



ORIGINAL ARTICLE

Impact vs. Access: A Multifaceted Analysis of the Tensions and Trends in Rheumatology Publishing

Etki ve Erişim: Romatoloji Yayıncılığındaki Eğilimlerin ve Trendlerin Çok Yönlü Analizi

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Highlights

- **Accessibility Trends:** Lower-quartile journals (Q3 and Q4) prioritize accessibility, exhibiting significantly higher open access rates compared to top-tier publications.
- **Impact Correlates:** While traditional and normalized impact metrics (IF and JCI) demonstrate strong internal consistency, they show no significant correlation with open access status or publication speed, suggesting that visibility and speed do not directly translate to citation impact in rheumatology.
- **Predictive Factors:** Machine learning analysis (Random Forest) identifies Journal Impact Factor Rank, Immediacy Index, and JCI as the primary predictors of a rheumatology journal's Impact Factor.
- **Prestige Hierarchy:** Cluster analysis reveals a distinct stratification in the field, isolating a specific high-impact group of journals led by Nature Reviews Rheumatology.

ABSTRACT

Aim: This study conducts a comprehensive bibliometric analysis of rheumatology journals to elucidate publication trends, scholarly impact, and accessibility dynamics within this critical medical field.

Materials and Methods: In May 2025, we evaluated 42 journals with "Rheumatology", "Rheum" or "Reum" in their titles using data from Web of Science, Journal Citation Reports, and publisher websites. Thirty-eight parameters, including Impact Factor (IF) 2023, Journal Citation Indicator (JCI), Article Processing Charges (APC), and open access percentages, were analyzed. Statistical methods encompassed Spearman correlations, Wilcoxon tests, and machine learning approaches, including Random Forest regression and K-means/hierarchical clustering, implemented in Python.

Results: England (23.81%) and the USA (21.43%) dominate journal origins, with English as the primary language (85.71%). Indexing splits between SCIE (54.76%) and ESCI (45.24%), while 2023 quartiles favor Q4 (28.57%) and Q3 (23.81%). Mean IF 2023 was 3.78 (median 2.10), JCI 0.96 (median 0.57), and APC \$786.69 (median \$0). Q3/Q4 journals showed higher open access rates (74.77%, 56.17%). IF 2023 correlated strongly with JCI ($p=0.977$, $p<3.17e-27$) but not open access ($r=-0.165$, $p=0.316$). Random Forest regression (OOB=0.806) identified JIF Rank, Immediacy Index, and JCI as key IF predictors. Clustering isolated a high-impact group (median IF 17.65), which includes Nature Reviews Rheumatology.

Conclusions: This analysis highlights rheumatology's dynamic scholarly landscape, marked by geographic leadership, open access trends, and prestige hierarchies. Machine learning-driven insights advocate for AI-guided publishing strategies to enhance equity and impact. Despite limitations, such as reliance on 2023 data and title-based journal selection, this study offers valuable guidance for researchers, editors, and policymakers shaping rheumatology's future.

Keywords: Bibliometrics, impact factor, journal citation indicator, journal indexing, open access, rheumatology,

ÖZ

Amaç: Bu çalışma, romatoloji dergilerinin kapsamlı bir bibliyometrik analizini gerçekleştirerek; bu kritik tıp alanındaki yayın eğilimlerini, akademik etkiyi ve erişilebilirlik dinamiklerini ortaya koymayı amaçlamaktadır.

Gereç ve Yöntemler: Çalışma kapsamında, Mayıs 2025 tarihinde Web of Science, Journal Citation Reports ve yayıncı web sitelerinden elde edilen veriler kullanılmıştır. Başlığında "Rheumatology", "Rheum" veya "Reum" ibareleri geçen 42 dergi değerlendirmeye alınmıştır. 2023 yılı Etki Faktörü (IF), Dergi Atıf Göstergesi (JCI), Makale İşleme Ücretleri (APC) ve açık erişim yüzdeleri dahil olmak üzere toplam 38 parametre analiz edilmiştir. İstatistiksel değerlendirmelerde Spearman korelasyonu ve Wilcoxon testlerinin yanı sıra; Python kullanılarak Random Forest regresyonu ve K-means/hiyerarşik kümeleme gibi makine öğrenimi yöntemleri uygulanmıştır.

Bulgular: Dergilerin menşei incelendiğinde İngiltere (%23,81) ve ABD'nin (%21,43) baskın olduğu, yayın dilinin ise ağırlıklı olarak İngilizce (%85,71) olduğu görülmüştür. Dizinlenme durumu SCIE (%54,76) ve ESCI (%45,24) arasında dağılım gösterirken; 2023 çeyrek dilimlerinde Q4 (%28,57) ve Q3 (%23,81) grubu dergilerin çoğunlukta olduğu saptanmıştır. Ortalama IF 2023 değeri 3,78 (medyan 2,10), JCI 0,96 (medyan 0,57) ve APC 786,69 \$ (medyan 0 \$) olarak bulunmuştur. Q3 ve Q4 grubu dergilerin daha yüksek açık erişim oranlarına (%74,77 ve %56,17) sahip olduğu belirlenmiştir. IF 2023 değeri, JCI ile güçlü bir korelasyon gösterirken ($p=0,977$, $p<3,17e-27$), açık erişim durumu ile anlamlı bir korelasyon göstermemiştir ($r=-0,165$, $p=0,316$). Random Forest regresyon analizi (OOB=0,806); JIF Sıralaması, Anında Erişim İndeksi (Immediacy Index) ve JCI parametrelerini, Etki Faktörünün (IF) temel belirleyicileri olarak tanımlamıştır. Kümeleme analizi ise, Nature Reviews Rheumatology'yi de içeren yüksek etkili (medyan IF 17,65) ayrı bir grubu izole etmiştir.

Sonuç: Bu analiz, coğrafi liderlik, açık erişim eğilimleri ve prestij hiyerarşileri ile karakterize edilen romatoloji alanındaki dinamik akademik manzarayı vurgulamaktadır. Makine öğrenimi destekli bulgular, yayıncılıkta eşitliği ve etkiyi artırmak adına yapay zeka rehberliğindeki stratejilerin önemine işaret etmektedir. Sadece 2023 verilerine dayanması ve başlık bazlı dergi seçimi gibi kısıtlılıklarına rağmen bu çalışma; romatolojinin geleceğine yön veren araştırmacılar, editörler ve politika yapıcılar için değerli bir rehber niteliğindedir.

Anahtar Kelimeler: Açık erişim, bibliyometri, dergi atıf göstergesi, dergi dizinleme, etki faktörü, romatoloji

Introduction

Rheumatology, a vital medical discipline, tackles the immense challenges posed by musculoskeletal and autoimmune diseases, which affect millions worldwide and demand robust research efforts [1–4]. This dynamic field generates a wealth of knowledge, with academic journals serving as critical channels for sharing groundbreaking findings and shaping evidence-based clinical practice [5]. By analyzing these publications through bibliometrics – a well-established method for tracking metrics like Impact Factor and Journal Citation Indicator – we gain insights into publication trends, scholarly impact and aspects like open access and database indexing [6–8]. Such analysis underscores the pivotal role of these journals in advancing rheumatology's academic landscape.

Bibliometric evaluation, a recognized method, reveals key trends and scholarly contributions within specialized fields like rheumatology [4, 9]. Despite the critical role of rheumatology journals, no comprehensive study has deeply explored their publication dynamics. Our work fills this gap by conducting a detailed bibliometric analysis of journals with “Rheumatology”, “Rheum” or “Reum” in their titles. Examining 38 parameters, including Impact Factor, Journal Citation Indicator [8, 10], Article Processing Charges and PubMed/MEDLINE coverage, this study uncovers trends in accessibility and influence, offering fresh perspectives for researchers, clinicians and publishers navigating this vital domain [6, 7, 10].

Our cross-sectional analysis explores core rheumatology journals using data from Web of Science, Journal Citation Reports and publisher websites. By evaluating a wide range of metrics, this study provides practical guidance for researchers selecting publication venues, offers editors context for managing their journals and equips policymakers with insights to shape access strategies [5, 6, 8, 11–13]. Understanding factors like impact metrics and open access is key to advancing rheumatology [12, 14, 15]. This work serves as a unique resource, bridging gaps and informing decisions across the academic and clinical landscape.

Materials and Methods

Data Collection

This study was designed as an observational, cross-sectional bibliometric analysis to comprehensively evaluate the characteristics of rheumatology journals. Data collection was systematically conducted in May 2025, leveraging multiple authoritative sources to ensure accuracy and relevance.

The primary data sources included the Web of Science (WoS) Master Journal List (<https://mjl.clarivate.com/search-results>) and the Journal Citation Reports (JCR) provided by Clarivate (<https://jcr.clarivate.com/>). Journals were selected based on the presence of “Rheumatology”, “Rheum” or “Reum” in their titles, ensuring a targeted focus on rheumatology-specific

publications, analogous to similar bibliometric studies. Additional data were gathered from journal websites and the National Library of Medicine (NLM) journal database to address specific metrics, such as publication timelines and indexing status.

The dataset comprised 38 parameters, reflecting a multidimensional perspective on journal characteristics: Journal Title, Impact Factor (IF) 2022, Impact Factor 2022 (Excluding Self-Citations), Number of Citations 2022 (for IF), Number of Citable Items 2022 (for IF), Total Citations 2022, Open Access Percentage 2022, Impact Factor 2023, Impact Factor 2023 (Excluding Self-Citations), Number of Citations 2023 (for IF), Number of Citable Items 2023 (for IF), Total Citations 2023, Open Access Percentage 2023, Journal Impact Factor (JIF) Rank 2023, Article Influence Score (AIS) 2023, 5-Year Impact Factor 2023, Immediacy Index (Immi) 2023, Requires Author Payment (1=Yes, 0=No), Article Processing Charge (APC) (USD), Open Access Fee (USD), Average Days Submission to Publication, ISSN, Initial Year of Publication, Frequency, Issues Per Year, Country, Primary Language, Index (SCIE/ESCI), Journal Citation Indicator (JCI) 2023, Journal Citation Indicator 2022, Indexed in Medline (1=Yes, 0=No), Covered by PubMed (1=Yes, 0=No), PubMed Coverage Start Year, Total Citable Articles 2023, Quartile 2022, Quartile 2023, Publisher, Website. These parameters enabled a thorough bibliometric analysis of journal impact, accessibility and operational characteristics.

Bibliometric indicators, including Journal IF, JCI, AIS, Immi and quartile rankings (Q1–Q4) for 2022 and 2023, were extracted from WoS and JCR. Journal-specific metadata, such as country of publication, primary language, publisher and indexing status (SCIE/ESCI), were retrieved from the WoS Master Journal List to provide a comprehensive profile of each journal.

Publication timelines were assessed by manually reviewing individual journal websites. For each journal, we identified the most recent 10 original research articles (where feasible) and recorded their submission and publication dates. The average time to publication was calculated as the interval between these dates, offering insights into journal processing efficiency. When fewer than 10 original articles were available, all recent research articles were included.

APCs and payment requirements were determined through a meticulous review of each journal's official website, focusing on author guidelines, submission policies and open access sections. For journals with per-page fee structures, APCs were estimated by assuming an average article length of 8 pages and multiplying the per-page fee by 8, ensuring consistency in cost comparisons. Financial data were recorded as reported in May 2025, reflecting current pricing structures.

PubMed and MEDLINE coverage were evaluated through targeted queries in the NLM journal database, cross-referenced with PubMed's journal

listings. WoS data analysis further confirmed indexing status, ensuring robust verification of inclusion in these databases. All data collection activities were finalized in May 2025, ensuring the dataset's currency and relevance.

Statistical Analysis

All analyses were performed in Python 3.10 (Pandas, NumPy, SciPy, scikit-learn, Matplotlib, Seaborn), providing an open, reproducible environment for data handling, statistics and visualization.

Data Preparation

The raw Excel file of rheumatology-journal metrics was imported, common text indicators of missingness were converted to NaN, and numeric strings were standardized (comma → dot) before casting to numeric types. Categorical fields (e.g., country, language, index status) were summarized as counts and percentages; quantitative variables (IF, JCI, APC and others) were described by mean, median, standard deviation, range and non-null counts.

Inferential Statistics

- **Correlation:** Spearman's ρ (primary) and Pearson's r assessed pairwise associations among continuous metrics; $p < 0.05$ denoted significance.
- **Year-to-year change:** Wilcoxon signed-rank tests compared paired 2022-vs-2023 IF and JCI values, complemented by percentage-change summaries.
- **Quartile mobility:** A transition matrix tracked shifts across JIF quartiles (Q1–Q4) between years and was visualized as a heat-map.
- **Group comparisons:** Mann-Whitney U (two groups) and Kruskal-Wallis H (≥ 3 groups) tested differences in IF and related indices across payment status, SCIE/ESCI listing, country and language.
- **Specialized metrics:** AIS, JCI and Imml were correlated with IF 2023 and compared across quartiles with boxplots.

Multivariate & Machine Learning Approaches

- **Clustering:**
 - ° K-means on Z-standardized features; optimal k selected by the elbow criterion, quality checked with silhouette and Calinski-Harabasz scores.
 - ° Hierarchical (Ward) clustering with dendrogram visualization; resulting clusters were profiled by Kruskal-Wallis tests.
- **Dimension reduction:** Principal Component Analysis projected clusters into two dimensions for interpretability.
- **Feature importance:** A Random-Forest regressor (median/mode imputation + one-hot encoding) modelled IF 2023; out-of-bag R^2 and Gini-based importances highlighted key predictors (e.g., OA percentage, APC).

Robustness Checks & Visualization

Key correlations were recalculated after excluding the outlier journal Nature Reviews Rheumatology to confirm stability. Interaction effects (e.g., SCIE/ESCI $\times$ payment) were explored with grouped boxplots and Kruskal-Wallis tests. Distributions, relationships and categorical summaries were illustrated through histograms, violin plots, scatter/pair plots, bar charts and heat-maps.

Combining non-parametric tests, clustering and tree-based modelling, this analytical pipeline offers a comprehensive yet interpretable assessment of rheumatology-journal performance. Although sample size limits generalizability, the approach provides a solid, reproducible foundation for further bibliometric research.

Results

The bibliometric landscape of 42 rheumatology journals, selected for "Rheumatology" or "Rheum" in their titles and analyzed with data compiled in May 2025, reveals a vibrant scholarly ecosystem. Geographically, England (23.81%) and the USA (21.43%) dominate journal origins, with English as the primary language for 85.71% of the cohort. Indexing splits nearly evenly between SCIE (54.76%) and ESCI (45.24%), while 2023 JIF quartiles skew toward Q4 (28.57%) and Q3 (23.81%). Key metrics for 2023 include a mean IF of 3.78 (median 2.10), a mean JCI of 0.96 (median 0.57) and a mean APC of \$786.69 (median \$0), with an average submission-to-publication duration of 168.83 days (median 172). Interestingly, Q3 and Q4 journals exhibited elevated open access percentages (74.77% and 56.17%, respectively), signaling a trend toward accessibility in lower-quartile publications. Comprehensive descriptive statistics, including frequencies for categorical variables (country, language, publisher, SCIE/ESCI, quartiles) and distributions for numerical variables (i.e. IF 2023, JCI 2023, Open Access Percentage 2023, APC), are presented in Table 1, with footnotes clarifying "Unknown" quartiles and missing data handling.

Temporal and relational dynamics among the 42 journals uncover compelling trends. The 2023 IF exhibited near-perfect correlation with its self-citation-excluded counterpart, showed no significant link with open access percentage ($\rho = -0.165$, $p = 0.316$) or publication speed ($\rho = -0.097$, $p = 0.618$). Figure 1 provides details on correlation instances. From 2022 to 2023, IF declined significantly (mean decrease -0.84 , median -0.30 ; Wilcoxon $p = 0.000606$), as visualized in Figure 2. Conversely, JCI increased modestly (mean $+0.03$, median $+0.03$; Wilcoxon $p = 0.0154$). Quartile transitions, detailed in Table 2, revealed that among 23 journals with defined quartiles, 12 improved (e.g., Q2→Q1: 3), 11 remained stable (e.g., Q1→Q1: 6) and none declined, highlighting upward mobility in this niche. Footnotes in Table 2 note the exclusion of "Unknown" quartiles ($N=23$).

Table 1. Descriptive Statistics of Rheumatology Journal Characteristics

A. Categorical Variables	Category	Frequency	Percentage (%)			
Country	England	10	23.81			
	USA	9	21.43			
	Other	23	54.76			
Primary Language	English	36	85.71			
	Multi-Language	3	7.14			
	Other	3	7.14			
Publisher	Springer Nature	8	19.05			
	Oxford Univ. Press	4	9.52			
	Wiley	4	9.52			
	Other	26	61.90			
Publication Frequency	Quarterly	13	30.95			
	Monthly	10	23.81			
	Other	19	45.24			
SCIE/ESCI	SCIE	23	54.76			
	ESCI	19	45.24			
2023 Quartile	Q4	12	28.57			
	Q3	10	23.81			
	Q1	9	21.43			
	Q2	9	21.43			
	Unknown	2	4.76			
Payment Required	No	27	64.29			
	Yes	15	35.71			
Medline Indexed	Yes	23	54.76			
	No	19	45.24			
PubMed Coverage	Yes	34	80.95			
	No	8	19.05			
B. Numerical Variables	Mean	Median	SD	Min	Max	Non-Null Count
Impact Factor 2023	3.78	2.10	5.66	0.20	29.40	41
Journal Citation Indicator 2023	0.96	0.56	1.30	0.02	5.51	40
Open Access Percentage 2023	47.75	31.03	41.04	0.00	100	39
Article Processing Charge (USD)	787	0.00	1495	0.00	7400	42
Average Days to Publish	169	172	71	15	330	29
Issues per Year	5.93	4.00	4.01	1	12	42

Unknown quartiles indicate journals with missing or unclassified data. Other categories for Country, Primary Language, Publisher and Publication Frequency include less frequent groups. Non-null count reflects available data; missing data were imputed via median for clustering analyses. Numerical values rounded to two decimal places for consistency.

Table 2. Quartile Transitions of Rheumatology Journals, 2022–2023

2022 to 2023 change	Q1	Q2	Q3	Q4
Q1	6	0	0	0
Q2	3	3	0	0
Q3	0	5	0	0
Q4	0	1	3	2

Footnote: Quartile data sourced from Web of Science; excludes journals with 'Unknown' quartiles in 2022 or 2023 (N=23).

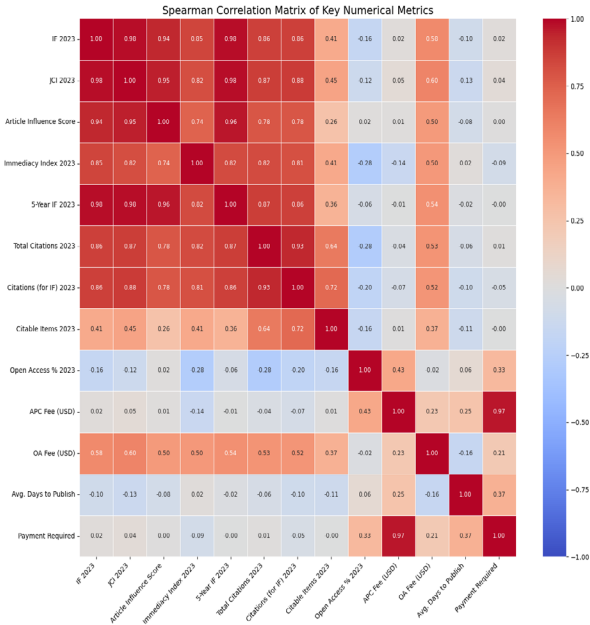


Figure 1. Spearman Correlation Matrix of Key Numerical Metrics

The Spearman correlation for the thirteen key numerical metrics is visualized in the form of a heat map.

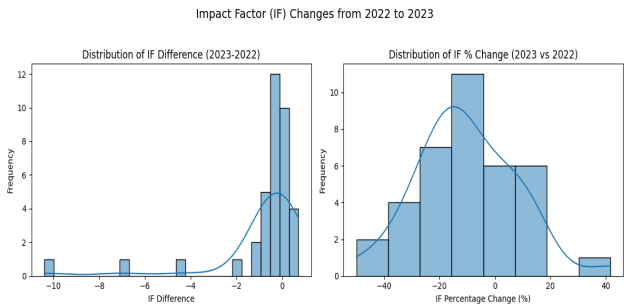


Figure 2. Distribution of Impact Factor Changes, 2022–2023

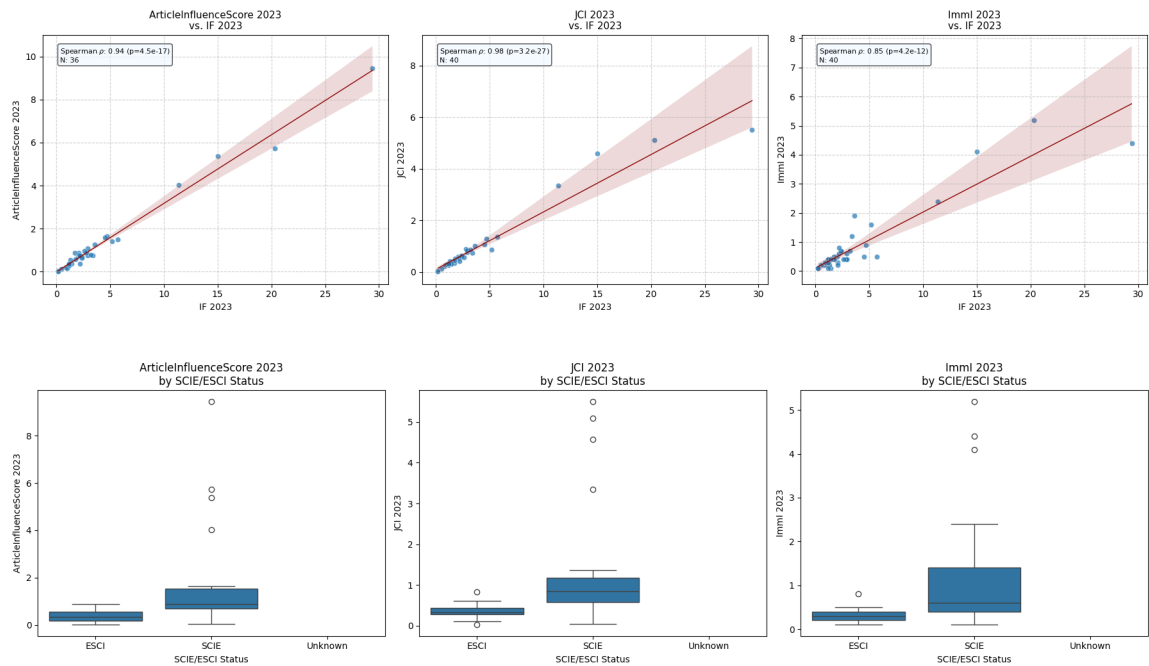


Figure 3. Correlations and Distributions of Specialized Metrics

First row: Three scatter plots (AIS, JCI, Immi vs. IF for year 2023) with regression lines and Spearman rho values. Second row: Boxplots of each metric by SCIE/ESCI status, showing medians and spread.

Specialized bibliometrics illuminate nuanced differences across the cohort. The 2023 AIS averaged 1.29 (median 0.75), with SCIE journals outpacing ESCI (median: 0.87 vs. 0.35) and Q1 journals leading Q4 (1.65 vs. 0.28). Similarly, JCI 2023 (mean 0.96, median 0.57) and Immi 2023 (mean 0.85, median 0.40) showed stark contrasts, with SCIE medians (JCI: 0.84, Immediacy: 0.60) surpassing ESCI (0.32, 0.30) and Q1 markedly higher than Q4 (JCI: 1.36 vs. 0.27). These metrics strongly correlated with 2023 IF (JCI: $\rho=0.977$, $p<3.17e-27$; Immi: $\rho=0.849$, $p<4.23e-12$), as depicted in Figure 3. Publication fees also revealed insights: higher Open Access Fees correlated with elevated IF ($\rho=0.731$, $p<4.42e-06$) and APC positively associated with open access percentage ($\rho=0.642$, $p=0.00992$). Table 3 summarizes these distributions and group medians, with footnotes addressing data limitations.

Advanced analytics through machine learning and clustering revealed distinct substructures within the dataset. A Random Forest regressor predicting IF 2023 achieved an impressive Out-of-Bag score of 0.806, pinpointing Journal Impact Factor Rank 2023 (importance: 0.23), Immi 2023 (0.21) and JCI 2023 (0.19) as top drivers (Table 3, Figure 4). K-means clustering ($k=4$, sizes: 14, 4, 23, 1) distinguished groups, with Cluster 1 ($N=4$) boasting a median IF 2023 of 17.65 and open access percentage of 26.44%, visualized in Figure 5. Hierarchical clustering (4 clusters, sizes: 3, 21, 5, 13) echoed these findings, grouping high-impact journals like Nature Reviews Rheumatology and Lancet Rheumatology into a prestigious Cluster 1, as illustrated in Figure 6. Significant inter-cluster differences emerged for IF 2023 (Kruskal-Wallis $p=0.0313$) and open access percentage ($p=1.68e-05$). An interaction between SCIE/ESCI status and payment requirements further shaped IF 2023 ($p=0.000408$), underscoring the intricate interplay of indexing and financial models.

Table 3. Specialized Metrics, Group Comparisons and Machine Learning Insights for Rheumatology Journals

Metric	Mean	Median	SD	N	SCIE/ESCI Medians	Quartile Medians	Top ML Feature Importance
Article Influence Score 2023	1.29	0.75	1.92	36	SCIE: 0.87, ESCI: 0.35	Q1: 1.65, Q2: 0.76, Q3: 0.72, Q4: 0.28	–
Journal Citation Indicator 2023	0.96	0.57	1.30	40	SCIE: 0.84, ESCI: 0.32	Q1: 1.36, Q2: 0.77, Q3: 0.49, Q4: 0.27	0.19
Immediacy Index 2023	0.85	0.40	1.18	40	SCIE: 0.60, ESCI: 0.30	Q1: 1.60, Q2: 0.70, Q3: 0.40, Q4: 0.20	0.21
Journal Impact Factor Rank 2023	29.80	30.50	16.73	40	–	–	0.23
Total Citations 2023	5456.00	1113.00	10059.28	40	–	–	0.08
5-Year Impact Factor 2023	4.18	2.45	5.93	36	–	–	0.18

Machine learning feature importances derived from a Random Forest regressor predicting Impact Factor 2023 (OOB score = 0.806); top five features listed. “–” indicates metrics not included in the model. SCIE/ESCI and quartile medians calculated for available data; “–” indicates insufficient data for calculation. Numerical values rounded to two decimal places for consistency.

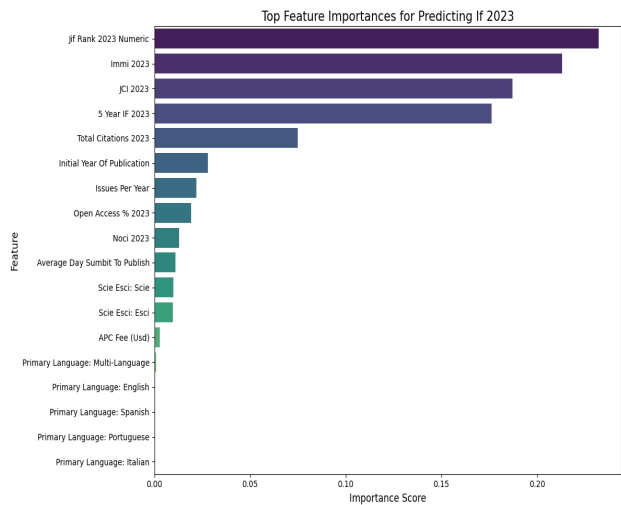


Figure 4. Feature Importances from Random Forest Regressor
OOB score: 0.806; importances are exploratory due to small dataset.

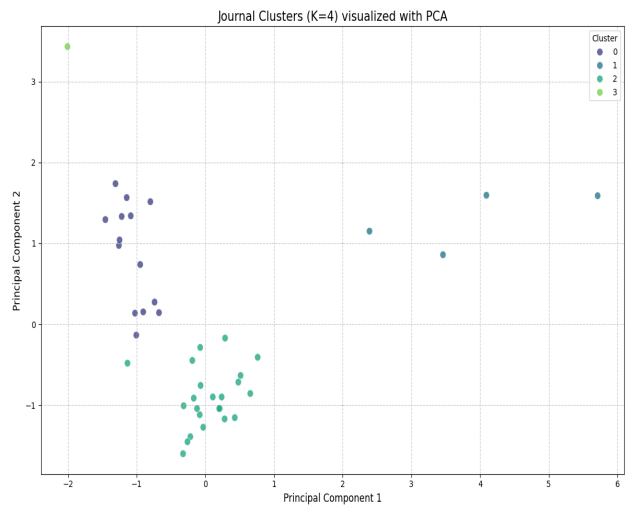


Figure 5. PCA Visualization of K-means Clustering (K=4)
Clusters based on standardized features; PCA explains 70.3% of variance.

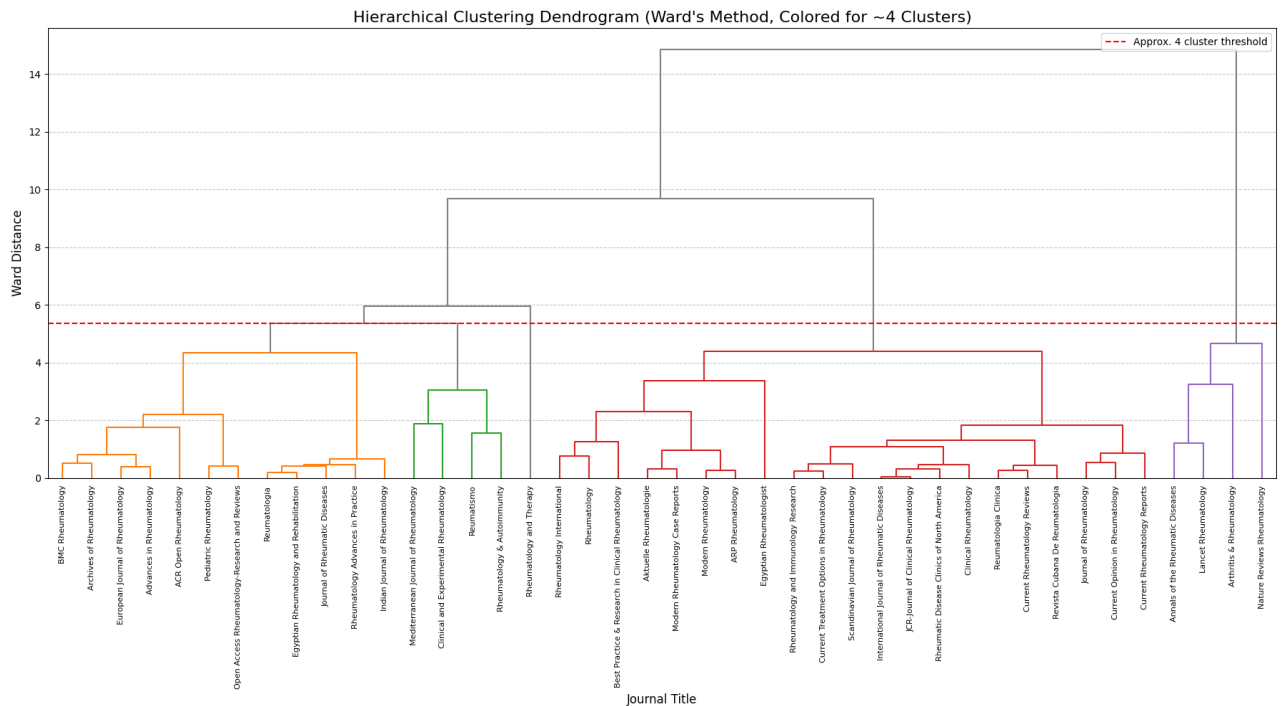


Figure 6. Hierarchical Clustering Dendrogram: Unveiling Journal Similarities
Clusters formed at K=4; longer vertical lines indicate greater dissimilarity. Key journals annotated (e.g., Nature Reviews Rheumatology).

Discussion

The bibliometric profile of 42 rheumatology journals paints a vivid picture of a dynamic scholarly niche, both mirroring and diverging from trends in medical publishing. England (23.81%) and the USA (21.43%) anchor the field, a dominance echoed in specialties like pain research and dental implantology [7, 14]. English's prevalence (85.71%) ensures global reach, aligning with high-impact medical journals [16]. The near-even SCIE/ESCI split (54.76%/45.24%) reflects a blend of established and emerging titles, signaling robust growth [14]. Strikingly, Q3 and Q4 journals' elevated open access rates (74.77%, 56.17%) underscore a commitment to accessibility, a trend linked to citation boosts in broader literature [13, 17]. These traits, detailed in Table 1, affirm rheumatology's evolving global influence, distinct yet resonant with bibliometric patterns across medical disciplines.

Temporal and relational dynamics reveal nuanced rhythms in rheumatology publishing. The 2023 Impact Factor's near-perfect correlation with its self-citation-excluded counterpart ($\rho=0.993$, $p<5.7e-37$) confirms metric integrity, unlike fields where self-citations inflate standings [13, 18]. Curiously, IF 2023's weak links to open access ($\rho=-0.165$, $p=0.316$) and publication speed ($\rho=-0.097$, $p=0.618$), visualized in Figure 1, diverge from neurosurgery's trends, where slower publication correlates with higher impact [5]. A significant IF decline from 2022 to 2023 (mean -0.84 , $p=0.000606$; Figure 2) may reflect post-pandemic normalization [10], while JCI's modest rise ($+0.03$, $p=0.0154$) suggests stable contextual influence. Upward mobility shines through quartile transitions, with 12 journals 'improving' and 11 'stable' among 23 with defined ranks (Table 2, Figure 1), a vibrancy unique to rheumatology compared to static fields like orthopedics [9].

Specialized metrics deepen our understanding of journal prestige. The 2023 AIS (mean 1.29, median 0.75), JCI (0.96, 0.57), and Imml (0.85, 0.40) strongly correlate with IF 2023 ($\rho=0.977$, 0.849; Figure 3), reinforcing their value in assessing impact [13]. SCIE journals outpace ESCI (JCI: 0.84 vs. 0.32; Imml: 0.60 vs. 0.30), and Q1 surpasses Q4 (AIS: 1.65 vs. 0.28; JCI: 1.36 vs. 0.27; Table 3), highlighting prestige hierarchies [10]. Higher Open Access Fees correlate with elevated IF 2023 ($\rho=0.731$, $p<4.42e-06$), and APCs align with open access rates ($\rho=0.642$, $p=0.00992$), though SCIE/ESCI APC medians warrant scrutiny [19]. These dynamics, visualized in Figure 3, suggest financial models shape accessibility and impact, a pattern seen in oncology [20].

Cutting-edge analytics unveil striking substructures, with machine learning and clustering redefining journal evaluation. A Random Forest regressor predicting IF 2023 (OOB=0.806) highlights JIF Rank (0.23), Imml (0.21), and JCI (0.19) as pivotal drivers (Table 3, Figure 4). K-means clustering ($K=4$) isolates a "high-impact" Cluster 1 ($N=4$, median IF_2023: 17.65, open access: 26.44%; Figure 5), while hierarchical clustering groups Nature Reviews Rheumatology and Lancet Rheumatology in a high-impact cluster (Figure 6). Significant

inter-cluster differences (IF 2023: $p=0.0313$; open access: $p=1.68e-05$) and a SCIE/payment interaction ($p=0.000408$) underscore complex dynamics. These ML-driven insights, resonant with bibliometric advances [6, 9], pave the way for AI-guided publishing strategies, fostering equitable access and precision in rheumatology scholarship.

This study provides compelling insights into rheumatology publishing, yet certain constraints merit attention. Selecting 42 journals with "Rheumatology", "Rheum" or "Reum" in their titles may have omitted relevant publications, such as arthritis-focused journals, potentially narrowing subdiscipline representation. This choice, however, ensured a focused and reproducible analysis. The reliance on 2023 data, driven by incomplete historical records (e.g., quartiles, new metrics) for prior years and unavailable 2024 data at analysis time, limits longitudinal trend evaluation. Missing open access percentages, due to WoS reporting gaps, and inconsistent APC medians further constrain findings. Additionally, the Random Forest model's predictive strength requires external validation to enhance generalizability. These limitations, while noteworthy, do not undermine the study's contributions to understanding rheumatology's scholarly dynamics.

Conclusion

This analysis of 42 rheumatology journals crafts a compelling portrait of a dynamic scholarly field, blending global influence with distinctive trends. England's and the USA's leadership, robust open access adoption and upward quartile mobility highlight the discipline's resilience. Specialized metrics like JCI and Imml, tightly aligned with IF 2023, affirm prestige hierarchies, while machine learning redefines evaluation. The Random Forest's predictive strength (OOB=0.806) and hierarchical dendrogram's elegant clusters, grouping luminaries like Nature Reviews Rheumatology, illuminate novel insights. These findings, which build on the advances seen in bibliometrics, provide insights into publishing that are driven by machine learning (ML) and have the potential to inform future models of publishing transparency and equity [6, 9]. Rheumatology's future demands strategic open access policies, refined indexing and data-informed frameworks to amplify impact. Further studies should explore longitudinal patterns and financial models, ensuring this field remains a beacon of accessible, influential scholarship in medical science.

Conflict of interest

The authors declare no conflicts of interest related to this study.

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