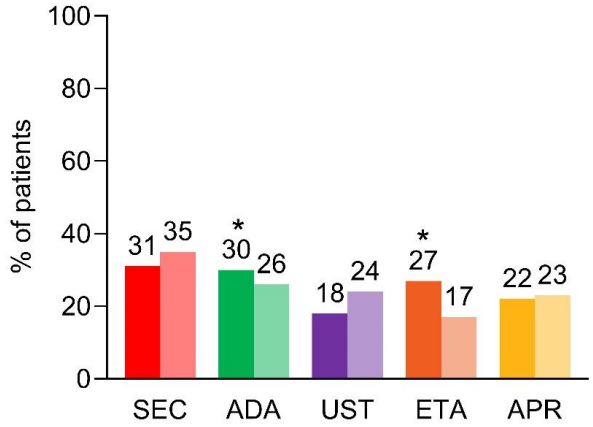

Figure 1. *Rates of adherence (PDC≥0.8) at 24-month follow-up by index treatment and psoriatic arthritis status. Full color bars designate patients with PsA; lighter bars designate patients without PsA. The sample size was 275, 2684, 910, 1063, and 2841 patients in the secukinumab, adalimumab, ustekinumab, etanercept, and apremilast cohorts, respectively. * P<0.05 between subgroups of each treatment cohort. ADA, adalimumab; APR, apremilast; ETA, etanercept; PDC, proportion of days covered; PsA, psoriatic arthritis; SEC, secukinumab; UST, ustekinumab.*

cohort, 22.0% of the ustekinumab cohort, 45.7% of the etanercept cohort, and 24.8% of the apremilast cohort had a diagnosis of PsA.

Across the five index drug cohorts, the mean age ranged from 46.5 to 49.7 years and 45.9–54.9% of patients were female (Table 1). Patients with PsA were older compared with those without PsA in all treatment cohorts; the mean age ranged from 48.4 to 51.2 years in patients with PsA compared with 45.7 to 49.3 years in patients without PsA. Higher proportions of patients with PsA had additional diagnosis claims for rheumatoid arthritis than patients without PsA in all treatment cohorts. In addition, more patients with PsA were prescribed medications for psoriasis and for comorbidities at baseline than patients without PsA.

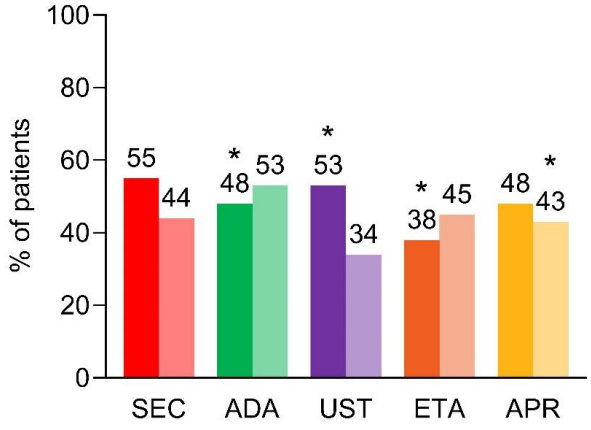

Figure 2. *Rates of discontinuation at 24-month follow-up by index treatment and psoriatic arthritis status. Full color bars designate patients with PsA; lighter bars designate patients without PsA. The sample size was 275, 2684, 910, 1063, and 2841 patients in the secukinumab, adalimumab, ustekinumab, etanercept, and apremilast cohorts, respectively. * P<0.05 between subgroups of each treatment cohort. ADA, adalimumab; APR, apremilast; ETA, etanercept; PsA, psoriatic arthritis; SEC, secukinumab; UST, ustekinumab.*

Treatment patterns

At the 24-month follow-up point, adherence rates were low in all treatment cohorts: secukinumab 33.5%, adalimumab 27.1%, ustekinumab 22.5%, etanercept 21.3%, and apremilast, 22.8% (data not shown). The adjusted rates in both patients with and without PsA were: 30.9% versus 34.8% for secukinumab, 30.0% versus 25.5% for adalimumab, 17.5% versus 23.9% for ustekinumab, 26.5% versus 16.8% for etanercept, and 22.4% versus 22.9% for apremilast (**Figure 1**). Discontinuation rates were high across all treatments: secukinumab 47.6%, adalimumab 51.3%, ustekinumab 38.4%, etanercept 42.1%, and apremilast 44.5% (data not shown). In patients with versus without a diagnosis of PsA, the corresponding rates were 54.6% versus 43.8% for secukinumab, 48.3% versus 53.0% for adalimumab, 52.5% versus 34.4% for ustekinumab, 38.1% versus 45.4% for etanercept, and 47.7% versus 43.4% for apremilast (**Figure 2**). Patients with PsA had worse adherence and discontinuation rates in the newer biologic cohorts (secukinumab and ustekinumab) but better outcomes in the anti-TNF cohorts (adalimumab and etanercept) when compared with patients without PsA.

Switching was common in all treatment cohorts and was higher among patients with PsA compared with patients without PsA in all but the etanercept cohort (**Figure 3**). Switching rates ranged from 47.0% to 55.1% for patients with PsA and from 24.8% to 51.3% for patients without PsA. In addition, higher proportions of patients with PsA used combination therapy than patients without PsA in all treatment cohorts (41.9%–59.8% versus 22.9%–33.7%), (**Figure 4**).

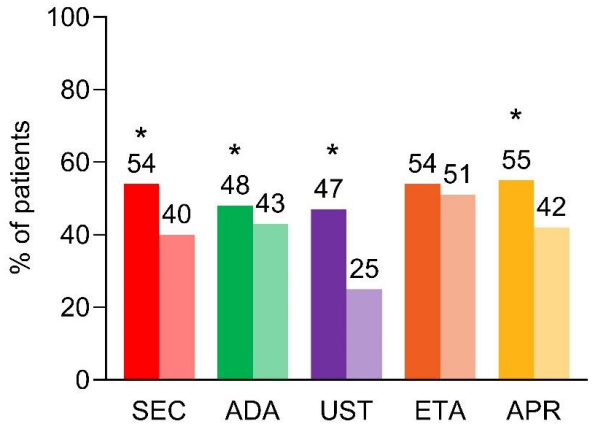

Figure 3. *Rates of switching at 24-month follow-up by index treatment and psoriatic arthritis status. Full color bars designate patients with PsA; lighter bars designate patients without PsA. The sample size was 275, 2684, 910, 1063, and 2841 patients in the secukinumab, adalimumab, ustekinumab, etanercept, and apremilast cohorts, respectively. * P<0.05 between subgroups of each treatment cohort. ADA, adalimumab; APR, apremilast; ETA, etanercept; PsA, psoriatic arthritis; SEC, secukinumab; UST, ustekinumab.*

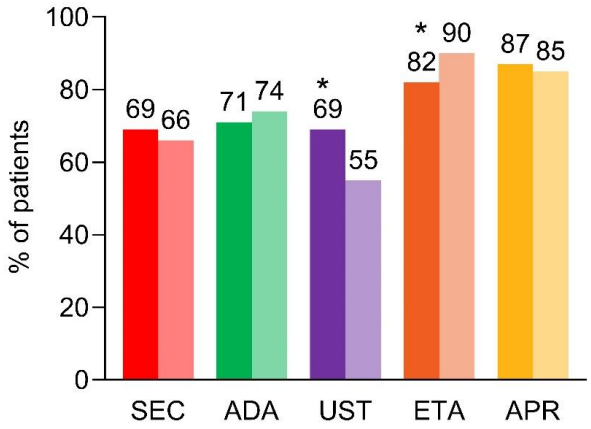

Figure 5. *Rates of non-persistence at 24-month follow-up by index treatment and psoriatic arthritis status. Full color bars designate patients with PsA; lighter bars designate patients without PsA. The sample size was 275, 2684, 910, 1063, and 2841 patients in the secukinumab, adalimumab, ustekinumab, etanercept, and apremilast cohorts, respectively. * P<0.05 between subgroups of each treatment cohort. ADA, adalimumab; APR, apremilast; ETA, etanercept; PsA, psoriatic arthritis; SEC, secukinumab; UST, ustekinumab.*

Most patients were non-persistent at 24-month follow-up, with rates ranging from 55.5% to 90.3% (**Figure 5**). Persistence only differed significantly by PsA status among patients in the ustekinumab and etanercept cohorts. Patients with PsA had worse persistence in the ustekinumab cohort, but better persistence in the etanercept cohort when compared with patients without PsA.

Similar trends were observed at the 12- and 18-month follow-up points (data not shown), with longer follow-up duration correlating with worse outcomes across the treatment cohorts.

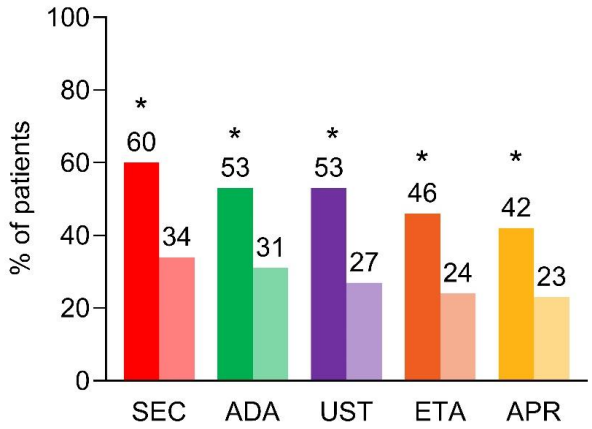

Figure 4. *Rates of combination therapy use at 24-month follow-up by index treatment and psoriatic arthritis status. Full color bars designate patients with PsA; lighter bars designate patients without PsA. The sample size was 275, 2684, 910, 1063, and 2841 patients in the secukinumab, adalimumab, ustekinumab, etanercept, and apremilast cohorts, respectively. * P<0.05 between subgroups of each treatment cohort. ADA, adalimumab; APR, apremilast; ETA, etanercept; PsA, psoriatic arthritis; SEC, secukinumab; UST, ustekinumab.*

Discussion

This study evaluated long-term real-world treatment patterns of biologics and apremilast among patients with psoriasis with and without comorbid PsA using a large US administrative claims database. Psoriatic arthritis was identified in 22%–46% of patients with psoriasis who initiated biologics or apremilast in the study. Overall, the treatment disruption over the 24-month follow-up was substantial, with high non-persistence, discontinuation, switching, and use of combination therapy in psoriasis patients with and without PsA. Both psoriasis and PsA are chronic diseases, and patients often need life-long treatment. Understanding long-term treatment patterns is important for both clinicians and payers to provide insight into the treatment journeys patients are likely to undertake in real-world clinical practice.

With a similar goal, a long-term observational study involving patients with psoriasis from the BIOBADADERM registry attempted to evaluate the relative safety profiles of biologic and non-biologic drugs from rates of adverse events (AEs) and serious AEs using methotrexate as reference [25]. Among the examined drugs in the real-life setting, ustekinumab and secukinumab were identified as having the best safety profile. With a broader scope, a recent large network meta-analysis from Sbidian et al. directly compared clinical effectiveness and safety of biologics, small molecules, and other systemic treatments and provided a final ranking based on those observations [26]. All biologics displayed an overall better benefit/risk ratio relative to other treatment options, but the data were limited to the induction period, and long-term outcome assessment was not possible [26]. In addition to presenting a superior benefit/risk ratio, early studies reported that biologics have significantly higher rates of adherence than conventional systemic treatments [27,28]. Nevertheless, treatment adherence and persistence remain a major challenge in clinical practice for both psoriasis and PsA, with discontinuation in the first year of treatment of up to 35%, switching up to 15%, and non-persistence up to 29% [4,18-21]. Recently, Egeberg et al. reported drug survival of two anti-IL17A biologics in a Danish nationwide cohort of patients with psoriasis [29]. Over the 3-year follow-up, the increase in discontinuation rate was consistent for secukinumab, especially in patients who had failed on other biologics [29]. However, the number of patients involved was modest and larger studies are needed before final conclusions can be drawn. Our findings are generally in line with previous literature [18-21,30,31], most notably with two similar studies [22,23] in which all examined outcomes in patients with psoriasis progressively worsened over time, from 12 to 24 months, independently from the adopted line of treatment. Moreover, maintenance of long-term therapy is even more challenging in the presence of a co-existing condition [22]. In Feldman et al., rates of discontinuation and switching were even higher in patients with psoriasis and metabolic syndrome than in patients without, the only exception being with apremilast [22]. In our analysis, over the 24 months of treatment, ustekinumab treatment was consistently associated with the lowest rates of discontinuation versus apremilast and adalimumab with the highest. Rates were comparable among the remaining systemic drugs. Although statistical comparison between drugs was not performed, analysis of demographic and clinical data revealed that among all groups, secukinumab had the highest prevalence of patients with obesity and diabetes, two medical conditions known to promote discontinuation related to either ineffectiveness or occurrence of AEs [32]. Moreover, each cohort included patients taking other systemic and/or non-systemic medications for psoriasis during the 12-month pre-index period, which could have influenced outcomes.

The current study adds to the available literature by comparing the adherence and persistence rates between the most commonly used biologic and non-biologic (apremilast) systemic treatments in patients with psoriasis with and without PsA, for which data are very limited. Psoriatic arthritis is the most common comorbidity among patients with psoriasis [5-7]; thus, the impact of this comorbid disorder on psoriasis disease management should not be neglected or overlooked. Given that treat-to-target is strongly recommended in PsA, one might expect discontinuation and switching rates to be higher in patients with this comorbidity [14,15]. However, the results of our study were more mixed, varying by treatment and outcome. Patients with comorbid PsA treated with anti-TNF biologics (adalimumab, etanercept) had better adherence rates and lower discontinuation rates than those without PsA. Conversely, among patients treated with the newer anti-IL17 or anti-IL12/23 biologics (secukinumab, ustekinumab), adherence, discontinuation, and non-persistence rates were worse among patients with comorbid PsA compared with those without. Compared to those without PsA, patients with PsA had higher rates of use of combination therapy across treatment cohorts and higher rates of treatment switching in all, except for the etanercept cohort.

In this study, psoriasis patients with PsA were also significantly more likely to discontinue apremilast

than those without, differing from what has previously been observed in patients with psoriasis and metabolic syndrome [22]. These results suggest that every comorbid condition might have a unique impact in terms of treatment outcomes and that these differences must be acknowledged to select the optimal treatment option for the patient.

Limited evidence exists to support whether the effects of IL17 and IL12/23 inhibitors and TNF inhibitors differ among patients with psoriasis and PsA [33]. Nonetheless, although the pathophysiological pathways that underlie psoriatic skin and joint disease overlap substantially, some treatments have been shown to be more effective in treating one or the other [9]. Guideline recommendations for PsA vary according to the predominant symptoms and response to previous therapies. There is also variation between guidelines with regard to recommendations on biologic types. For example, although IL12/23 and IL17 inhibitors are recommended for patients with PsA with an insufficient response to methotrexate by the 2015 European League Against Rheumatism guidelines, they consider anti-TNF inhibitors a preferable first choice [15]. By contrast, the Group for Research and Assessment of Psoriasis and Psoriatic Arthritis 2015 guidelines consider IL12/23 and IL17 inhibitors comparable to anti-TNF agents [14].

Talamonti et al. recently demonstrated that PsA diagnosis was strongly correlated with long-term complete Psoriasis Area Severity Index remission rates among psoriasis patients treated with the anti-TNF therapy adalimumab [34]. Given that lack of efficacy is the primary reason for treatment discontinuation and poor adherence among psoriasis patients [4], our results are consistent with the findings of Talamonti et al. [34]. Patients with PsA were less likely to discontinue adalimumab treatment than those without PsA and had higher rates of adherence to this therapy. Similar patterns were seen among patients treated with etanercept, another anti-TNF agent with a similar efficacy and safety profile [35]. Notably, the highest proportion of patients with PsA in our study was in the etanercept cohort (46%).

By contrast, although newer anti-IL17 and anti-IL12/23 biologics such as secukinumab and ustekinumab are effective for treating PsA, the results in the skin are often more impressive than those in the joints [9,33]. Our findings are also consistent with this—the ustekinumab cohort had the smallest proportion of patients with PsA (22%), and the rates of adherence, discontinuation, and non-persistence were worse in PsA patients than in those without this comorbidity. These outcomes also appeared to be worse among PsA patients in the secukinumab cohort in our study compared with patients without PsA, although, owing to small sample size we were not able to demonstrate significance. It is possible that, as some authors have suggested, anti-TNF therapy may be a more effective choice for PsA than IL12/23 or IL17 agents, especially in the presence of dactylitis and enthesitis [15,33,35]. However, it is worth noting that patients in the ustekinumab and secukinumab cohorts in our study had the highest proportions of prior biologic use at index, suggesting that they were more likely to have severe or treatment-refractory disease with a longer disease duration than patients in other treatment cohorts, which may have influenced these results.

Patients with PsA had higher rates of switching with all treatments except etanercept. In addition, these patients were more likely to use combination therapy relative to patients without PsA regardless of their index treatment. Guidelines state that the treatment objective in both psoriasis and PsA is to reach remission or at least low/minimal disease activity [13,14]. If this treatment objective is not achieved, a change in therapy is recommended. Accordingly, lack of efficacy is responsible for the majority of switching among patients treated with biologics [36]. Although reasons for treatment patterns are not available in claims data, the finding that patients with PsA were more likely to switch from their index therapy or add-on other treatments suggests that, in general, the currently available treatments have reduced efficacy in patients with PsA and may be inadequate at controlling patient symptoms and slowing disease progression.

Although patient satisfaction has been improved with the introduction of biologic therapies, up to 50% of psoriasis patients still do not consider themselves “highly” or “completely” satisfied when

on a biologic treatment, and 85% still express the need for better therapies [37,38]. Given the diverse array of therapies now available for moderate-to-severe psoriasis and PsA, understanding the differential outcomes of these therapies in real-world clinical practice is important and may aid clinicians in choosing the appropriate treatment for individual patients. Nonetheless, there appears to be a need for more effective therapies that can improve adherence and persistence for psoriasis with or without comorbid PsA.

This study is subject to several limitations. Patients were identified through administrative claims data; therefore, miscoding of diagnoses, patient characteristics, or study outcomes are possible. Psoriatic arthritis may be underdiagnosed, so it is possible that some of the patients in the "no PsA" subgroups did indeed have PsA [9]. In addition, medication adherence was based on prescription fulfillment claims, but filled prescriptions may not have been taken as prescribed. Claims do not capture data on reasons for treatment switching, discontinuation, or use of combination therapy; they do not capture factors such as disease severity and socioeconomic status. Therefore, how various factors may have influenced the treatment patterns remains unknown. The study was descriptive and the sample size was small for some of the treatment cohorts. Additionally, although the 12-month pre-index period is longer than that in most previous studies, it may not be sufficient to capture all prescription and disease history. There was insufficient data to analyze newer anti-IL17 agents such as ixekizumab, or the newer anti-IL23 agents guselkumab, tildrakizumab, and risankizumab. Patients who died and those with serious health conditions who went on long-term disability during the study period would likely have been excluded from the analysis owing to <24 months follow-up. Finally, although MarketScan is a large database with good geographic distribution, generalization of findings to populations beyond the commercially insured should be made with caution.

Conclusion

A substantial proportion of patients with psoriasis who initiated biologics or apremilast had comorbid PsA. Overall, rates of adherence were low and discontinuation, non-persistence, switching, and combination therapy use were high across the treatment cohorts. When treatment patterns were compared in patients with versus without PsA, the results varied according to the index treatment, with outcomes being better in PsA patients on anti-TNF agents and worse in PsA patients on anti-IL17 and anti-IL12/23 agents. Maintaining long-term therapy remains a challenge for psoriasis patients both with and without PsA.

Potential conflicts of interest

This study was funded by Sun Pharmaceutical Industries, Inc. YZ and JZ were employees of Sun Pharmaceutical Industries, Inc., at the time the study was conducted. AMM was an employee of Sun Pharmaceutical Industries, Inc., at the time the study was conducted and has individual shares in Johnson and Johnson, and as part of retirement account/mutual funds. LLG, GS, and EHM are employees of IBM Watson Health and were contracted by Sun Pharmaceutical Industries, Inc., to support the study. DJM was an employee of IBM Watson Health at the time the study was conducted. SRF is a researcher who has received funding from Sun Pharmaceutical Industries, Inc. The authors thank Clare Byrne PhD, of Asclepius Analytics and Judy Lofton of AlphaBioCom, LLC, for editorial support, funded by Sun Pharmaceutical Industries, Inc.

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Table 1. *Baseline demographic and clinical characteristics in the overall study population by index treatment and psoriatic arthritis status (N=7773).*

	Secukinumab			Adalimumab			Ustekinumab			Etanercept			Apremilast		
	PsA (N=97)	No PsA (N=178)		PsA (N=943)	No PsA (N=1741)		PsA (N=200)	No PsA (N=710)		PsA (N=486)	No PsA (N=577)		PsA (N=704)	No PsA (N=2137)	
Age, years, mean (SD)	50.9 (10.0)	48.5 (11.9)		48.4 (10.8)	45.7 (12.4)	*	48.7 (10.9)	45.9 (13.1)	*	49.6 (10.6)	46.7 (12.3)	*	51.2 (11.0)	49.3 (12.7)	*
Male, %	43.3	56.7	*	46.6	50.6	*	41.5	53.7	*	45.1	49.0		40.2	46.7	*
Comorbidities, %															
Anxiety	10.3	4.5		3.7	4.4		4.0	3.4		3.7	4.0		4.1	4.1	
Coronary heart disease	11.3	9.0		9.4	6.2	*	12.0	9.0		11.1	6.2	*	11.1	9.4	
Depression	8.2	3.4		4.6	4.1		4.0	4.1		4.9	2.8		5.0	3.4	
Diabetes	30.9	15.2	*	13.5	12.9		17.0	12.0		14.8	11.6		18.0	13.7	*
Hyperlipidemia	33.0	30.9		30.8	26.2	*	32.5	25.5	*	30.7	25.3		33.5	31.4	
Hypertension	43.3	36.5		36.6	29.6	*	41.0	29.9	*	36.2	30.3	*	41.5	35.5	*
Obesity	27.8	21.9		19.8	16.0	*	18.5	16.2		20.4	17.3		20.2	16.1	*
Rheumatoid arthritis	17.5	1.1	*	8.9	3.8	*	12.0	0.7	*	10.3	7.5		10.1	1.1	*
Medications, %															
Antidepressants	44.3	29.2	*	30.9	26.7	*	35.5	23.5	*	37.9	26.5	*	35.1	26.4	*
CV drugs/ antihypertensives	64.9	47.2	*	47.2	42.4	*	60.0	40.0	*	54.7	42.8	*	55.4	48.9	*
Methotrexate	28.9	17.4	*	43.5	22.2	*	28.5	12.7	*	37.9	19.1	*	29.0	8.9	*
Other biologics	25.8	21.9		4.5	2.9	*	27.0	14.2	*	7.2	3.3	*	10.9	5.9	*
Adalimumab	10.3	6.7					14	9.2	*	4.9	2.1	*	5	2.6	*
Ustekinumab	9.3	8.4		0.5	0.6					1.4	0.7		2.4	1.9	
Etanercept	2.1	5.1		3.7	2.2	*	13.5	5.8	*				4.8	2.1	*
Systemic steroids	46.4	23.0	*	46.2	28.4	*	39.5	19.3	*	43.4	28.2	*	41.3	25.8	*
Topical steroids	70.1	77.0		63.6	77.5	*	71.0	74.4		59.7	71.8	*	69.5	83.7	*
Other treatments															
Phototherapy	3.1	10.1	*	1.9	6	*	5.5	6.3		2.5	4.9	*	4	8.7	*
Laser treatment	3.1	2.8		1.1	2		4	2.5		1.2	1.7		1.4	5.4	*

*P<0.05 between subgroups of each treatment cohort. CV, cardiovascular; PsA, psoriatic arthritis; SD, standard deviation.