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Psoriasis in the U.S. Medicare population: prevalence, treatment, and factors associated with biologic use

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Abstract

Psoriasis is a common chronic inflammatory disorder, primarily of the skin. Despite an aging population, knowledge of the epidemiology of psoriasis and its treatments among the elderly is limited. We examined the prevalence of psoriasis and its treatments, with a focus on biologics and identification of factors associated with biologic use, using a nationally representative sample of Medicare beneficiaries in 2011. Based on several psoriasis identification algorithms, the claims-based prevalence for psoriasis in the United States ranged from 0.51% to 1.23%. Treatments employed for moderate to severe psoriasis (phototherapy, oral systemic, or biologic therapies) were received by 27.3% of the total psoriasis sample, of whom 37.2% used biologics. Patients without Medicare Part D low-income subsidies had 70% lower odds of having received biologics than those with low-income subsidies (odds ratio 0.30; 95% confidence interval, 0.19– 0.46).

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Similarly, the odds of having received biologics was 69% lower among black patients than white patients (0.31; 0.16–0.60). This analysis identified potential financial and racial barriers to receipt of biologic therapies and underscores the need for additional studies to further define the epidemiology and treatment of psoriasis among the elderly.

Introduction

Psoriasis is a common, chronic, multisystem, inflammatory disease of the skin and sometimes joints. Approximately 7.5 million Americans (National Psoriasis Foundation) are affected by psoriasis, resulting in a prevalence of 2% to 4% in the United States according to population-based estimates.(Gelfand *et al*., 2005b; Kurd and Gelfand, 2009; Rachakonda *et al*., 2014) Psoriasis is associated with significant economic,(Feldman *et al*., 2014) psychosocial,(Kimball *et al*., 2005) and physical(Yeung *et al*., 2013) health burdens that are proportional to disease severity. An increasing body of epidemiologic literature provides evidence that psoriasis, particularly more severe disease, is independently associated with increased risks of major adverse cardiovascular events,(Gelfand *et al*., 2009; Gelfand *et al*., 2006a; Mehta *et al*., 2010), diabetes,(Azfar *et al*., 2012) renal disease,(Wan *et al*., 2013) and other emerging comorbid diseases.(Yeung *et al*., 2013)

Treatment options for psoriasis include topical therapies, phototherapy, and systemic medications. Moderate to severe psoriasis, which affects nearly 25% of patients with the disease,(National Psoriasis Foundation) is an indication for treatment with phototherapy, oral systemics (i.e., methotrexate, cyclosporine, or acitretin), or biologics, while mild disease is generally treated with topical therapies alone. Psoriatic arthritis, which affects 6% to 17% of patients with psoriasis according to population-based studies,(Gelfand *et al*., 2005a; Ibrahim *et al*., 2009; Lofvendahl *et al*., 2014; Ogdie *et al*., 2013; Shbeeb *et al*., 2000; Wilson *et al*., 2009) is an indication for treatment with oral systemic or biologic therapies. In the last decade, several new therapies for moderate to severe psoriasis have been approved, primarily driven by the development of targeted biologics including tumor necrosis factor, interleukin (IL)-12/-23, and IL-17 inhibitors. Yet most psoriasis patients remain inadequately treated and dissatisfied with their therapies.(Armstrong *et al*., 2013; Horn *et al*., 2007) Furthermore, access to biologics remains a challenge for many patients because of limited insurance coverage, prohibitive costs, and other factors.(Kamangar *et al*., 2013; Polinski *et al*., 2009; Romanelli *et al*., 2015)

Despite marked progress in the understanding of the epidemiology, pathophysiology, and treatment of psoriasis during recent years, major knowledge gaps still exist, particularly regarding the prevalence of and treatment patterns for psoriasis among the growing elderly population which, in the United States, is estimated to reach 79.7 million by 2040. (Administration on Aging, 2012) As over 90% (Centers for Medicare and Medicaid Services, 2011) of the elderly (65 years and older) population in the United States receive medical coverage through the Medicare system, the aim of our study was to investigate the prevalence of psoriasis among Medicare beneficiaries who are actively receiving medical care, examine their clinical characteristics, and determine the prevalence of psoriasis

therapies, with a focus on biologic use and factors associated with receiving biologic treatment.

Results

Claims-based psoriasis prevalence

Claims-based psoriasis prevalence was determined for 799,607 beneficiaries in the 2011 5% Medicare sample using eight different algorithms (Table 1). Using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) 696.1 code to identify psoriasis, claims-based prevalence ranged from 1.13% (95% confidence interval [CI]: 1.10-1.15) using an algorithm identifying at least one inpatient or outpatient claim for psoriasis to 0.51% (95% CI: 0.50-0.53) using an algorithm identifying at least one inpatient or outpatient claim for psoriasis made by a dermatologist. We also explored a broader method of identifying psoriasis using claims for either psoriasis or psoriatic arthritis (ICD-9-CM 696.0). Claims-based psoriasis prevalence using this method ranged from 1.23% (95% CI: 1.20-1.25) to 0.60% (95% CI: 0.58-0.61). For our main analyses, we identified psoriasis by the presence of at least two inpatient or outpatient claims for psoriasis which resulted in a prevalence of 0.58% (95% CI: 0.56-0.60).

Psoriasis patient characteristics

Psoriasis patient and Medicare plan characteristics are summarized in Table 2. The mean age of psoriasis patients was 68.6 years (standard deviation [SD], 13.4); 43.2% were male, and 88.8% were white. Regional distribution was as follows: 24.0% in the Northeast, 23.0% in the Midwest, 36.2% in the South, and 16.6% in the West. County-level mean per capita income was $40,115 (SD, 11,817). Average number of dermatologists per 100,000 county residents was 3.6 (SD, 3.6). The majority of beneficiaries qualified for Medicare based on age alone (63.6%). Most beneficiaries were not receiving a Medicare Part D low-income subsidy (LIS) (58.4%). Only 19.0% of the beneficiaries were in Part D plans with enhanced alternative coverage. The most commonly coded comorbidities among beneficiaries with psoriasis were cardiometabolic disorders: 67.6% with hypertension, 59.9% with dyslipidemia, and 32.4% with diabetes; 23.5% had atherosclerotic outcomes. In contrast, the prevalence of obesity was relatively low at 9.3%. The prevalence of psoriatic arthritis was 9.4% which is similar to population-based estimates of psoriatic arthritis among patients with psoriasis.(Ogdie *et al*, 2013) Other comorbid diseases of interest include inflammatory bowel disease (1.2%), liver disease (5.1%), depression (17.1%), and renal disease (9.8%). As indicators of overall comorbidity, the average number of non-psoriasis medications received was 4.7 (SD, 3.4), and the mean RxHCC score was 1.0 (SD, 0.6).

Psoriasis therapy prevalence

The prevalence of therapies received by Medicare beneficiaries with psoriasis is summarized in Table 3. Most patients had at least one claim for psoriasis therapy (83.5%), and 16.5% received no therapy. Topical therapies were used by 76.6% (N=3,551), the majority of whom received topical corticosteroids (97.9%). Phototherapy was used by 7% (N=324). Oral systemic medications were used by 14.3% (N=664), the majority of whom received methotrexate (85.7%). Biologics were received by 10.2% (N=471), among whom specific

biologic use was distributed as follows: 44.4% etanercept, 34.2% adalimumab, 22.7% infliximab, and 7.9% ustekinumab. Among biologic users, 31.0% used a physician-administered drug (i.e., alefacept, infliximab, or ustekinumab) and 78.6% used a self-administered biologic (i.e., adalimumab or etanercept). Of those who used biologics, 61.8% of patients received biologics only (with or without topical therapies), and the remaining 38.2% also received oral systemics and/or phototherapy during the year.

In the absence of direct measures of psoriasis severity in claims data, we used psoriasis treatment as a surrogate to define mild versus moderate to severe disease. Patients who received either no therapy or topical therapies only were considered to have mild psoriasis and those who received phototherapy, oral systemics, or biologics were considered to have moderate to severe psoriasis. Using this method, 70.9% of patients had mild disease and 27.3% had moderate to severe disease (Table 4). Of patients identified to have moderate to severe psoriasis, phototherapy was used by 25.6%, oral systemics by 52.4%, and biologics by 37.2%.

Factors associated with biologic use

In multivariate analyses, we identified factors associated with biologic use among patients receiving therapies consistent with moderate to severe psoriasis. Factors associated with a lower likelihood of receiving biologics were: higher primary care provider density (odds ratio [OR] 0.92; 95% confidence interval [CI]: 0.86-0.98), absence of Part D LIS (OR 0.30; 95% CI: 0.19–0.46), black race (OR 0.31; 95% CI: 0.16–0.60), and comorbid cancer (OR 0.47; 95% CI: 0.31–0.72) and dementia (OR 0.26; 95% CI: 0.07-0.97) (Table 5). Factors associated with a greater likelihood of biologic use included: higher dermatology provider density (OR 1.08; 95% CI: 1.01–1.16), residence in an urban county (OR 1.54; 95% CI: 1.13-2.11), and comorbid ankylosing spondylitis (OR 2.26; 95% CI; 1.13–4.53), inflammatory bowel disease (OR 8.11; 95% CI: 1.91–34.5), psoriatic arthritis (OR 3.79; 95% CI: 2.74–5.24), and renal disease (OR: 2.03, 95% CI: 1.24–3.35).

Discussion

In this nationally representative sample of Medicare fee-for-service beneficiaries with Part D drug coverage, we determined claims-based psoriasis prevalence and examined the clinical characteristics, treatment prevalence, and factors associated with biologic use for patients with psoriasis. Claims-based psoriasis prevalence ranged from 0.51% to 1.23%, depending on the identification algorithm used. These prevalence estimates were lower than what has been reported in population-based studies,(Gelfand *et al*., 2005b; Kurd and Gelfand, 2009; Rachakonda *et al*., 2014) perhaps because patients with milder disease do not seek medical care for their skin disease and/or due to the presence of other barriers to receiving psoriasis care. The distribution of comorbid diseases among psoriasis patients was as expected, with the most common comorbidities being related to cardiometabolic disease. With the exception of obesity, the prevalence of cardiometabolic comorbidities was generally greater than what has previously been reported for the general population,(Neimann *et al*., 2006; Yeung *et al*., 2013) and is likely, in part, attributable to our focus on an elderly population that is more likely to suffer from comorbid conditions.(Sundquist *et al*., 2001) Prevalence of

cardiometabolic diseases and outcomes may also be affected by misclassification.(Quan *et al.*, 2008) The prevalence of psoriatic arthritis claims was in accordance with population-based estimates of 6% to 17% for psoriasis patients.(Gelfand *et al.*, 2005a; Ibrahim *et al.*, 2009; Lofvendahl *et al.*, 2014; Ogdie *et al.*, 2013; Shbeeb *et al.*, 2000; Wilson *et al.*, 2009)

In our study, 16.4% of patients were not receiving treatment for their psoriasis; this is lower than the approximately 40% of patients with psoriasis who were reported to not be receiving treatment in two published surveys of National Psoriasis Foundation members.(Armstrong *et al.*, 2013; Horn *et al.*, 2007) Similar to claims-based psoriasis prevalence, we suspect that the prevalence of untreated psoriasis patients in our study is an underestimate because of our inability to capture those patients, especially with mild disease, who are not receiving care for their psoriasis. Phototherapy was received by a mere 7% of patients. This observation is consistent with the declining phototherapy usage rates observed in the United States, (Housman *et al.*, 2002; Shaw *et al.*, 2014) which are suggested to result from a combination of factors including poor reimbursement rates (especially for Medicare recipients),(Lebwohl, 2013) greater out-of-pocket costs to patients compared with biologics,(Yentzer *et al.*, 2009) and greater time commitment required from the patient, despite phototherapy being a first-line, effective, and well-tolerated treatment for moderate to severe psoriasis.(Menter *et al.*, 2008) Oral systemic medications, namely methotrexate, were found to be the most common treatments for beneficiaries receiving therapies used for moderate to severe psoriasis, followed by biologics with approximately one-third of beneficiaries having received a biologic in 2011. Among biologic therapies, self-administered biologics were used by most patients, perhaps reflecting patient preferences for subcutaneous self-injectables over intravenous biologics, a finding suggested by previous studies of patients with rheumatoid arthritis who are candidates for similar biologics.(Barton, 2009; Huynh *et al.*, 2014) The prevalence of ustekinumab claims in our study was predictably low, perhaps owing to its more recent approval by the FDA for treatment of moderate to severe psoriasis in September 2009 compared with the other biologics.

Examination of the factors associated with biologic use among those patients receiving therapies used to treat moderate to severe psoriasis revealed both expected and novel findings. Medicare beneficiaries lacking LIS under the Part D plan had 70% lower odds of receiving biologics than their counterparts with LIS that allowed for minimal out-of-pocket drug costs for self-injectable biologics (approximately $3 to $6 copayment depending on income levels), independent of other patient and plan characteristics. Moreover, patients without LIS may face substantially greater costs for several of the Part D covered biologics with 25% to 33% co-insurance within the initial coverage limit and 50% of the drug costs in the Part D coverage gap.

We also found black beneficiaries to be approximately 70% less likely to receive biologics than white beneficiaries. LIS status(Zhang *et al.*, 2013) and black race(Chu *et al.*, 2013; Schmajuk *et al.*, 2011; Solomon *et al.*, 2012) have been similarly associated with biologic use in studies of patients with rheumatoid arthritis. Together, these findings suggest the presence of economic and racial factors that may impact the treatment of moderate to severe psoriasis and merit further study.

Expectedly, higher dermatology provider density and residence in an urban county setting were each associated with greater odds of receiving a biologic. The presence of comorbidities for which biologic treatment is indicated (i.e., ankylosing spondylitis, inflammatory bowel disease, and psoriatic arthritis) was also associated with greater odds of receiving biologics. Patients with history of renal disease were twice as likely to receive biologic therapy as patients without renal disease, likely because of the relative contraindication to methotrexate use among those with renal insufficiency. On the other hand, patients with history of cancer, a relative contraindication to biologics, and those with dementia were less likely to receive biologics than patients without cancer and dementia, respectively. Lastly, it is notable that the likelihood of receiving a biologic did not differ between those who qualified for Medicare based on their age versus those who qualified because of disability.

Our study has several strengths, including use of Medicare claims data that are representative of the elderly (65 years and older) population in the United States, 93% of whom were enrolled in Medicare in 2011,(Services, 2011) making our findings generalizable to the majority of this population who has fee-for-service Medicare with Part D drug coverage. Medicare data have high quality information on demographics, clinical encounters, and prescriptions for beneficiaries. In particular, race data have been shown to be valid for whites and blacks.(Zaslavsky *et al*., 2012) There are also several limitations of our study to consider.

Misclassification of psoriasis(Icen *et al*., 2008) and comorbidities(Quan *et al*., 2008) as identified by administrative claims is possible. We identified patients with psoriasis by the presence of at least two claims for ICD-9-CM 696.1 which has been suggested to have a positive predictive value of 70%.(Icen *et al*., 2008) This definition was preferred over that of at least one claim for psoriasis by a dermatologist to balance our efforts to minimize misclassification and avoid selection of a more severe population of psoriasis patients who would be more likely to see a dermatologist. Furthermore, because our study relies on medical claims to identify patients with psoriasis, our results may underestimate the true prevalence of psoriasis among the elderly. Our study also encompasses data from 2011 that may not be representative of the current state of psoriasis treatment among the elderly, particularly for those receiving ustekinumab which was approved for psoriasis in September 2009. As data on direct measures of psoriasis severity were unavailable, we used treatment as a proxy to define severity that may have resulted in misclassification. We also lacked information on other patient- and provider-level factors such as individual income or education status, or provider prescription patterns that may further affect biologic use. Lastly, our findings may not be generalizable to beneficiaries enrolled in Medicare managed care (i.e., Medicare Advantage or Part C) plans and non-Medicare patient populations.

Our study is, to our knowledge, the first to examine the epidemiology and treatment of psoriasis in the United States Medicare population. We found the claims-based prevalence of psoriasis to be lower than population-based estimates. Cardiometabolic disorders and depression were prevalent among Medicare beneficiaries with psoriasis, confirming previous epidemiologic studies performed in generally younger populations and possibly suggesting an even greater burden of comorbid disease among the elderly psoriasis population.

Phototherapy was underutilized, consistent with decreasing use of phototherapy in the United States.(Housman *et al*., 2002; Shaw *et al*., 2014) Oral systemic medications were used by more than half of Medicare beneficiaries receiving therapies indicated for moderate to severe psoriasis, followed closely by biologic use at approximately 37%. Notably, our data identify potential financial and racial barriers to psoriasis patients receiving biologic therapies. To improve psoriasis treatment, future studies should evaluate if similar barriers also exist for other populations, such as those with private insurance, Medicaid, or other medical coverage programs. Collectively, our findings provide an important addition to the limited literature on psoriasis and its treatments among the elderly and highlight areas for future study.

Materials & Methods

Data source, study population, design

We performed a retrospective claims analysis of the 2011 5% Medicare Chronic Condition Warehouse files available from the United States Centers for Medicare and Medicaid Services (CMS). Medicare is a nationwide health insurance program administered by the United States federal government for the elderly (65 years and older) and disabled. Medicare data are broadly representative of the elderly population in the United States. We estimated the annual cross-sectional prevalence of psoriasis claims among beneficiaries with continuous fee-for-service Medicare Part A (hospital insurance) and B (medical insurance) coverage and stand-alone Part D (prescription drug) plan enrollment in 2011. In our primary analyses, we also examined patient demographics, socioeconomic status, Medicare plan characteristics, clinical characteristics, and treatments for psoriasis among patients who had at least two inpatient or outpatient claims for psoriasis, identified by ICD-9-CM code 696.1. In secondary analyses, we identified psoriasis by at least one inpatient or outpatient claim for psoriasis by a dermatologist and present data in supplementary Tables 1 through 4.

Claims-based psoriasis prevalence

Claims-based psoriasis prevalence was examined using eight algorithms (Table 1): i) at least one inpatient or outpatient claim for ICD-9-CM 696.1 (psoriasis); ii) at least one inpatient or two outpatient claims for ICD-9-CM 696.1; iii) at least two inpatient or outpatient claims for ICD-9-CM 696.1; iv) at least one inpatient or outpatient claim for ICD-9-CM 696.1 by a dermatologist; v) at least one inpatient or outpatient claim for ICD-9-CM 696.1 or 696.0 (psoriatic arthritis); vi) at least one inpatient or two outpatient claims for ICD-9-CM 696.1 or 696.0; vii) at least two inpatient or outpatient claims for ICD-9-CM 696.1 or 696.0; and viii) at least one inpatient or outpatient claim for ICD-9-CM 696.1 or 696.0 by a dermatologist or rheumatologist. Since most patients with psoriatic arthritis also have psoriasis,(Gladman *et al*., 2005),(Love *et al*., 2007) our algorithms explored the use of ICD-9-CM codes for both psoriasis (696.1) and psoriatic arthritis (696.0). Provider specialty was determined using the Medicare provider specialty supplemental file. Algorithm (ii) was used for our main analyses. This algorithm was selected to minimize psoriasis misclassification, avoid limitation of the study population to more severe cases presenting to dermatologists, and minimize inclusion of those with concomitant psoriatic arthritis, since having arthritis may have driven therapy decisions and affected treatment patterns.

Psoriasis treatments

We examined the prevalence of topical therapies, phototherapy, and oral systemic and biologic medications used to treat psoriasis among all Medicare beneficiaries with psoriasis. The prevalence of phototherapy, oral systemics, and biologics among patients identified as having moderate to severe psoriasis was also determined. Topical therapies included corticosteroids, calcineurin inhibitors, vitamin D analogs, coal tar or anthralin, retinoids (i.e., tazarotene), and salicylic acid. Phototherapy included both ultraviolet B (UVB) and psoralen and ultraviolet A (PUVA). Oral systemic therapies included methotrexate, cyclosporine, and acitretin. Biologic therapies included adalimumab, alefacept, etanercept, infliximab, and ustekinumab.

Psoriasis severity

In the absence of direct measures of psoriasis severity in claims data, per convention, the receipt of phototherapy, oral systemic, or biologic was used as a proxy to define moderate to severe psoriasis.(Gelfand *et al*., 2006a; Gelfand *et al*., 2006b; Seminara *et al*., 2011; Wu *et al*., 2012) Mild psoriasis was defined by the absence of therapy or receipt of topical therapies only.

Variables

Patient and Medicare plan characteristics served as covariates in regression analyses and were summarized descriptively. Patient demographics and characteristics included age, sex, race, census region of residence, reason for Medicare eligibility (aged or disabled), and Part D LIS status. County-level socioeconomic characteristics included per-capita income, poverty rate, urban versus rural status, and low educational level. The density of dermatologists and adult primary care providers per number of residents in the patient's county of residence was used as a measure of availability of and/or access to dermatologists and primary care providers, respectively. Clinical variables included specific comorbid disease status including other autoimmune diseases for which biologic therapies are indicated (i.e., ankylosing spondylitis, inflammatory bowel disease, psoriatic arthritis, and rheumatoid arthritis), cardiovascular disease risk factors, an aggregate of atherosclerotic outcomes (i.e., cerebrovascular disease, myocardial infarction, and peripheral vascular disease), components of the Charlson comorbidity index,(Quan *et al*., 2005) and other measures of comorbidity including total number of non-psoriasis medications, and prescription drug hierarchical condition category (RxHCC) risk score. Each comorbid disease was defined by at least two inpatient or outpatient claims for the disease of interest. The RxHCC score was originally created using the RxHCC model to predict each Medicare beneficiary's total drug spending in the following year based on indicators for 197 medical conditions identified from Medicare claims.(Robst *et al*., 2007) Although the RxHCC risk score was designed for Medicare prescription drug plan payment purposes, it has been used to adjust for potential selection biases in medical and drug use studies among Medicare patients.(Donohue *et al*., 2012; Doshi *et al*., 2010; Li *et al*., 2012; Li *et al*., 2014) Furthermore, the RxHCC model was adapted from the hierarchical condition category (HCC) risk adjustment model which has been shown to be a better predictor of mortality than other comorbidity measures such as the Charlson and Elixhauser comorbidity indices.

(Li *et al*., 2010) Unlike the official RxHCC risk score which includes weights for age and sex, our score was based on medical conditions only, allowing us to independently examine age and sex effects in regression analyses. Medicare Part D plans cover drugs that are approved for self-administration (i.e., topicals, orals, and the self-administered biologics adalimumab and etanercept). Part D plan characteristics include type of Part D benefit (defined standard benefit, actuarially equivalent standard, basic alternative, and enhanced alternative). Except for the enhanced alternative benefit, all Part D benefits provide basic benefits which include defined standard coverage or benefits that are actuarially equivalent to the standard coverage. LIS is generally provided to Part D beneficiaries who are financially disadvantaged and allows for minimal out-of-pocket drug costs to those receiving the subsidy compared with non-LIS beneficiaries.

Analysis

We used descriptive statistics to calculate the prevalence of psoriasis claims and summarize demographic, socioeconomic, Medicare plan and comorbid disease characteristics, and psoriasis therapies. Multivariate logistic regressions adjusted for clustering at the Medicare plan level were used to identify the factors associated with biologic use. All variables except for psoriasis therapies were included in the logistic regressions in order to determine which factors were associated with biologic use; the aggregate atherosclerotic outcomes variable was included in place of individual cerebrovascular disease, myocardial infarction, and peripheral vascular disease variables. Parsimonious models removing clinically or statistically non-significant variables were also evaluated and produced similar results to the full regression models. Risk-adjusted rates were calculated from the full multivariate logistic regression model.

There were no missing data; variables with designated “other” or “unknown” values were included as such. Statistical significance was determined by a two-tailed p-value < 0.05. All analyses were performed using Stata (Version 13, StataCorp, College Station, TX, USA).

Protection of human subjects

This study was approved by the University of Pennsylvania Institutional Review Board and CMS (Data Use Agreement 25762). Per CMS Data Use Agreement, any data cells containing fewer than 11 beneficiaries were not shown. The study was conducted in accordance with the Declaration of Helsinki and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology guidelines.(von Elm *et al*., 2007)

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations

AIDS	acquired immune deficiency syndrome
CI	confidence interval
CMS	Centers for Medicare and Medicaid Services
HIV	human immunodeficiency virus
ICD-9-CM	International Classification of Diseases, Ninth Revision, Clinical Modification
IL	interleukin
LIS	low-income subsidy
OR	odds ratio
RxHCC	prescription drug hierarchical condition category

SD	standard deviation

Table 1

Claims-Based Psoriasis Prevalence[a]

Psoriasis Identification Algorithm	N	% (95% Confidence Interval)
ICD-9-CM 696.1 (Psoriasis)		
At least 1 inpatient or outpatient claim	9,017	1.13 (1.10-1.15)
At least 1 inpatient or 2 outpatient claims	4,925	0.62 (0.60-0.63)
At least 2 inpatient or outpatient claims	4,638	0.58 (0.56-0.60)
At least 1 inpatient or outpatient claim by dermatologist	4,096	0.51 (0.50-0.53)
ICD-9-CM 696.1 (Psoriasis) or 696.0 (Psoriatic Arthritis)		
At least 1 inpatient or outpatient claim	9,827	1.23 (1.20-1.25)
At least 1 inpatient or 2 outpatient claim	5,695	0.71 (0.69-0.73)
At least 2 inpatient or outpatient claims	5,398	0.68 (0.66-0.69)
At least 1 inpatient or outpatient claim by dermatologist or rheumatologist	4,772	0.60 (0.58-0.61)

[a]Of 799,607 beneficiaries in the 2011 5% Medicare sample.

Table 2

Psoriasis Patient Characteristics[a]

Characteristic	Number (%) N=4,638
Age, mean (SD)	68.6 (13.4)
Age (category)	
<65	1,237 (26.7)
65–69	934 (20.1)
70–74	912 (19.7)
75–79	681 (14.7)
≥80	874 (18.8)
Sex, male	2,002 (43.2)
Race	
White	4,118 (88.8)
Black	236 (5.1)
Latino	104 (2.2)
Other/Unknown	180 (3.9)
Census Region	
Northeast	1,113 (24.0)
Midwest	1,069 (23.0)
South	1,678 (36.2)
West	770 (16.6)
County-Level Characteristics	
Income, per capita/10,000, mean (SD)	4.0 (1.2)
County poverty rate,[b] mean (SD)	15.5 (5.3)
Residence in Urban County	3611 (78.2)
Residence in County with Low Educational Level[c]	520 (11.3)
Number of primary care providers[d] per 10,000 residents, mean (SD)	6.3 (3.0)
Number of dermatologists per 100,000 residents, mean (SD)	3.6 (3.6)
Medicare eligibility	
Aged	2,952 (63.6)
Disabled	1,237 (26.7)
Aged plus disabled	449 (9.7)
Low-income subsidy (LIS) status	
Full	1,838 (39.6)
Partial	47 (1.0)
None	2,709 (58.4)
Mixed	44 (0.9)
Comorbidities	

Characteristic	Number (%) N=4,638
AIDS/HIV	18 (0.39)
Autoimmune disease	
Ankylosing spondylitis	74 (1.6)
Inflammatory bowel disease	55 (1.2)
Rheumatoid arthritis	290 (6.3)
Rheumatologic disease	382 (8.2)
Cardiometabolic disease	
Cerebrovascular disease	497 (10.7)
Congestive heart failure	515 (11.1)
Diabetes	1,503 (32.4)
Dyslipidemia	2,776 (59.9)
Hypertension	3,137 (67.6)
Myocardial infarction	159 (3.4)
Obesity	431 (9.3)
Peripheral vascular disease	636 (13.7)
Atherosclerotic outcomes (aggregate of cerebrovascular disease, myocardial infarction, and peripheral vascular disease)	1,091 (23.5)
Hemiplegia or paraplegia	49 (1.1)
Liver disease	
Mild liver disease	208 (4.5)
Moderate to severe liver disease	27 (0.58)
Malignant disease	
Cancer	518 (11.2)
Metastatic solid tumor	37 (0.80)
Neuropsychiatric disease	
Dementia	134 (2.9)
Depression	794 (17.1)
Peptic ulcer disease	59 (1.3)
Psoriatic arthritis	436 (9.4)
Pulmonary disease, chronic	1,108 (23.9)
Renal disease	455 (9.8)
Non-Psoriasis Medications	
Number of 30-day supply equivalent prescriptions for non-psoriasis medications, mean (SD)	4.7 (3.4)
Type of Medicare Part D Plan[e]	
Basic	3,491 (75.3)
Enhanced	879 (19.0)
Unknown	268 (5.8)
RxHCC score, mean (SD)	1.0 (0.6)

AIDS, acquired immune deficiency syndrome; HIV, human immunodeficiency virus; LIS, low-income subsidy; RxHCC, prescription drug hierarchical condition category risk score; SD, standard deviation.

[a] Psoriasis is defined by at least two inpatient or outpatient claims for psoriasis (ICD-9-CM 696.1).

[b] County poverty rate is defined as the percentage of persons in the county living in poverty.

[c] County with low educational level is defined by at least 25% of residents not having a high school diploma or general educational development (GED) in the patient's county of residence.

[d] Primary care providers included medical providers practicing in the fields of general family medicine, general practice, and general internal medicine.

[e] Basic plans include defined standard benefit, actuarially equivalent standard, and basic alternative type of Part D plans. Enhanced plans include enhanced alternative type of Part D plans.

Table 3

Psoriasis Therapy Prevalence[a]

Therapy	Number (%)[b] N=4,638
Topicals[c]	3,551 (76.6)
Corticosteroids	3,477 (75.0)
Class I	1,846 (39.8)
Non-Class I	2,718 (58.6)
Calcineurin inhibitors	121 (2.6)
Vitamin D analogs	643 (13.9)
Retinoids	21 (0.45)
Salicylic acid	12 (0.17)
Phototherapy	324 (7.0)
Psoralen plus Ultraviolet A	34 (0.73)
Excimer laser	126 (2.7)
Oral systemics	664 (14.3)
Methotrexate	569 (12.3)
Cyclosporine	22 (0.47)
Acitretin	90 (1.9)
Biologics[d]	471 (10.2)
Part B (physician-administered)	146 (3.1)
Infliximab	107 (2.3)
Ustekinumab	37 (0.80)
Part D (self-injectables)	370 (8.0)
Adalimumab	161 (3.5)
Etanercept	209 (4.5)

[a] Psoriasis is defined by at least two inpatient or outpatient claims for psoriasis (ICD-9-CM 696.1).

[b] Percentages do not equal 100 because patients may have received more than one therapy.

[c] Coal tar/anthralin use was examined but not reported separately per Centers for Medicare and Medicaid Services (CMS) data use agreement due to cell size of 10 or less.

[d] Alefacept was examined but not reported separately per CMS data use agreement due to cell size of 10 or less.

Table 4

Psoriasis Severity

Severity Defined by Therapy	Number (%)[a] N = 4,638
Mild (n=3,289; 70.9%)	
No therapy	763 (23.2)[b]
Topicals only	2,526 (76.8)[b]
Moderate to Severe[c] (n=1,267; 27.3%)	
Phototherapy	324 (25.6)[d]
Oral Systemics	664 (52.4)[d]
Methotrexate	569 (44.9)[d]
Cyclosporine	22 (1.7)[d]
Acitretin	90 (7.1)[d]
Biologics	471 (37.2)[d]
Adalimumab	161 (12.7)[d]
Etanercept	209 (44.4)[d]
Infliximab	107 (16.5)[d]
Ustekinumab	37 (2.9)[d]
Unknown (n=82; 1.8%)	

[a] Percentages do not equal 100 because patients may have received more than one therapy.

[b] Percentages are calculated amongst those with mild psoriasis.

[c] Alefacept was included as a biologic therapy to identify moderate to severe psoriasis but not reported separately per CMS data use agreement due to cell size of 10 or less.

[d] Percentages are calculated amongst those with moderate to severe psoriasis.

Table 5

Factors Associated with Biologic Use Among Patients Receiving Therapy Indicated for Moderate to Severe Psoriasis[a]

Characteristic	Status	Unadjusted Odds Ratio (95% Confidence Interval)	Adjusted Odds Ratio[b] (95% Confidence Interval)	Adjusted Rate, % (95% Confidence Interval)
Factors Associated with Higher Odds of Biologic Use				
Dermatology Provider Density	3.4 per 100,000 (sample mean)	1.01 (0.98-1.04)	1.08 (1.01-1.16)	37.4 (35.3-39.5)
	4.4 per 100,000 (one unit increase)			38.9 (36.4-41.3)
Residence in Urban County	No	Reference		31.5 (26.9-36.1)
	Yes	1.22 (0.94-1.60)	1.54 (1.13-2.11)	39.2 (36.8-41.7)
Ankylosing Spondylitis	No	Reference		37.3 (35.2-39.4)
	Yes	2.52 (1.24-5.09)	2.26 (1.13-4.53)	52.5 (39.2-65.9)
Inflammatory Bowel Disease	No	Reference		37.3 (35.2-39.4)
	Yes	7.46 (2.29-24.3)	8.11 (1.91–34.5)	75.6 (53.5-97.7)
Psoriatic Arthritis	No	Reference		30.7 (28.2-33.2)
	Yes	3.71 (2.85-4.83)	3.79 (2.74–5.24)	57.3 (51.8-62.8)
Renal Disease	No	Reference		36.1 (33.8-38.4)
	Yes	1.45 (1.00-2.11)	2.03 (1.24–3.35)	49.5 (40.6-58.5)
Factors Associated with Lower Odds of Biologic Use				
Primary Care Provider Density	6.2 per 10,000 (sample mean)	0.98 (0.94-1.01)	0.92 (0.86-0.98)	36.9 (34.8-39.1)
	7.2 per 10,000 (one unit increase)			35.8 (33.4-38.1)
Part D Low-Income Subsidy	Full	Reference		50.6 (44.9-56.3)
	None	0.36 (0.29-0.45)	0.30 (0.19–0.46)	27.2 (23.5-30.9)
Race	White	Reference		38.2 (35.9-40.5)
	Black	0.55 (0.31-0.99)	0.31 (0.16–0.60)	19.8 (11.4-28.1)
Cancer	No	Reference		38.2 (35.9-40.5)
	Yes	0.38 (0.26-0.56)	0.47 (0.31–0.72)	25.7 (19.4-31.9)
Dementia	No	Reference		37.7 (35.5-39.8)
	Yes	0.41 (0.13-1.28)	0.26 (0.07-0.97)	17.2 (2.1-32.3)

[a] Moderate to severe psoriasis is identified by receipt of either phototherapy, oral systemic or biologic therapy.

[b] Based on a multivariable logistic regression model including the following covariates: age, sex, race, census region of residence, county-level per-capita income, county-level poverty rate, county-level urban versus rural status, county-level low educational level, density of dermatologists and adult primary care providers per number of residents in the patient's county of residence, part D plan type, low-income subsidy status, number of non-psoriasis medications, RxHCC score, and comorbid disease status including all components of the Charlson comorbidity index, autoimmune diseases for which biologic therapies are indicated, cardiovascular risk factors, and aggregate of atherosclerotic outcomes.