Impact of Early Treatment on Healthcare Utilization and Risk of Osteoarthritis in Psoriasis Patients

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Abstract
Background: Psoriasis is a chronic immune-mediated inflammatory disorder with systemic implications, often leading to comorbidities such as psoriatic arthritis (PsA). Delayed treatment can exacerbate disease progression and increase healthcare utilization.
Objectives: This retrospective cohort study aims to evaluate the impact of early treatment initiation on healthcare utilization among psoriasis patients and explore the association between psoriasis and the risk of developing osteoarthritis (OA).
Methods: The study utilized de-identified patient data from TriNetX spanning a 10-year period (2013-2023). Psoriasis patients were grouped by age and categorized based on the timing of treatment initiation (within 90, 91-180, 181-270, and 271-365 days post-diagnosis). Healthcare utilization was analyzed, including ambulatory, emergency, and inpatient visits. Additionally, the incidence of OA among psoriasis patients was compared to a control group without underlying illnesses.
Results: Delayed treatment initiation was associated with significantly increased healthcare utilization across all age groups. Patients who received treatment within 90 days post-diagnosis had lower healthcare utilization compared to those who delayed treatment. Furthermore, patients with psoriasis demonstrated a higher incidence of OA compared to the control group, indicating a potential shared inflammatory mechanism between the two conditions.
Conclusions: Early treatment of psoriasis reduces healthcare utilization and may help mitigate disease progression and associated comorbidities, including OA. Proactive management strategies are crucial in reducing the burden on healthcare systems and improving long-term patient outcomes. Further research into shared inflammatory pathways between psoriasis and OA is warranted to develop targeted therapies.

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Keywords: Psoriasis, Healthcare Utilization, Osteoarthritis

1. Introduction

Psoriasis is a chronic, immune-mediated inflammatory disorder that manifests primarily as erythematous plaques covered with silvery scales. These plaques typically localize on extensor surfaces, the scalp, and the lumbosacral region [1, 2, 3]. Histologically, psoriasis is distinguished by the hyperproliferation and abnormal differentiation of keratinocytes, leading to characteristic epidermal thickening (hyperkeratosis). This thickening is accompanied by elongated rete ridges, dilated and tortuous capillaries within the dermal papillae, and fine fibrillary collagen bundles [5]. The aberrant keratinocyte behavior results in parakeratosis, where nuclei are retained in the stratum corneum, contributing to the scaly appearance of psoriatic plaques [5]. Furthermore, increased mitotic activity in the basal and suprabasal layers further underscores the hyperproliferative nature of this disease [5].

Psoriasis is not limited to cutaneous manifestations; it is a systemic condition that can impact multiple organ systems. Notably, it affects the joints in a substantial proportion of patients, leading to psoriatic arthritis (PsA) in up to 40% of cases. PsA is characterized by chronic joint inflammation, which can result in significant joint damage and disability if not managed appropriately [3]. Psoriasis can also involve the eyes, with ocular manifestations occurring in approximately 10% of patients, predominantly women, though such involvement is almost always associated with cutaneous symptoms [1].

The systemic nature of psoriasis is further evidenced by its association with a broad spectrum of comorbidities, including cardiovascular diseases, metabolic syndrome, and gastrointestinal disorders. Patients with psoriasis are at an elevated risk for conditions such as hyperlipidemia, hypertension, coronary artery disease, and type 2 diabetes, all of which contribute to the development of metabolic syndrome. This syndrome is observed at double the rate in psoriasis patients compared to the general population [3]. Chronic systemic inflammation, a hallmark of psoriasis, has been implicated in increased vascular inflammation, which may accelerate the onset of cardiovascular events such as myocardial infarction and stroke.

Epidemiologically, psoriasis affects both males and females, with an earlier onset in females and those with a family history of the disease. The age of onset typically follows a bimodal distribution, with peaks occurring between the ages of 30-39 years and 60-69 years in men, while women generally experience onset approximately a decade earlier [6]. In the United States, psoriasis affects about 3.0% of the adult population, translating to approximately 7.6 million individuals [6]. There are notable racial and ethnic disparities in the prevalence of psoriasis, with Caucasian individuals having the highest prevalence at 3.6%, whereas African American individuals show the lowest prevalence at 1.5% [6].

For mild to moderate psoriasis, initial treatment typically involves topical therapies such as coal tar, corticosteroids, vitamin D analogs, and retinoids, which aim to reduce inflammation, normalize keratinocyte differentiation, and alleviate symptoms [1]. However, in cases where the disease is more severe or resistant to topical treatments, phototherapy and systemic therapies become necessary. Phototherapy options include narrowband ultraviolet B (NB-UVB) and psoralen plus ultraviolet A (PUVA) therapy, with NB-UVB being preferred due to its effectiveness and favorable safety profile, making it suitable for a wide range of patients, including children and pregnant women [4]. Systemic therapies, including methotrexate, cyclosporine, and acitretin, are employed in more severe cases or when phototherapy is inadequate.

Recent advancements in biologic therapies have significantly enhanced the treatment landscape for moderate to severe psoriasis. These therapies include inhibitors of tumor necrosis factor (TNF), interleukin-17 (IL-17), and interleukin-23 (IL-23), which offer targeted immune modulation and have demonstrated substantial efficacy in controlling psoriatic disease [2, 4, 6].

Beyond its physical manifestations, psoriasis has a profound impact on the psychological well-being of patients. The chronic and visible nature of the disease, coupled with its associated comorbidities, contributes to a high prevalence of depression, anxiety, and suicidal ideation among psoriasis patients [3]. The psychological burden of psoriasis is comparable to that of other major chronic diseases, such as myocardial infarction and cancer [3].

Given the systemic nature of psoriasis and its extensive impact on patient health, early intervention may be crucial in managing both the disease and its associated comorbidities. Early treatment has the potential not only to control skin symptoms but also to prevent or mitigate the development of comorbidities such as PsA. The effectiveness of early treatment in reducing healthcare utilization—a marker of disease control and a burden on healthcare systems—remains an area of significant clinical interest. High healthcare utilization can indicate poorly controlled disease, leading to frequent visits to dermatologists, rheumatologists, and other healthcare providers, thereby increasing the burden on both patients and healthcare systems. Although early treatment for psoriasis is hypothesized to help manage the disease more effectively and reduce comorbidities, its actual impact on healthcare utilization has not been conclusively determined.

This study aims to assess the impact of early treatment on healthcare utilization in psoriasis patients, examine the effect of early intervention on existing comorbidities such as PsA, and investigate the potential association between psoriasis and the development of osteoarthritis (OA), a comorbidity not widely reported in current literature. By evaluating whether early treatment can reduce the need for frequent healthcare visits, this study seeks to provide evidence for more proactive management strategies that not only improve patient outcomes but also reduce the strain on healthcare resources.

2. Methods

In this retrospective cohort study, we examined healthcare utilization among psoriasis patients from January 1, 2013, to January 1, 2023. The data for this study were sourced from TriNetX, an open-access health research network, which provided de-identified patient information from healthcare organizations across the United States. No additional patient consent was required due to the use of de-identified data, and this study complied with all relevant HIPAA regulations.

The study population consisted of patients with a confirmed diagnosis of psoriasis, categorized into four age groups: 0-18 years, 19-35 years, 36-55 years, and 56-73 years. We analyzed the timing of treatment initiation, which was classified into four intervals following the initial diagnosis: within 90 days, 91-180 days, 181-270 days, and 271-365 days. The treatments under evaluation included a range of topical agents, systemic therapies, and biologic agents. Topical agents included clobetasol, tacrolimus, betamethasone, calcipotriene, salicylic acid, pimecrolimus, and anthralin. Systemic therapies consisted of methotrexate, cyclosporine, apremilast, and acitretin. The biologic agents assessed were etanercept, secukinumab, infliximab, adalimumab, ustekinumab, guselkumab, ixekizumab, tildrakizumab, brodalumab, certolizumab pegol, risankizumab, and bimekizumab.

The primary outcome measured was the extent of healthcare utilization by these patients after at least three months of treatment. The types of healthcare visits considered included ambulatory visits, emergency visits, and inpatient encounters. Patients whose healthcare utilization was solely for routine psoriasis follow-up appointments were excluded from the analysis.

A similar methodology was applied to patients diagnosed with psoriatic arthritis (PsA), who were also divided into the

same age groups and treatment initiation intervals. The healthcare utilization for PsA patients was analyzed across the same types of visits after three months of treatment, with similar exclusions for routine PsA follow-up visits.

Additionally, we assessed the incidence of osteoarthritis (OA) among patients diagnosed with psoriasis by determining how many developed OA within a 5-year period following their initial psoriasis diagnosis. This incidence was then compared to a control group of healthy patients with no underlying illnesses, including psoriasis, to evaluate the relative risk of OA development.

Statistical analysis was performed to determine the significance of the findings. An Analysis of Variance (ANOVA) was used to assess the correlation between early treatment initiation and healthcare utilization while controlling for factors such as sex and age. To compare the incidence of OA between psoriasis patients and the control group, a T-test was conducted. Statistical significance was set at a p-value of less than 0.05. All figures were generated in Microsoft Excel (version 16.77).

3. Results

Healthcare utilization following the initial diagnosis of psoriasis was evaluated across four distinct age groups, with treatment initiation categorized by intervals based on days post-diagnosis (Figure 1). In the 0-18 years age group, healthcare utilization was 15.75% for those who initiated treatment within the first 90 days post-diagnosis. Utilization rates increased to 22.43% when treatment was delayed to 91-180 days, further rising to 23.53% for treatment initiation within 181-270 days, and peaking at 23.84% for those treated between 271-365 days. A similar pattern was observed in the 19-35 years age group, albeit with lower overall utilization rates. This group exhibited an initial utilization rate of 12.90% for treatment within 90 days, which gradually stabilized between 17.36% and 17.47% for later treatment initiation intervals. In the 36-55 years age group, healthcare utilization increased from 16.05% for treatment initiated within 90 days to 19.55% for those treated within 181-270 days, followed by a slight decline to 18.90% for treatment initiated within 271-365 days. The 56-73 years age group demonstrated the highest initial utilization rates, beginning at 19.21% for early treatment, escalating to 23.24% for treatment within 91-180 days, and then decreasing slightly as treatment was delayed.

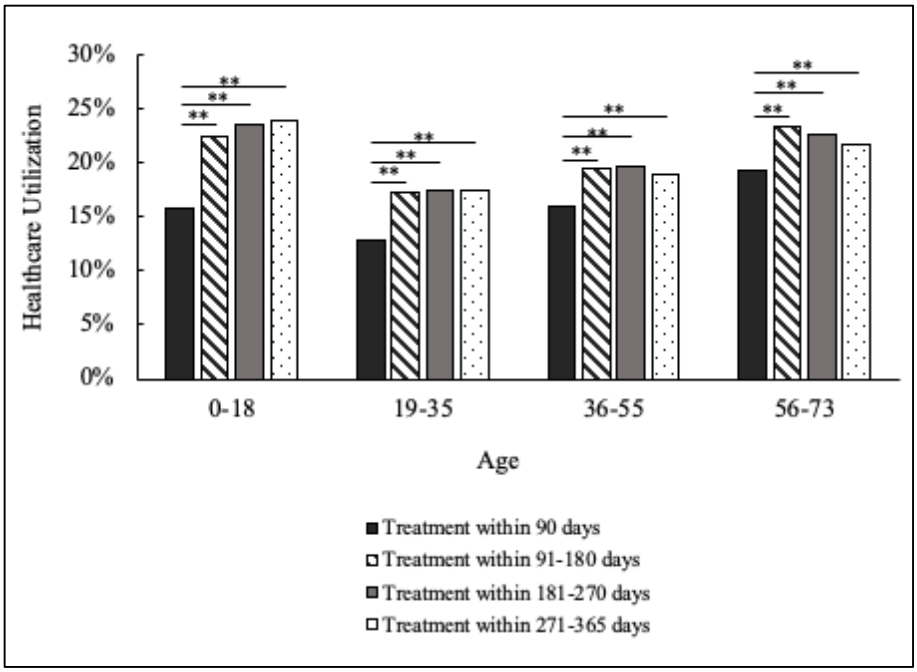

Fig 1: Healthcare Utilization by Age Group in Psoriasis Patients Based on Timing of Treatment Initiation. Statistically significant differences ($p < 0.05$) between treatment intervals within each age group are indicated by asterisks (**)

Subsequently, we examined healthcare utilization in patients diagnosed with Psoriatic Arthritis (PsA) following their psoriasis diagnosis to determine whether similar patterns would emerge (Figure 2). In the 0-18 years age group, healthcare utilization was initially 3.28% for those treated within 90 days post-diagnosis, increasing to 5.64% for treatments initiated within 91-180 days, 6.59% within 181-270 days, and peaking at 6.61% for treatment initiated within 271-365 days. The 19-35 years group showed a similar upward trend, with utilization rates starting at 5.83% within 90 days and peaking at 10.67% for treatment within 181-270 days. In the 36-55 years age group, healthcare utilization increased sharply from 9.80% for early treatment to 15.76% for treatment initiated between 271-365 days. The oldest cohort, 56-73 years, exhibited a similar pattern, with rates increasing from 9.71% within the first 90 days to 14.95% for later treatment initiation. These findings suggest that while early treatment may help manage initial healthcare needs, the progression of PsA leads to increasing healthcare utilization over time.

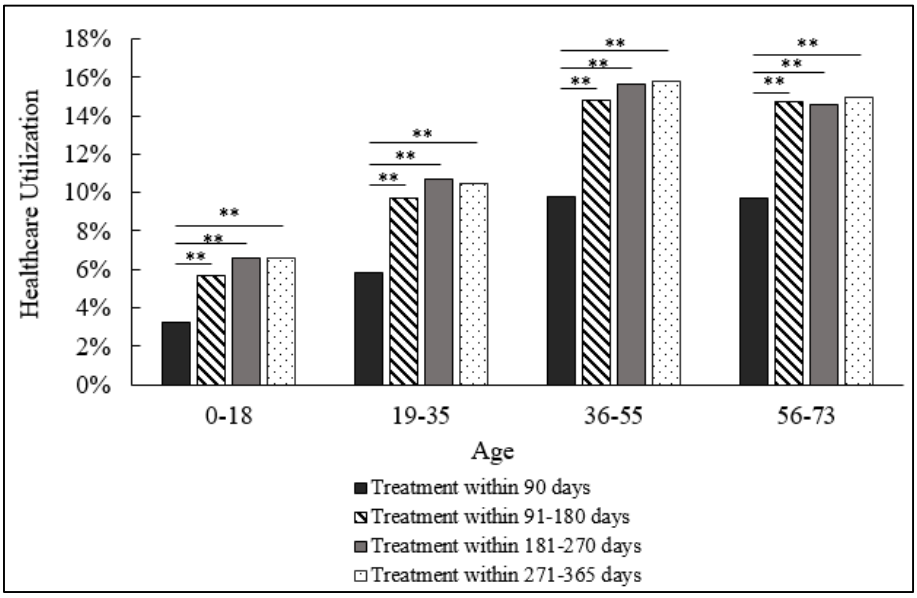

Fig 2: Healthcare Utilization in Patients with Psoriatic Arthritis (PsA) Based on Timing of Treatment Initiation Across Different Age Groups. Statistically significant differences ($p < 0.05$) between treatment intervals within each age group are indicated by asterisks (**)

Recognizing that Psoriatic Arthritis (PsA) is a well-documented comorbidity associated with psoriasis, we further investigated whether psoriasis patients are at an elevated risk for other forms of arthritis, specifically osteoarthritis (OA). To assess this, we compared the incidence of OA in patients with psoriasis to a control group of individuals without any underlying illnesses, including psoriasis. Our analysis revealed a significantly higher occurrence of OA in the psoriasis group, with 12.88% of patients developing OA within five years of their psoriasis diagnosis, compared to 10.00% in the control group (Figure 3). This finding indicates that individuals with psoriasis are not only at heightened risk for PsA but also may have an increased susceptibility to developing other forms of arthritis, such as OA, underscoring the importance of comprehensive management strategies for these patients.

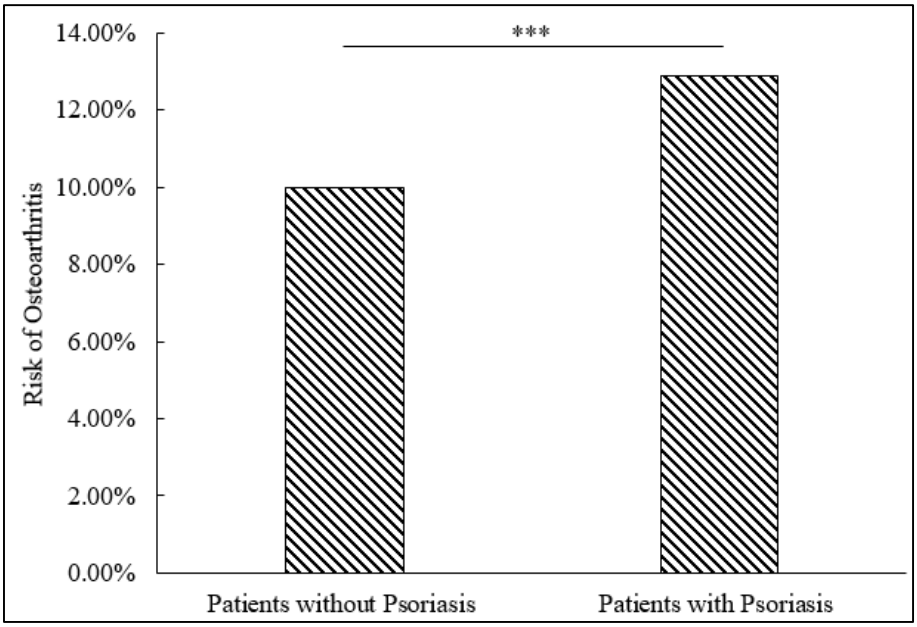

Fig 3: Increased Risk of Osteoarthritis in Patients with Psoriasis Compared to Patients without Psoriasis. Statistically significant differences ($p < 0.001$) between groups are indicated by asterisks (***)

4. Discussion

Our analysis demonstrates a clear correlation between delayed treatment initiation for psoriasis and increased healthcare utilization across all age groups. When treatment is postponed, the disease often progresses unchecked, leading to more severe symptoms, frequent flares, and an increased likelihood of developing comorbidities such as psoriatic arthritis (PsA) and osteoarthritis (OA). This progression inevitably results in higher healthcare utilization [7]. As psoriasis worsens, managing the disease becomes more complex, often necessitating multidisciplinary care. Patients with delayed treatment face more severe psoriasis manifestations, including larger plaques, increased discomfort, and reduced quality of life [8]. Moreover, inadequately managed psoriasis exacerbates the psychological burden, with higher rates of depression and

anxiety due to the chronic and visible nature of the disease [9]. On the other hand, early intervention offers numerous benefits. Timely treatment can effectively control the disease, reducing the risk of progression and preventing the onset of related comorbidities. For example, early use of systemic or biologic therapies may mitigate the inflammation driving both psoriasis and PsA, reducing joint damage and disability. Beyond the physical benefits, early management significantly enhances psychological well-being by stabilizing symptoms and improving overall quality of life. This underscores the importance of early intervention in not only controlling the disease but also reducing its broader impact on a patient's mental health.

The increased risk of developing osteoarthritis (OA) in patients with psoriasis can be attributed to the shared pathological mechanisms between these two conditions, particularly their inflammatory and immune-mediated pathways. Both diseases are characterized by chronic inflammation, and although the inflammatory responses are driven by different factors, they involve similar mechanisms. In psoriasis, an immune-mediated response involving T cells, specifically T helper type 1 (Th1) and T helper type 17 (Th17) cells, releases pro-inflammatory cytokines such as tumor necrosis factor-alpha (TNF-α), interleukin-17 (IL-17), and interleukin-23 (IL-23) [10, 11]. While IL-23 is more specific to psoriasis, TNF-α and IL-17 are also critical in OA, where they contribute to cartilage degradation, synovial inflammation (synovitis), and pain [11, 12]. The presence of shared cytokines like TNF-α and IL-17 in both conditions suggests a common inflammatory pathway that could link the development of OA in individuals already suffering from psoriasis [12]. The involvement of key signaling pathways, such as the nuclear factor kappa-light-chain-enhancer of activated B cells (NF-κB) and mitogen-activated protein kinase (MAPK) pathways, is another significant similarity between psoriasis and OA. In psoriasis, the NF-κB pathway is activated in keratinocytes and immune cells, leading to the production of pro-inflammatory cytokines [10]. Similarly, in OA, NF-κB is activated in chondrocytes and synovial cells, driving the catabolic processes that degrade cartilage and perpetuate inflammation [11, 12]. The MAPK pathway, which is involved in inflammatory signaling in both diseases, contributes to keratinocyte proliferation and cytokine production in psoriasis and to the response to mechanical stress and inflammation in OA, leading to cartilage breakdown [10, 11]. The activation of these pathways in both conditions suggests that the systemic inflammation and immune dysregulation in psoriasis could similarly influence joint tissues, thereby promoting the development of OA [12].

Our findings also have important implications for healthcare policy, particularly in terms of reducing the burden on healthcare systems. Psoriasis is associated with high healthcare utilization, especially when treatment is delayed, leading to increased costs and resource strain. Early intervention could alleviate this burden by controlling the disease more effectively, thereby reducing the need for frequent specialist visits. This issue is particularly relevant for underserved populations who may have limited access to specialized care, resulting in delayed treatment and poorer outcomes. Socioeconomic factors play a significant role in these delays, as patients from lower-income backgrounds or those without adequate health insurance are less likely to seek early treatment.

5. Conclusion

This study underscores the potential importance of early treatment initiation in managing psoriasis and reducing healthcare utilization. Our analysis demonstrated that delayed treatment is associated with higher healthcare utilization across all age groups, which could suggest that timely intervention may help manage the disease more effectively. Additionally, patients with psoriasis exhibited a higher incidence of osteoarthritis, possibly due to shared inflammatory mechanisms, including cytokine activity and signaling pathways. These findings highlight the need for further research into the benefits of early intervention and comprehensive management strategies that can address both psoriasis and its associated comorbidities. Improved access to care and early treatment could help reduce the burden on healthcare systems and improve long-term patient outcomes.

6. Future Directions

While our study provides valuable insights into the impact of early treatment on healthcare utilization and the risk of OA, it also raises several questions for future research. Longitudinal studies are needed to assess the long-term outcomes of early intervention, particularly regarding the development and progression of comorbidities. Moreover, further investigation into the specific inflammatory pathways shared between psoriasis and OA could provide a clearer understanding of how these conditions are linked and inform the development of targeted therapies that address both skin and joint manifestations.

7. Data Availability

The anonymized data collected is available as open data via the Science Data Bank repository: 10.57760/sciencedb.14216

9. Declarations

1. Competing interests

No funding was received to assist with the preparation of this manuscript. Additionally, the authors have no relevant financial or non-financial interests to disclose.

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