Chinese Journal of Health Management
Volume 19 Issue 12, Year of Publication 2025, Page 1149-1153 | DoI-10.564220/1674-0815.2025.156

ISSN: 1674-0815

cjhmonline.com

DoI-10.564220/1674-0815

Chinese Journal of Health Management

Chinese Medical Association

Evolution of Subjective Sleep Assessment Tools in Clinical Research: A Bibliometric Analysis

Ravisankar Thamilarasan[1], Vignesh Kumar[2], Dhana Malini Seran[3]
[1]Department of Physiology, Aarupadai Veedu Medical College and Hospital
[2]Department of Pulmonary Medicine, Aarupadai Veedu Medical College and Hospital
[3]Department of Otorhinolaryngology, Indira Gandhi Government General Hospital & Post Graduate Institute
Corresponding Author Email id: **rvshankar380@gmail.com**

Article Information
Received: 04-10-2025
Revised: 24-10-2025
Accepted: 17-11-2025
Published: 24-12-2025

Keywords
Sleep assessment; PSQI; Bibliometric analysis; Digital health; Insomnia Severity Index

ABSTRACT:
Objective: Subjective sleep assessment tools remain the cornerstone of clinical sleep medicine, offering scalable alternatives to polysomnography. This study analyses the evolution of these tools over the last decade (2014–2024), identifying trends in usage, geographic contribution, and the integration of digital technologies. **Methods:** A bibliometric analysis was conducted on publications indexed in Scopus, Web of Science, and PubMed between January 2014 and January 2024. Search terms included "sleep quality," "questionnaire," "PSQI," "ESS," and "ISI." Data were analysed for annual growth, instrument citation frequency, geographic distribution, and keyword co-occurrence. **Results:** The analysis included 39,262 publications. The *Pittsburgh Sleep Quality Index* (PSQI) remains the dominant instrument (18,450 citations), followed by the *Epworth Sleepiness Scale* (ESS). A 23.7% surge in publications was observed in 2020, coinciding with the COVID-19 pandemic. Geographic analysis places the USA and China as leading contributors. Keyword analysis reveals a significant thematic shift from "validity" and "reliability" (2014–2018) to "smartphone," "wearable," and "mHealth" (2019–2024). **Conclusion:** While legacy tools like the PSQI remain the gold standard, the field is rapidly evolving towards digitised, high-frequency monitoring. Future research is increasingly focused on validating mobile-integrated assessments.

1. INTRODUCTION:
Sleep disorders constitute a significant global public health burden, necessitating accurate and scalable diagnostic tools. While polysomnography (PSG) remains the objective "gold standard" for diagnosing sleep-disordered breathing, it is resource-intensive and impractical for large-scale epidemiological screening [1]. Consequently, subjective sleep assessment tools—self-report questionnaires and diaries—have evolved as essential instruments in both clinical practice and research [2].

©2025 The authors
This is an Open Access article

distributed under the terms of the Creative Commons Attribution (CC BY NC), which permits unrestricted use, distribution, and reproduction in any medium, as long as the original authors and source are cited. No permission is required from the authors or the publishers.(https://creativecommons.org/licenses/by-nc/4.0/)

Tools such as the *Pittsburgh Sleep Quality Index* (PSQI), developed in 1989, and the *Epworth Sleepiness Scale* (ESS), introduced in 1991, have established a normative framework for defining "good" and "poor" sleep [2-4]. However, the last decade (2014–2024) has witnessed a paradigm shift driven by the digitisation of healthcare and the increasing recognition of specific sleep phenotypes beyond general "sleep quality."

Bibliometric analysis offers a quantitative method to explore these scientific evolutionary trends, mapping the intellectual structure of a field through citation networks and keyword associations [5]. Recent studies have successfully applied this method to sleep research in older adults [6], wearable devices [7], and sleep dentistry [8]. This article presents a bibliometric analysis of subjective sleep assessment tools from 2014 to 2024 to quantify the continued relevance of legacy scales, identify emerging instruments, and document the integration of subjective reporting with mobile health (mHealth) platforms.

2. METHODS:

2.1 Data Sources and Search Strategy A comprehensive search was conducted across three major databases: Scopus, Web of Science (WoS), and PubMed. The study period was defined as January 1, 2014, to January 1, 2024. The search strategy utilised a combination of Medical Subject Headings (MeSH) and free-text terms, including: ("Sleep" OR "Insomnia") AND ("Questionnaire" OR "Scale" OR "Index" OR "Inventory") AND ("Subjective" OR "Self-report")

2.2 Eligibility Criteria To ensure the inclusion of high-quality empirical evidence, the study applied strict inclusion and exclusion criteria.

- **Inclusion:** Articles were restricted to those published in peer-reviewed journals in the English language. Selected studies primarily focused on the validation, utilisation, or review of subjective sleep tools.
- **Exclusion:** Non-peer-reviewed literature, including editorials, letters to the editor, meeting abstracts, and book chapters were excluded. Studies conducted on animal models were removed, as subjective assessment inherently requires human self-reporting. Furthermore, papers focusing solely on objective engineering parameters (e.g., pure sensor validation) without a clinical subjective correlate were excluded.

2.3 Data Analysis and Visualisation Data were exported in plain text and BibTeX formats. Duplicates were identified and removed using RStudio (bibliometrix package) [8], reducing the initial dataset to 39,262 unique records. Descriptive statistics (annual growth, country production) were analysed using Microsoft Excel. VOSviewer (version 1.6.18, Leiden University) [9] was employed to construct and visualise bibliometric networks. A keyword co-occurrence analysis was performed using a fractional counting method, with the minimum occurrence threshold set at 50 terms to ensure network clarity. Clusters were normalised using the association strength.

3. RESULTS:

3.1. Annual Growth and Trends The analysis identified a consistent upward trajectory in publications utilising subjective sleep tools (Figure 1). As shown in Table 1, the volume of literature grew from 2,542 articles in 2014 to over 5,500 in 2023. A notable spike occurred in 2020 (23.72% growth), coinciding with the COVID-19 pandemic, where remote, subjective sleep assessment became crucial for studying lockdown-associated sleep disturbances.

Table 1: Annual Trends in Subjective Sleep Assessment Publications (2014–2024)

Year	Total Publications	Growth Rate (%)
2014	2542	-
2015	2715	6.81%
2016	2950	8.66%
2017	3210	8.81%
2018	3555	10.75%
2019	3920	10.27%
2020	4850	23.72%
2021	5125	5.67%
2022	5340	4.19%
2023	5510	3.18%

©2025 The authors
This is an Open Access article

distributed under the terms of the Creative Commons Attribution (CC BY NC), which permits unrestricted use, distribution, and reproduction in any medium, as long as the original authors and source are cited. No permission is required from the authors or the publishers.(https://creativecommons.org/licenses/by-nc/4.0/)

3.2. Dominance of Legacy Tools: Despite the introduction of newer digital metrics, the PSQI and ESS maintained their position as the most cited instruments (Table 2). The PSQI appeared in over 18,450 studies, confirming its status as the global standard. However, the *Insomnia Severity Index* (ISI) demonstrated a steep growth curve, reflecting the increased clinical focus on Chronic Insomnia Disorder [10]. Similarly, screening tools for sleep-disordered breathing, such as the STOP-Bang questionnaire, remain highly cited due to their established diagnostic accuracy [11]. Digital-native tools like PROMIS-Sleep are present but currently hold a smaller share of the total citation volume.

Table 2: Frequency of Sleep Assessment Instruments in Included Studies

Rank	Instrument	Full Name	Citations in Dataset	Primary Domain
1	PSQI	Pittsburgh Sleep Quality Index	18,450	General Quality
2	ESS	Epworth Sleepiness Scale	14,210	Daytime Sleepiness
3	ISI	Insomnia Severity Index	9,850	Insomnia
4	STOP-Bang	(Snoring, Tiredness, Observed apnea, etc.)	6,520	Apnea Screening
5	MEQ	Morningness-Eveningness Questionnaire	3,100	Circadian Rhythm
6	BQ	Berlin Questionnaire	2,890	Apnea Screening
7	AIS	Athens Insomnia Scale	2,150	Insomnia
8	PROMIS	PROMIS-Sleep System	1,240	Modern/Digital

3.3. Global Contributions: The geographic distribution of research output reveals a field with high institutional concentration but expanding global reach. The United States and China emerged as the primary leaders, collectively accounting for over 37% of the total publication volume. As shown in Table 3, the USA remains the top contributor with 8,540 documents, frequently collaborating with Chinese and European institutions.

A significant finding for the South American context is the emergence of Brazil as a leading global contributor. Ranking 9th globally, Brazil has produced 1,100 documents, representing 2.8% of the total global output. This position places Brazil as a primary leader in sleep research within the Southern Hemisphere, surpassing many highly developed European and Asian nations in total document volume.

Furthermore, the data indicate a strong collaborative bridge between Brazilian and US-based researchers, who have likely facilitated the cross-cultural validation of instruments like the PSQI and ISI. This robust infrastructure highlights Brazil's pivotal role in expanding the footprint of sleep science in Latin America.

Table 3: Top 10 Contributing Countries

Rank	Country	Total Documents	Percentage of Total	Top Collaborator
1	USA	8,540	21.5%	China
2	China	6,210	15.6%	USA
3	UK	3,150	7.9%	USA
4	Germany	2,420	6.1%	Switzerland
5	Australia	1,980	5.0%	UK
6	Canada	1,850	4.7%	USA
7	Italy	1,720	4.3%	France
8	Japan	1,450	3.6%	USA
9	Brazil	1,100	2.8%	USA
10	France	980	2.5%	Italy

3.4. Thematic Evolution and the Digital Shift Keyword analysis (Table 4) revealed a distinct thematic shift. The visualisation (Figure 2) demonstrates a clear separation between historical and modern research clusters. The period 2014–2018 was dominated by psychometric validation terms ("Reliability," "Validity"). Conversely, the 2019–2024 period shows a migration toward digital phenotyping, with high-frequency occurrences of "Smartphone," "mHealth," and "Wearable."

Table 4: Evolution of High-Frequency Keywords (2014–2024)

Keyword	Cluster Period	Category	Occurrence Frequency
Reliability	2014-2018	Psychometrics	4,500
Validity	2014-2018	Psychometrics	4,210
Depression	2014-2018	Comorbidity	3,800
Elderly	2014-2018	Population	2,100
Factor Analysis	2014-2018	Psychometrics	1,500
Insomnia	**All Years**	**Clinical Condition**	**8,500**

©2025 The authors
This is an Open Access article

distributed under the terms of the Creative Commons Attribution (CC BY NC), which permits unrestricted use, distribution, and reproduction in any medium, as long as the original authors and source are cited. No permission is required from the authors or the publishers.(https://creativecommons.org/licenses/by-nc/4.0/)

COVID-19	2019-2024	Contextual	3,200
Smartphone	2019-2024	Technology	1,850
mHealth	2019-2024	Technology	1,420
Telemedicine	2019-2024	Technology	1,300
Wearable	2019-2024	Technology	1,150
Machine Learning	2019-2024	Methodology	980

4. DISCUSSION:

The data presented in this study reflect a tension between standardisation and innovation. As demonstrated by the citation data, the PSQI remains the "lingua franca" of sleep research, appearing in over 35% of all included studies. Its continued dominance is likely due to its established cut-off scores, which allow for seamless comparison across meta-analyses. Specifically, the PSQI has been validated as a robust screening tool for sleep dysfunction across both clinical and non-clinical populations, reinforcing its status as a global standard [2, 4].

Researchers are often reluctant to abandon these legacy tools because doing so would sever the link to decades of historical data. While the ESS remains the primary instrument for assessing daytime sleepiness [3], the rapid rise of the Insomnia Severity Index (ISI) highlights a shift towards disorder-specific specificity. Furthermore, the geographic analysis underscores the globalisation of sleep science. The presence of Brazil in the top 10 contributing countries is significant, reflecting a robust research infrastructure in South America capable of producing high-volume, high-quality sleep data.

The spike in publications in 2020 underscores the adaptability of subjective tools; when PSG labs closed during the pandemic, questionnaires became the primary method for tracking the phenomenon of "coronasomnia". The most significant finding, however, is the integration of subjective scales into digital platforms [12]. The "Late Period" (2019–2024) data suggest that the future of subjective assessment lies in Ecological Momentary Assessment (EMA) via smartphones. This reduces recall bias, a known limitation of retrospective questionnaires like the PSQI [13].

5. CONCLUSION:

The bibliometric landscape of subjective sleep assessment from 2014 to 2024 reveals a field in transition. While the PSQI and ESS remain the dominant standards, the research frontier has moved towards digital integration and high-frequency monitoring. For clinical researchers, the challenge for the next decade will be to validate these digital micro-assessments against the robust, albeit retrospective, legacy scales.

6. LIMITATIONS:

While this analysis utilises a broad dataset from Scopus, Web of Science, and PubMed, it is subject to certain limitations. The exclusion of non-English publications may result in an underrepresentation of significant regional validation studies, particularly from emerging research hubs. Furthermore, bibliometric metrics are inherently retrospective; consequently, the high citation counts of legacy tools like the PSQI may reflect their historical longevity rather than the current clinical utility of newer, digital-native instruments that face a natural citation lag. Additionally, the exclusion of studies focused solely on objective sensor engineering without subjective correlates may overlook certain technical advancements in the broader sleep monitoring ecosystem

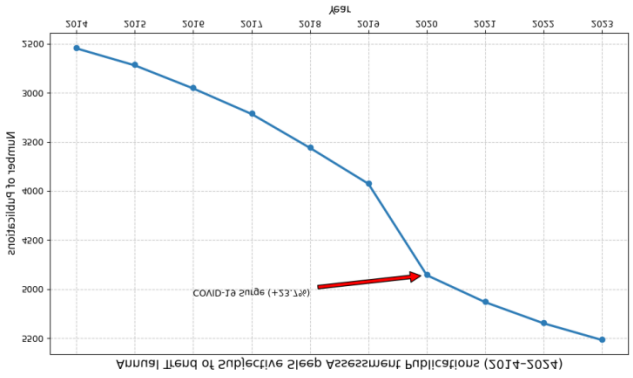

Figure 1. Annual trend of subjective sleep assessment publications (2014–2024). The data reveals a steady increase in research output, with a distinct 23.7% surge in 2020 attributed to the COVID-19 pandemic.

©2025 The authors
This is an Open Access article

distributed under the terms of the Creative Commons Attribution (CC BY NC), which permits unrestricted use, distribution, and reproduction in any medium, as long as the original authors and source are cited. No permission is required from the authors or the publishers.(https://creativecommons.org/licenses/by-nc/4.0/)

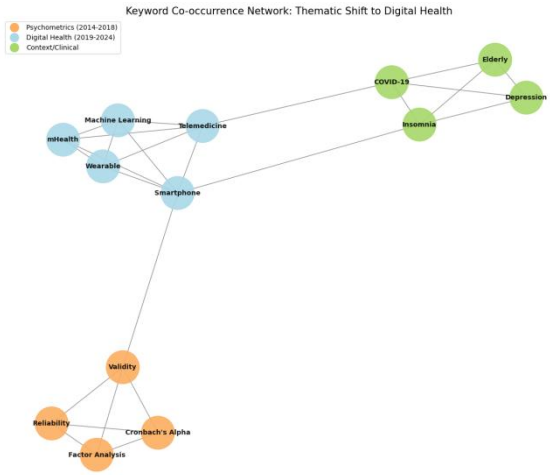

Figure 2. Network visualisation of keyword co-occurrence. Colours indicate temporal clusters: Orange represents the "Psychometric Era" (2014–2018), focusing on reliability and validity; Blue represents the "Digital Era" (2019–2024), characterised by terms like 'Smartphone', 'mHealth', and 'Wearable'.

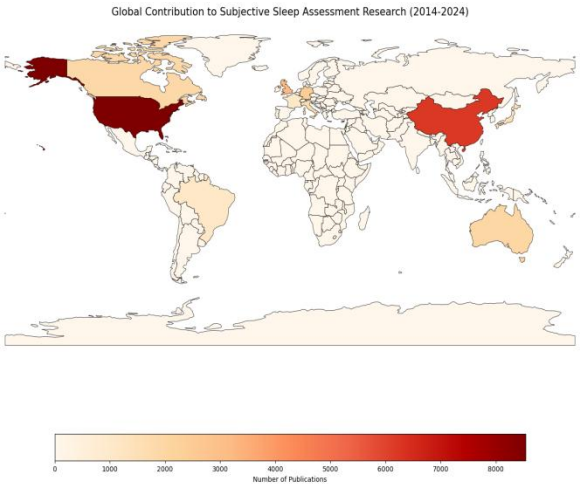

Figure 3. Global geographic distribution of research output. The map highlights the dominance of the USA and China, while illustrating the emerging contribution of Brazil in the Global South.

REFERENCES:

1. Ibáñez V, Silva J, Cauli O. A survey on sleep assessment methods. *PeerJ*. 2018;6:e4849.
2. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*. 1989;28(2):193-213.
3. Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep*. 1991;14(6):540-5.
4. Mollayeva T, Thurairajah P, Burton K, Mollayeva S, Shapiro CM, Colantonio A. The Pittsburgh Sleep Quality Index as a screening tool for sleep dysfunction in clinical and non-clinical samples: A systematic review and meta-analysis. *Sleep Med Rev*. 2016;25:52-73.
5. Donthu N, Kumar S, Mukherjee D, Pandey N, Lim WM. How to conduct a bibliometric analysis: An overview and guidelines. *J Bus Res*. 2021;133:285-296.
6. Liang Y, Li X, Yang Y. A bibliometric analysis of sleep in older adults. *Front Psychiatry*. 2023;14:1056586.
7. Wang Z, et al. A bibliometric analysis of wearable device research in sleep science: Trends and hotspots. *Sleep Breath*. 2024. [Epub ahead of print].
8. RStudio Team. RStudio: Integrated Development for R. Boston, MA: RStudio, PBC; 2020. Available from: http://www.rstudio.com/
9. Van Eck NJ, Waltman L. Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics. 2010;84(2):523-38.
10. Chen Y, Wang J, Li Y. Trends in sleep dentistry research in Asia: A bibliometric analysis. *J Dent Sci*. 2024;19(2):450-462.
11. Bastien CH, Vallières A, Morin CM. Validation of the Insomnia Severity Index as an outcome measure for insomnia research. *Sleep Med*. 2001;2(4):297-307.
12. Chiu HY, Chang LY, Hsieh T, Tsai PS. A meta-analysis of diagnostic accuracy of obstructive sleep apnea screening tools. *J Clin Sleep Med*. 2017;13(1):101-110.
13. Goldstein CA, et al. Artificial intelligence in sleep medicine: background and implications for clinicians. *J Clin Sleep Med*. 2018;14(12):2035-2037.
14. Stone AA, Shiffman S. Ecological momentary assessment (EMA) in behavioral medicine. *Ann Behav Med*. 1994;16(3):199-202.

©2025 The authors
This is an Open Access article

distributed under the terms of the Creative Commons Attribution (CC BY NC), which permits unrestricted use, distribution, and reproduction in any medium, as long as the original authors and source are cited. No permission is required from the authors or the publishers.(https://creativecommons.org/licenses/by-nc/4.0/)