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Global Research Trends and Thematic Networks in Crohn's Disease–Related Sleep Disorders (2006-2024)

Crohn Hastalığıyla İlişkili Uyku Bozukluklarında Küresel Araştırma Eğilimleri ve Tematik Ağlar (2006–2024)

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Abstract

Objective: The clinical relevance of sleep disturbances, reduced sleep quality, fatigue, and psychological comorbidities (e.g., anxiety, depression) in Crohn's disease (CD) is increasingly recognized. This study aimed to bibliometrically map scientific literature (2006-2024) on CD and sleep-related factors, identifying research trends, key contributors, and collaboration networks.

Materials and Methods: A total of 229 English-language articles and reviews from the Web of Science Core Collection were analyzed. Bibliometric methods and network visualizations were performed using Bibliometrix, VOSviewer, and Scimago Graphica. The analysis included descriptive statistics, co-authorship networks, keyword co-occurrence analysis, thematic evolution, and trending topics.

Results: A marked increase in publications was observed starting in 2016, with key author and institution clusters. Core research themes included CD, sleep, fatigue, quality of life, depression, and anxiety, with recent trends focusing on sleep quality and anxiety. Co-citation analyses highlighted interdisciplinary links among gastroenterology, sleep medicine, and psychosomatic research.

Conclusion: This study provides a comprehensive overview of the evolving research landscape, emphasizing the growing significance of mental health and sleep quality in the clinical management of CD. The findings underscore the need for continued interdisciplinary investigation and the integration of sleep-related factors in future research.

Keywords: Crohn's disease, sleep disorders, sleep quality, quality of life, bibliometric analysis

Öz

Amaç: Crohn hastalığında (CH) uyku bozuklukları, azalmış uyku kalitesi, yorgunluk ve psikolojik eş hastalıkların (ör. anksiyete, depresyon) klinik önemi giderek daha fazla kabul görmektedir. Bu çalışma, 2006-2024 döneminde CH ve uyku ile ilişkili faktörler üzerine yapılan bilimsel literatürü bibliyometrik olarak haritalandırarak araştırma eğilimlerini, başlıca katkıda bulunanları ve iş birliği ağlarını belirlemeyi amaçladı.

Gereç ve Yöntem: Web of Science Core Collection'dan elde edilen 229 İngilizce makale ve derleme incelendi. Bibliometrix, VOSviewer ve Scimago Graphica yazılımları kullanılarak bibliyometrik yöntemler ve ağ görselleştirmeleri gerçekleştirildi. Analiz kapsamında betimleyici istatistikler, ortak yazarlık ağları, dergi/kaynak ortak-atıf haritalaması, anahtar kelime ortak-kullanım analizi, tematik evrim ve güncel konu başlıkları değerlendirildi.

Bulgular: 2016'dan itibaren yayınlarda belirgin bir artış gözlendi; öne çıkan yazar ve kurum kümeleri belirlendi. Temel araştırma temaları CH, uyku, yorgunluk, yaşam kalitesi, depresyon ve anksiyete olarak saptandı; son yıllarda özellikle uyku kalitesi ve anksiyete konuları öne çıktı. Ortak-atıf analizleri, gastroenteroloji, uyku tıbbı ve psikosomatik araştırmalar arasındaki disiplinlerarası bağlantıları ortaya koydu.

Sonuç: Bu çalışma, gelişen araştırma alanına kapsamlı bir bakış sunarak CH'nin klinik yönetiminde ruh sağlığı ve uyku kalitesinin artan önemini vurgulamaktadır. Bulgular, disiplinlerarası araştırmaların sürdürülmesi ve gelecekteki çalışmalarda uyku ile ilişkili faktörlerin entegrasyonu gerekliliğini ortaya koymaktadır.

Anahtar Kelimeler: Crohn hastalığı, uyku bozuklukları, uyku kalitesi, yaşam kalitesi, bibliyometrik analiz

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Introduction

Crohn's disease (CD) was first described in 1932 by Crohn, Ginzburg, and Oppenheimer. Formerly called localized ileitis, CD is a chronic inflammatory bowel condition potentially affecting any part of the digestive system (1). CD causes patchy, transmural inflammation (skip lesions) along the gastrointestinal tract (2). Unlike ulcerative colitis, which primarily affects the colon, the potential for widespread involvement in CD makes its symptoms more unpredictable (3). Symptoms mainly stem from leukocyte accumulation in the intestinal lining, though the precise etiology of this immune activity remains unclear (4).

The disease course alternates between flare-ups and remission (5). Yet, even in remission, about 74% of patients experience persistent, milder symptoms (6). Subclinical inflammation often persists during remission, with elevated interleukin-1β and interleukin-8 levels observed in these patients (7). Similarly, C-reactive protein levels are higher in CD patients than in healthy individuals (8). This persistent inflammation and discomfort significantly reduce quality of life (QoL) in CD patients (9), who often report poorer general health and lower energy than healthy individuals (10).

In addition to physical symptoms, CD also impacts mental health, with over 60% of patients reporting anxiety and/or depression (11,12). Sleep disturbances are similarly common in CD and can influence disease progression. One study identified poor sleep quality in all patients with active CD and most of those in remission (13). Both sleep duration and quality are affected (14). According to Salwen-Deremer et al. (15), nearly 70% of patients experienced poor sleep, with 50% meeting the criteria for clinical insomnia. Beyond causing tiredness, inadequate sleep can shorten remission periods and exacerbate CD, as evidenced by its association with an over five-fold increased risk of surgery or hospitalization (16). A bidirectional relationship exists between sleep and the immune system; poor sleep may be an early indicator of subclinical inflammation (17). Sleep can affect next-day pain perception and may correlate with disease activity and outcomes (18,19). Therefore, early sleep quality monitoring might help predict disease activity and progression (20,21).

This study utilized bibliometric tools to examine the scientific literature on CD and sleep issues, identifying key research themes, authors, collaborations, and publication trends.

Materials and Methods

Data Source and Search Strategy

The data necessary for this bibliometric analysis were obtained from the Web of Science Core Collection (WoSCC) database provided by Clarivate Analytics. The data extraction process was carried out in March 2025. The search strategy was developed using key terms covering related factors such as CD, sleep disorders, sleep quality, and circadian rhythm. In the search query, the combination of terms [TS = ("CD" OR "CD") AND TS = (sleep OR insomnia OR "sleep quality" OR "sleep disturbance* OR "circadian rhythm")] was used in the subject areas (topic: TS).

Statistical Analysis

The examined time period was determined as 2006–2024. Only publications indexed in English in WoSCC (included document types: "article" and "review") were included in the analysis. The collected raw data set (savedrecs.txt) was exported in plain text format as full record and cited references." The detailed document screening and selection process is illustrated in Figure 1.

Data Analysis and Visualization

Three complementary tools were used for bibliometric analysis and network visualizations: the Bibliometrix R package (accessed via Biblioshiny interface, RStudio Version 2024.12.1.0), VOSviewer (Version 1.6.20), and Scimago Graphica (Version 1.0.49.0). The analysis workflow was structured under four main categories.

Descriptive Analyses (Bibliometrix/Biblioshiny)

Key bibliometric characteristics (publications, authors, sources, keywords, references, average citations, publication age, collaboration metrics) were extracted and summarized. Annual publication and average citation trends were illustrated using time series plots. Country publication output and citation performance were visualized with bar and lollipop charts, respectively. The most globally cited documents were listed and graphically represented. Additionally, the temporal distribution of cited references and deviations from 5-year median values were assessed using "reference spectroscopy" plots to visualize citation bursts over time.

Conceptual Structure Analyses (Keywords)

A keyword co-occurrence network was constructed in VOSviewer, using a minimum threshold of three co-occurrences. Overlay visualizations were generated to display thematic clusters and their respective average citation reports.

Social Structure Analyses (Collaboration Network)

International co-authorship networks were analyzed (minimum two publications and one link strength per country), with results presented as overlay and density maps. Scimago Graphica visualized inter-author collaboration networks, with node size reflecting PageRank centrality. VOSviewer generated additional co-authorship networks, where node size represented total citations or publications per author.

In all network maps, node size indicated entity frequency or impact (e.g., publications, citations), and edge thickness showed connection or collaboration strength. VOSviewer's algorithm (e.g., Louvain method) grouped related elements into clusters within each network.

Results

General Characteristics of the Dataset and Publication Trends

This study entailed a comprehensive examination of 229 articles and reviews published between 2006 and 2024, selected through a multi-stage filtering process (Figure 1), with a particular focus on the interplay between CD, sleep,

and the factors that influence them. The general bibliometric characteristics of the final dataset are summarized in Table 1.

The annual scientific output during the study period is illustrated in Figure 2. A marked increase in the number of publications is observed starting from 2016, reaching its peak in 2024.

Productivity, Impact, and Collaboration at the Country and Institutional Level

The top 10 countries contributing the most to scientific productivity in the dataset are presented in Figure 3. The United States was by far the most productive country in this dataset, ranking first in both total publication volume and overall academic impact, with 3,189 citations.

Figure 1. Flowchart of the data selection process for the bibliometric analysis.
WoSCC: Web of Science Core Collection.

The top 7 institutions contributing to the dataset are presented in Figure 4. Five of those institutions are located in the United States, with Harvard University and its affiliates producing the most publications during the study period. Among the institutions outside the United States, the greatest contributor was Medical University Lodz (Figure 4).

Author-level Productivity, Impact, and Collaboration

The co-authorship network, presented in Figure 5, shows that prominent authors like Kappelman MD, Martin CF, Long MD, and Sandler RS are centrally positioned, establishing pivotal networks that connect diverse clusters.

In terms of productivity, Kappelman MD and Martin CF are the most prolific authors. However, when considering academic impact, Ananthakrishnan AN and Sandler RS have the highest total citation counts within the network, indicating their publications are highly influential in the field.

Conceptual Structure: Keywords, Themes, and Trends

The keyword co-occurrence network presented in Figure 6 demonstrates that the most frequently used keywords in the literature are inflammatory bowel disease (IBD), CD, sleep, fatigue, QoL, depression, and sleep quality.

Recently, terms like "sleep quality," "anxiety," and "validation" have increased in frequency, indicating these themes are now prominent and reflect a shift in research focus (Figure 7).

As illustrated in the thematic evolution map (Figure 8), literature analysis shows "IBD" was the dominant theme in 2006-2014, followed by "ulcerative colitis" in 2015-2017, and then "CD" in 2018-2020. Finally, from 2021 to 2024, thematic focus shifted towards psychology and QoL, with "anxiety," "sleep

Table 1. The general characteristics of the bibliometric dataset analyzed in this study.

Main information about data	
Timespan	2006–2024
Sources (journals, books, etc.)	132
Documents	229
Annual growth rate (%)	14.44
Average document age (years)	5.72
Average citations per document	32.24
References	8518
Keywords plus (ID)	633
Author's keywords (DE)	507
Authors	1348
Authors of single-authored documents	4
Single-authored documents	4
Average co-authors per document	7.18
International co-authorships (%)	12.66
Article: original research	195
Article: book chapter	1
Article: proceedings paper	3
Review	30

disturbance," "depression," and "QoL" becoming increasingly prominent research topics. These findings indicate a research shift from dominant clinical definitions towards a more specific psychological and sociological orientation.

Discussion

This bibliometric analysis of WoSCC publications (2006–2024) on CD and sleep (disorders, quality, circadian rhythm) aimed to reveal the historical development, conceptual/intellectual structure, collaboration networks, and research trends in this area.

Development of the Field and Research Trends

Scientific interest in CD and sleep significantly increased after 2016, aligning with the growing importance of patient-reported outcomes and QoL in the management of IBD. A 2015 peak in average citations suggests a concentration of high-impact publications around that time, with a 2013 study by Ananthakrishnan et al. (22) and a 2011 study by Graff et al. (23) emerging as central nodes in reference co-citation networks.

Thematic evolution and trend analyses show a research focus shift from general concepts (e.g., IBD, Crohn's disease, QoL) to specific psychosocial keywords (e.g., sleep quality, anxiety, depression, fatigue, validation). This suggests a strengthened

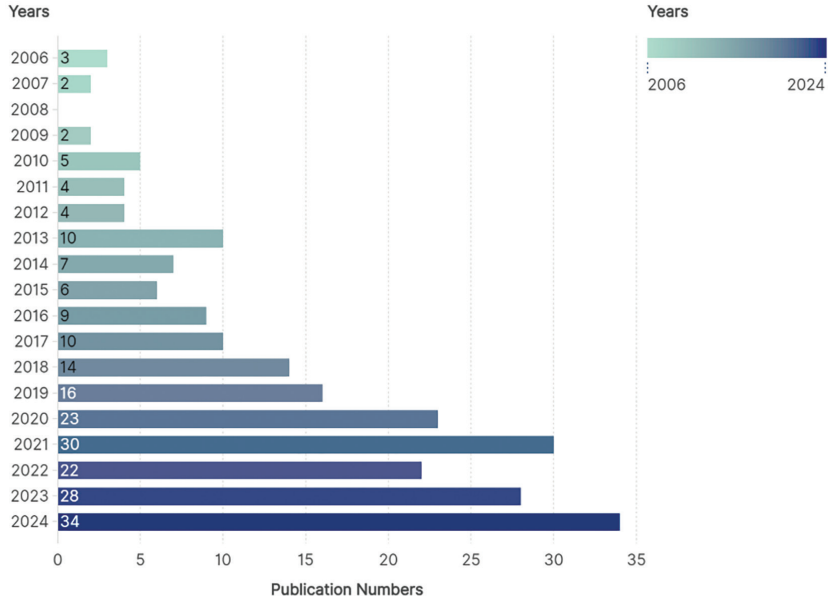

Figure 2. Number of publications by year. The color gradient highlights this temporal shift, where darker shades represent more recent years.

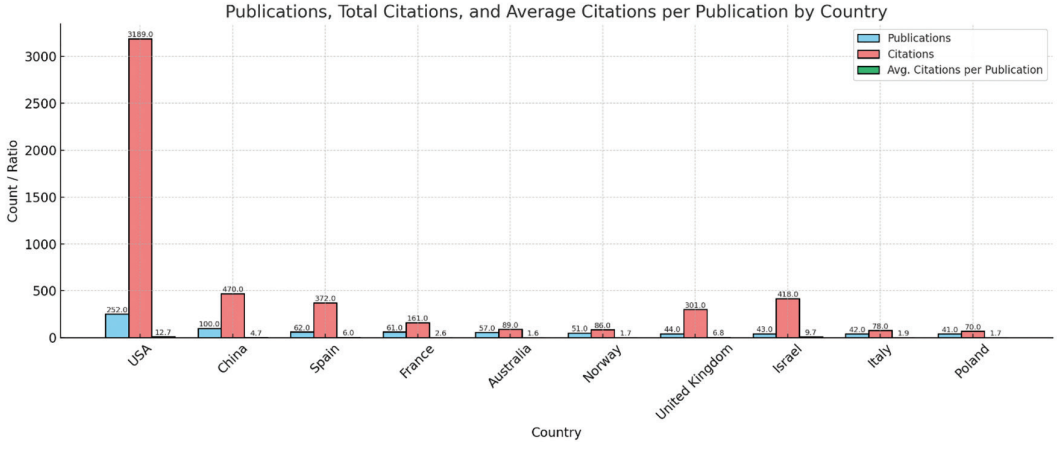

Figure 3. Comparison of the top 10 most productive countries in terms of publication count, total citations, and average citations per publication.

holistic approach to patient experience beyond disease biology. Reference spectroscopy indicates current publications' intellectual foundations are largely from the 2008–2012 period.

Thematic Structure and Interdisciplinarity

Keyword co-occurrence network analysis revealed three main thematic axes: sleep-related terms (e.g., sleep quality, disturbances, chronotype), psychological factors (e.g., depression, anxiety), and symptoms/outcomes (e.g., fatigue, pain, QoL). This clustering reflects the interdisciplinary clinical complexity in CD (24).

Leading Actors and Collaborations

The United States leads in publication numbers and citation impact, followed by China (high publication volume) and Canada (high average citations despite fewer publications).

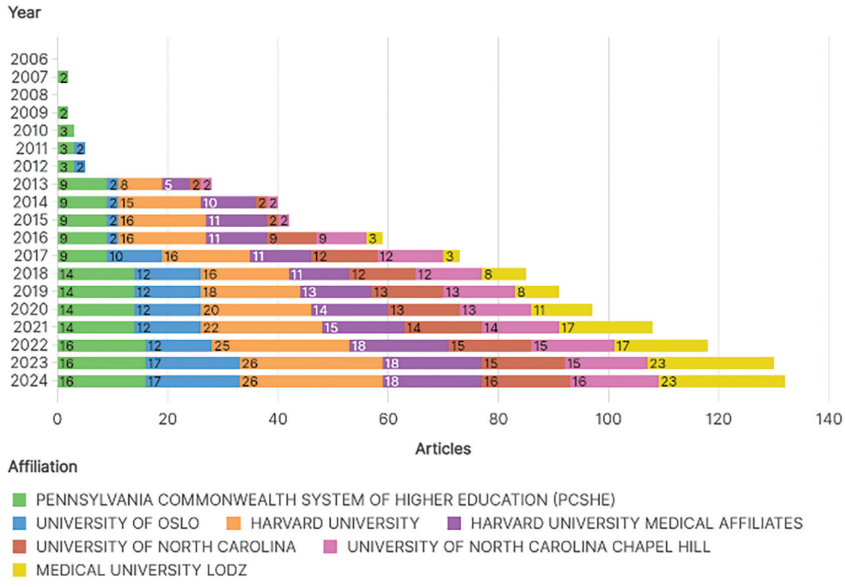

Figure 4. The cumulative number of publications from the most productive institutions over time.

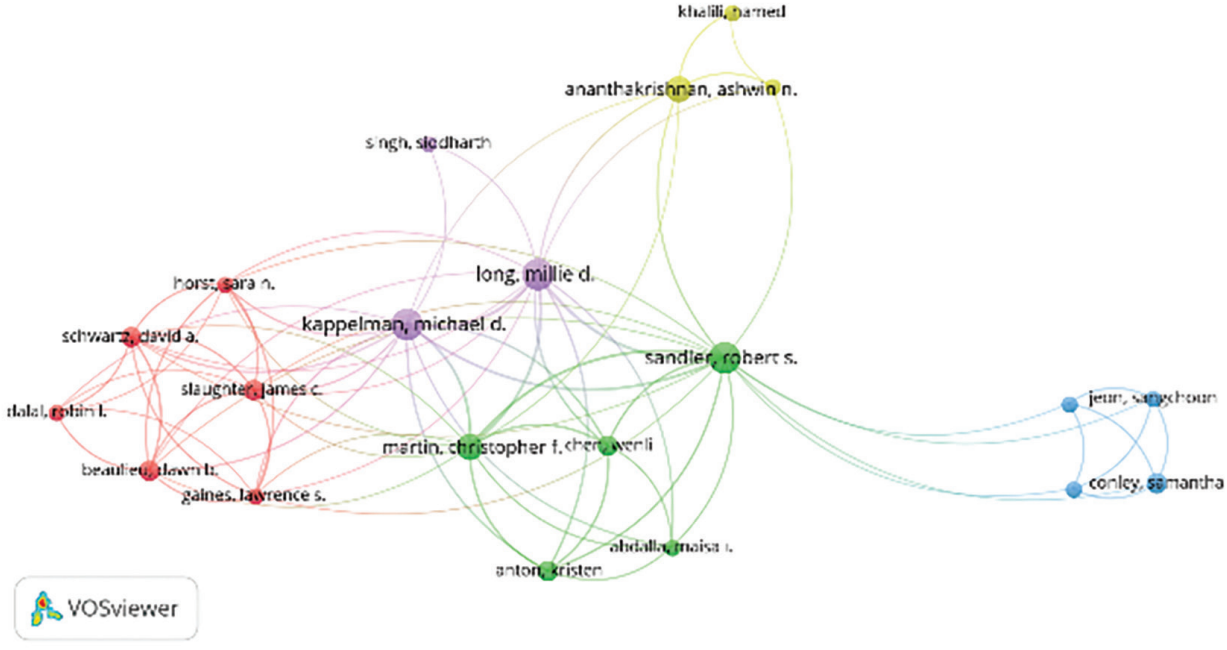

Figure 5. Co-authorship network created with VOSviewer. Nodes represent authors and links represent co-publications. Colors indicate clusters of collaboration between authors.

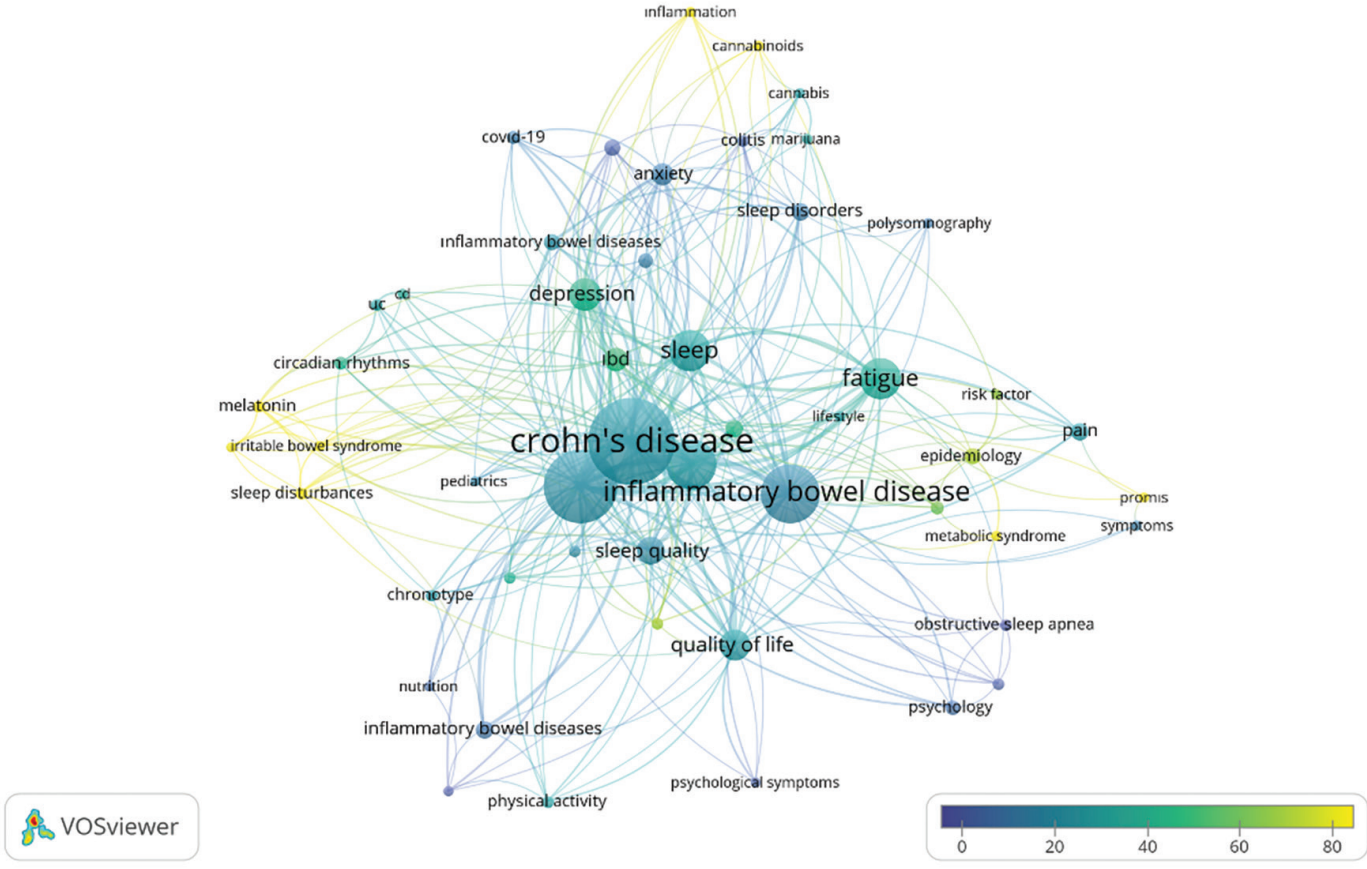

Figure 6. Keyword co-occurrence network visualization based on bibliometric data.

In addition, US -based groups are central in international collaborations.

Study Limitations

The strengths of this study include its specific focus (CD and sleep), broad timespan (2006–2024), use of Web of Science data, and multifaceted analysis (VOSviewer, Bibliometrix).

Limitations include using only WoSCC data (excluding Scopus, PubMed) and English-only publications (potential language bias). The keyword-based search might also have missed relevant publications. Furthermore, bibliometric analyses primarily assess quantity over quality, and new publications face citation delays. Additionally, the bibliometric tools offer strong structural visualizations but lack in-depth qualitative thematic content evaluation.

Consistency with the Literature and Clinical Significance

Recent systematic reviews and meta-analyses support these findings. Ballesio et al. (25) found IBD patients had worse subjective sleep quality than healthy controls ($g = 0.49$, $p < 0.001$), especially during active disease ($g = 0.66$, $p < 0.001$). Similarly, Hao et al. (26) linked poor sleep quality to disease activity in IBD [odds ratio (OR) = 3.52, $p < 0.001$]. Another study reported the prevalence of poor sleep in IBD patients as 56% [95% confidence interval (CI): 51-61%] (11), and a systematic review correlated disease activity with shorter sleep in pediatric IBD (27). In a very recent meta-analysis, poor sleep quality predicted adverse outcomes in CD (OR = 1.58, 95% CI: 1.26–1.99) (28). These data show that sleep disorders are not merely symptoms but represent key clinical components in CD management.

Future Research Directions

Evidence supports systematically including sleep disorder assessment in CD monitoring. Specific interventions for IBD-associated sleep disorders, especially non-pharmacological approaches, remain under-researched and have not been fully integrated into clinical guidelines. Cognitive behavioral therapy for insomnia shows potential for improving sleep quality in IBD patients as an alternative/adjunct to medication (29). Aromatherapy is also a promising non-pharmacological option for fatigue and sleep disorders (30). Holistic models (lifestyle changes, inflammation control, multidisciplinary teams) should underpin individualized treatment (31,32), which is vital for symptom control and integrated care to enhance overall QoL.

Future research directions include:

Longitudinal studies on causal effects of sleep disorders (e.g., insomnia, obstructive sleep apnea) on CD activity/inflammation.

Mechanistic studies on causal links between sleep, psychological state, and QoL (e.g., circadian rhythm, microbiota, cytokines).
In-depth content/efficacy studies on key themes (e.g., cannabinoids, psychosocial interventions).
Evaluating interventions like CBT and mindfulness via randomized controlled trials.
Increasing sample diversity through international/intercultural comparative studies.
Validating and standardizing patient-reported outcome measures.

Conclusion

This bibliometric analysis shows that the complex relationships between CD, sleep, and related psychological factors are being increasingly addressed in the literature. The findings obtained provide a guiding framework for future scientific studies by identifying the existing knowledge structures, research trends, and gaps in this field.

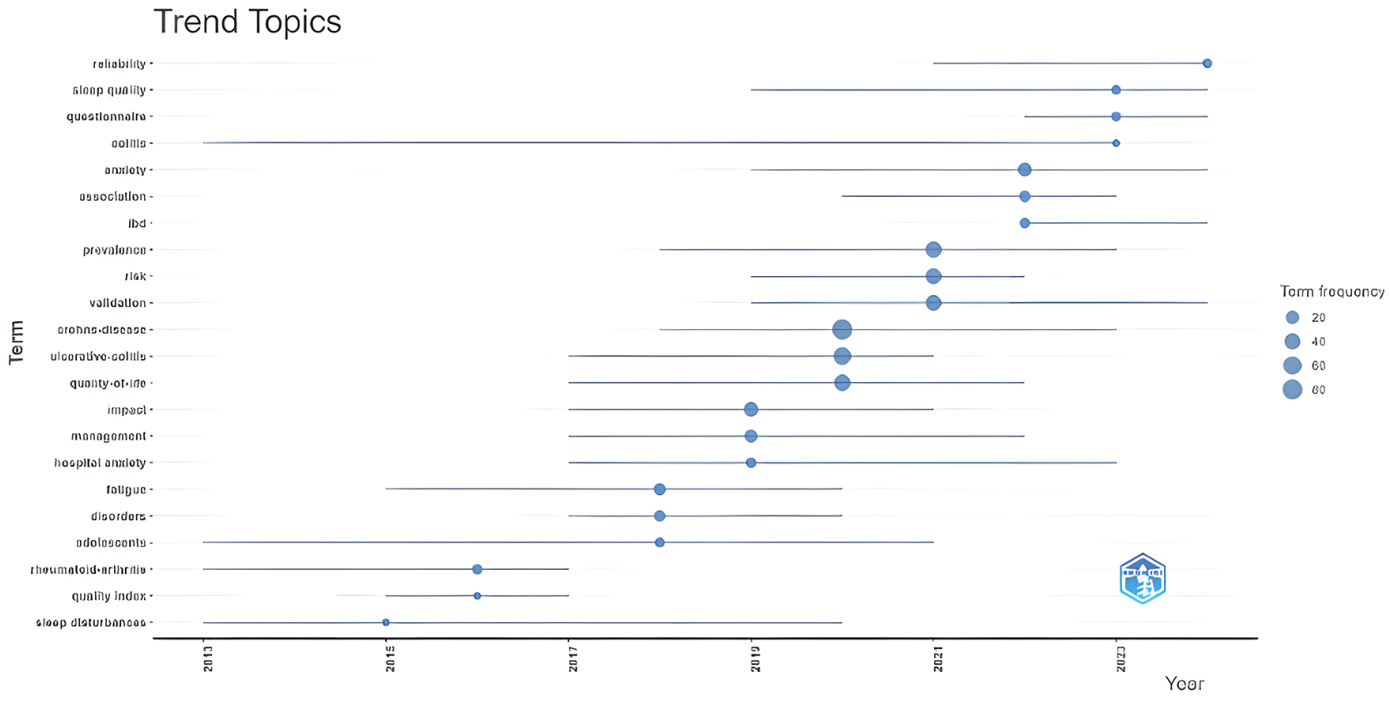

Figure 7. Trend topic analysis. This visualization shows the emergence and frequency of keywords by year.

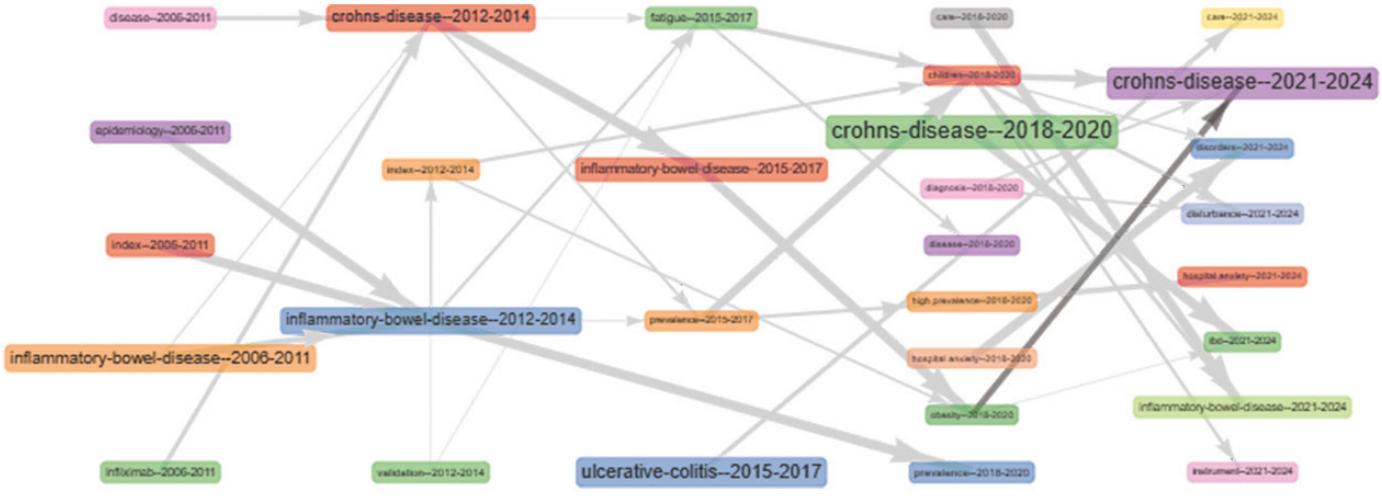

Figure 8. Thematic evolution map. Colored boxes represent dominant research themes within specific year ranges. Arrows indicate thematic transitions and interconnections over time.

Ethics

Ethics Committee Approval: The data necessary for this bibliometric analysis were obtained from the Web of Science Core Collection database provided by Clarivate Analytics.

Informed Consent: Patient consent was not required for this study because no identifiable patient data were used.

Footnotes

Authorship Contributions

Concept: A.İ., M.M.Ç., M.H.Ş., Design: A.İ., M.M.Ç., M.H.Ş., Data Collection or Processing: A.İ., M.M.Ç., M.H.Ş., Analysis or Interpretation: A.İ., M.M.Ç., M.H.Ş., Literature Search: A.İ., M.M.Ç., M.H.Ş., Writing: A.İ., M.M.Ç., M.H.Ş.

Conflict of Interest: No conflict of interest was declared by the authors.

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