

Research Article

# Bibliometric Analysis of the Top-100 Cited Articles on Postoperative Sleep During the Last 10 Years

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## Abstract

**Background** The quality of postoperative sleep is vital for surgical patients. A large number of patients after surgery suffer from sleep disorders. There are plenty of studies on postoperative sleep disorders. The aim of this study is to do a bibliometric analysis of the top-100 cited articles on postoperative sleep during the last 10 years, providing some clues to the investigators. **Methods** Publication retrieval was conducted in Web of Science (WoS) Core Collection on 12 January 2024. The 100 most frequently cited articles on postoperative sleep were identified and analyzed by VOSviewer and Excel. We mainly analyzed the publication year, citations, usage count, author, institution, country/region, journal and keywords. **Results** The number of citations ranged from 20 to 124 in WoS Core Collection, with a median of 35 and a mean of 40.79. USA (n = 39), China (n = 22) and Canada (n=9) ranked top three in terms of the number of publications and citations. Univ Copenhagen, Univ Toronto, and Lundbeck Ctr Fast Track Hip & Knee Arthroplasty were the top three institutions leading the researches on postoperative sleep. The journals specialized in Anesthesiology recorded the most high-quality articles. Postoperative pain, sleep, sleep quality, quality of life and postoperative delirium were the highly used keywords, while general anesthesia, fatigue, cognitive impairment and postoperative cognitive dysfunction were the latest topics. **Conclusion** At present, postoperative sleep researches have focused on the impacts of postoperative sleep disorders and pharmacological therapies to postoperative sleep disorders. However, non-pharmacological management of postoperative sleep should be paid more attention in the future.

## Keywords

Postoperative Sleep, Bibliometric Analysis, Top-100

## 1. Background

Postoperative sleep disorders, manifesting as sleep deprivation, circadian rhythm disturbance, and abnormal sleep

structure, may lead to postoperative delirium and cognitive impairment, exacerbate postoperative pain, and delay

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postoperative recovery [1-3]. Therefore, the quality of postoperative sleep is vital for surgical patients. However, Patients usually develop obvious sleep disturbances after surgery, especially major surgery. Postoperative sleep disorder was reported to occur in more than 40% patients after Gynecological Laparoscopy [4]. Major surgery, such as cardiac surgery, can lead to worse postoperative sleep quality [5].

The risk factors have been well determined. Aging is related to sleep structure changes and the ability to adjust sleep to the environment [6]. Patients with higher age was reported to have lower sleep efficiency after surgery [7]. Patients who have Preoperative sleep disorders, such as obstructive sleep apnea (OSA), are at higher risk of sleep disturbances after surgery [8]. Postoperative pain is believed to be the most crucial risk factor for sleep disorders [3, 9]. Other factors, such as noise and lights in the ward, also impact on the sleep quality [10].

A number of measures to relieve postoperative sleep disorders have been prompted in the last decades. One the one hand, nonpharmacological methods include reducing the noise and light of the wards, avoiding interruptions at night, and sleep aid devices [11-13]. On the other hand, hypnotics and sedatives are frequently used to improve sleep quality. Analgesics are also helpful with alleviating sleep disorders by controlling postoperative pain, local analgesics, and non-opioids included [4, 14]. However, the role of pharmacotherapy on improving the sleep quality or quantity of inpatients is still dubious [15]. Some scholars assumed that non-pharmacological interventions rather than pharmacological therapy, especially cognitive behavioral therapy, can be considered as a first choice for insomnia together with other interventions [16].

The studies on postoperative sleep disorders are still ongoing and the annual number of publications remains high level. As the citation number of publications is a vital part to indicate the importance of the studies, highly cited articles are of much importance for investigators. Bibliometric analysis, a method to evaluating academic output, research trend, and research impact, branch of information science, has been widely used in the evaluation of scientific research performance in certain fields [17, 18]. To present the current status and indicated future hotspots in the field of postoperative sleep, we intended to analyze the top-100 cited articles on postoperative sleep during the last 10 years.

## 2. Methods

### 2.1. Database and Retrieval Strategy

Web of Science (WoS), a popular database in science area, was the data source of this study. We used the retrieval formula “(TS=(postoperative sleep disorder) OR TS=(postoperative sleep disturbance) OR TS=(postoperative insomnia) OR TS=(postoperative agrypnia) OR TS=(postoperative sleep-

lessness) OR TS=(postoperative hyposomnia) OR TS=(postoperative sleep quality)” on 12 January 2024 in WoS Core Collection. The document type was restricted to article and review article. The publication year was limited to the last decade, namely from 2014 to 2023.

### 2.2. Determination of the Eligible Publications

According to the automatic ranking function of the database, the articles were sorted according to the number of citations in the WoS core database. Papers met the exclusion criteria were excluded and the next articles were screened until 100 papers were determined eligible.

The inclusion and exclusion criteria were defined ahead of data retrieval. Studies involving postoperative sleep of patients were taken into consideration. The exclusion criteria were as follows: preoperative sleep disturbance; no surgery involved; other article types; retracted articles; animal experiments.

The screening procedure was conducted by two independent investigators. The disagreements were resolved by discussion and consultation.

### 2.3. Data Extraction

Basic bibliometric items such as the authors, article title, journals, publication year, keywords, organization, country/region, cited times, usage count during the last 180 days and usage count since 2013 of the 100 articles were automatically extracted. Both plain text and Excel files were exported. Consequently, items such as journal impact factor (IF), WoS categories and Journal Citation Reports (JCR) quartile were extracted from WoS.

### 2.4. Data Analyses

Microsoft Excel and VOSviewer were applied to do the analyses and visualization. The annual number of the cited times and usage count of the articles was analyzed by Excel, while the publication number and cited times of the certain authors, institutions, countries/regions and journals were analyzed by VOSviewer.

Deduplication of the items was conducted via VOSviewer. For instance, sleep disturbance was replaced by sleep quality, spine fusion by spine surgery, and so on. Mergences of the synonyms formed a thesaurus file, and then, this file was imported to VOSviewer. Deduplication was automatically performed. Therefore, a single item in the VOSviewer maps might represent for compilations of several thesauruses.

## 3. Results

The literature retrieval was conducted on 12 January 2024 in WoS Core Collection. A total of 2846 records were retrieved by the above-mentioned formula, 1974 publications were published during 2014 to 2023, and the number of arti-

cle/review article was 1933. The 100 most frequently cited articles were determined and analyzed.

Among the 100 articles, the citations ranged from 20 to 124 times. The mean cited times were 40.79, while the median was 35. The lowest usage count during the last 180 days, whereas the highest usage count was 19. The mean was 0.91 and the median was 0. The lowest usage count since 2013 was 0, whereas the highest usage count was 84. The mean was 13.68 and the median was 9.

### 3.1. Distribution of the Publication Year

The 100 articles were consecutively published from 2014 to 2022 (Table 1). The most productive year was 2015, with 26 highly cited publications. Articles published in 2014 were cited 65.09 times in average, ranking the first place. Moreover, the largest mean usage count of the articles occurred in 2020.

### 3.2. Distribution of the Authors, Institutions and Countries/Regions

In total, 659 authors from 183 institutions of 26 countries/regions contributed to the 100 most frequently cited articles. As shown in Table 2, the 10 most influential authors came from the United States of America (USA), Denmark, and Canada. The most influential author was Chung Frances (245 citations), followed by Mace Jess C (213 citations) and Smith Timothy L (213 citations). The average citations of the top-10 authors ranged from 51 to 81.67. Table 3 shows the 10 most influential institutions. The 10 most influential institutions came from USA, Denmark, Canada, Taiwan and China. The most influential institution was Univ Copenhagen (321 citations), followed by Univ Toronto (288 citations) and Lundbeck Ctr Fast Track Hip & Knee Arthroplasty (218 citations). The average citations of the top-10 institutions ranged from 46 to 72.67. As for country/region force, USA had the most publications and total citations, followed by China, Canada and Denmark (Figure 1). The citation number of the top-10 countries/regions ranged from 112 to 1645. Articles from China, the United Kingdom (UK) and the Netherlands were relatively newly published (Figure 1).

### 3.3. Journal Analyses

The 100 articles were recorded by 73 journals. The journals were involved in 23 WoS categories. Anesthesiology was of the most occurrence, followed by Clinical Neurology and Surgery (Figure 2). IF of the journals was between 1.1 and 16.9, with the mean of 4.974 and the median of 4. As for the JCR quartile, there are 51 journals in Q1, 31 in Q2, 15 in Q3 and 3 in Q4. Table 4 shows the most frequently cited journals. Current Opinion in Anesthesiology was of the most citations, while Anesthesia and Analgesia and British Journal of Anaesthesia ranking the 2<sup>nd</sup> and 3<sup>rd</sup> place. The highly cited articles from Clinical Nutrition, Nature and Science of Sleep,

Journal of Biomedical Research and Frontiers in Neurology were relatively fresh (Figure 3).

### 3.4. Keywords Analyses

The keywords added by the authors were analyzed. As depicted in Figure 4, postoperative pain, sleep, sleep quality, quality of life and postoperative delirium have high occurrence, while general anesthesia, fatigue, cognitive impairment and postoperative cognitive dysfunction were the latest topics. The major surgery types included spinal surgery, arthroplasty, rotator cuff surgery, tonsillectomy, and total knee arthroplasty. Drugs that related to postoperative sleep researches involved dexmedetomidine, dexmedetomidine, melatonin, opioids and zolpidem. Postoperative complications associated with sleep mainly focused on cognitive dysfunction, anxiety and depression.

## 4. Discussion

In the present study, we searched the articles on postoperative sleep in WoS Core Database and selected the top-100 cited ones to do bibliometric analyses.

Citation count of an article is regarded as a symbol of contribution to the scientific fields. Analysis of the most frequently cited articles is able to help readers understand the research status, discover hotspots and identify trends of a certain area. The most frequently cited article in the last 10 years was published on JAMA Otolaryngology-Head & Neck Surgery in 2014, entitled *Response Shift in Quality of Life After Endoscopic Sinus Surgery for Chronic Rhinosinusitis* [19]. The results indicated that endoscopic sinus surgery had significant impacts on postoperative sleep quality. The most frequently used article in the last 180 days or since 2013 was published on International Journal of Nursing Studies in 2020, entitled *Benefits of a WeChat-based multimodal nursing program on early rehabilitation in postoperative women with breast cancer: A clinical randomized controlled trial* [20]. This study clued that WeChat-based multimodal nursing program was beneficial for the improvement of postoperative sleep quality and early postoperative rehabilitation. Other non-pharmacological methods, such as multicomponent Good Sleep Bundle, sleep package including an eye mask, earplugs, lavender scent pad, and non-caffeinated tea also shows benefits in postoperative sleep [12, 21]. However, according to the analyses of keywords, non-pharmacological therapy has not led to a significant influence in this field. The above-mentioned non-pharmacological interventions were relatively newly published. Thus, future hotspots of postoperative sleep may be non-pharmacological managements.

Through the analyses of countries/regions and institutions, we found that USA published the most articles and owned the most citations. The countries/regions mainly distributed in North America, Europe and East Asia. These countries/regions have high income and are leaders in many medical speciality. Another reason might be that people in these

countries/regions not only emphasize the treatment of surgical diseases, but also the enhanced recovery after surgery.

The journals recorded these articles are the high-level ones in the certain categories. Over one half of the journals located in the first quartile. Moreover, over 80 percent of the journals ranking first 50 percent of the discipline. Besides, our results shows that Anesthesiology contributes a lot in the research of postoperative sleep, as there are 26/73 journals belong to Anesthesiology in WoS system. Since the proposing of perioperative medicine, anesthesiologists have paid much attention to the preoperative and postoperative procedure [22, 23]. Postoperative recovery and outcomes have been taken into consideration. As an indispensable part of postoperative recovery, anesthesiologists have tried a lot in improving postoperative sleep quality. Dexmedetomidine, an  $\alpha_2$ -adrenoceptor agonists, is usually used in clinical anesthesia, such as assisted sedation and analgesia [24, 25]. It was demonstrated that intranasal dexmedetomidine could improve postoperative sleep quality in patients with chronic insomnia, without increasing the incidence of adverse effects [26]. To be more specific, the use of dexmedetomidine prolonged N2 and N3 sleep duration and shortened average length of hospitalization [27]. The effectiveness of dexmedetomidine accounts for the high presence in our keywords map. Other high-frequency keywords associated with pharmacological intervention to postoperative sleep disorders include melatonin and zolpidem. However, a previous meta-analysis concluded that there is insufficient evidence that pharmacotherapy improves the quality or quantity of sleep of hospitalized patients suffering from poor sleep [15]. What is worthy noticing is that this meta-analysis was published in 2016. Therefore, the role of pharmacotherapy on postopera-

tive sleep needs to be systematically reviewed and analyzed. A high-quality meta-analysis is in urgent need.

We acknowledge some limitations that worth noticing in the present bibliometric analysis. For one thing, citation and usage count of the articles are daily updated, our analyses only represent the results of the retrieval date. This is why the bibliometric analysis needs to be updated periodically to find the latest trends. Secondly, we searched articles in the WoS Core Collection. We may miss some articles from other databases. However, WoS Core Collection records high-quality articles and is commonly used in bibliometric analysis [28].

## 5. Conclusion

In conclusion, a plenty of articles on postoperative sleep have been published during the past 10 years, indicating that this topic remains hot in academic community and is still important to health care. Countries/regions from the North America, Europe, and East Asia, such as USA, China, Canada and Denmark made great contributions to postoperative sleep research globally. Univ Copenhagen, Univ Toronto and Lundbeck Ctr Fast Track Hip & Knee Arthroplasty were the top three institutions leading researches on postoperative sleep. The leading journals in certain areas published most of the high-quality postoperative sleep papers. At present, postoperative sleep researches have focused on the impacts of postoperative sleep disorders and pharmacological therapies to postoperative sleep disorders. However, non-pharmacological management of postoperative sleep should be paid more attention in the future.

**Table 1.** Distribution of publication year of the top-100 cited articles.

Publication years	Publication counts	Average cited times	Average usage count in the last 180 days	Average usage count since 2013
2014	11	65.09	0.36	19.36
2015	26	46.88	0.65	12.5
2016	15	38.67	0.33	14.2
2017	12	35.17	0.58	12
2018	11	39.36	0.64	10.64
2019	12	29.08	0.58	6.75
2020	6	30.83	4.17	23.17
2021	6	25.5	2.67	20.5
2022	1	22	3	13

**Table 2.** The top-10 authors in terms of the number of citations.

Authors	Citations	Documents	Average citations	Country
Chung Frances	245	3	81.67	Canada
Mace Jess C	213	4	53.25	USA
Smith Timothy L	213	4	53.25	USA
Kehlet Henrik	204	4	51.00	Denmark
Deconde Adam S	190	3	63.33	USA
Kang Weimin	152	2	76.00	Canada
Liao Pu	152	2	76.00	Canada
Shapiro Colin M	152	2	76.00	Canada
Krenk Lene	124	2	62.00	Denmark
Doufas Anthony G	115	2	57.50	USA

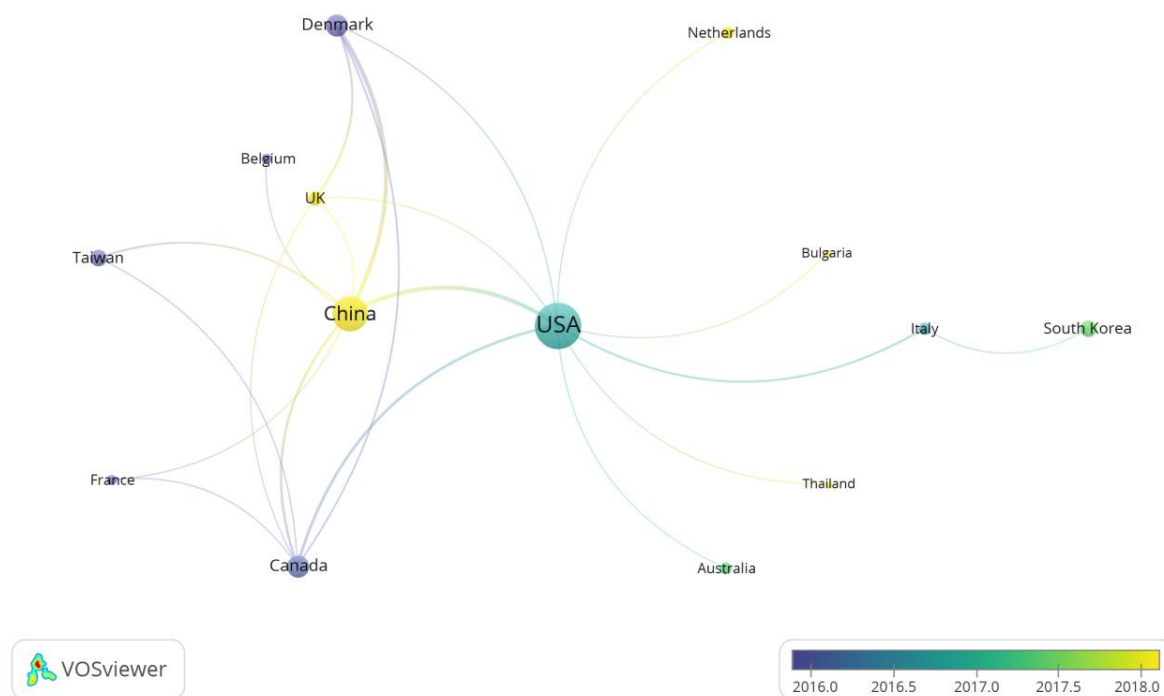
**Table 3.** The top-10 institutions in terms of the number of citations.

Institution	Citations	Documents	Average Citations	Country/region
Univ Copenhagen	321	6	53.50	Denmark
Univ Toronto	288	4	72.00	Canada
Lundbeck Ctr Fast Track Hip & Knee Arthroplasty	218	3	72.67	Denmark
Oregon Hlth & Sci Univ	213	4	53.25	USA
Univ Alberta	152	2	76.00	Canada
John Hopkins Univ	151	3	50.33	USA
Stanford Univ	138	3	46.00	USA
Natl Taiwan Univ	128	2	64.00	Taiwan
Natl Taiwan Univ Hosp	128	2	64.00	Taiwan
Peking Univ	116	2	58.00	China

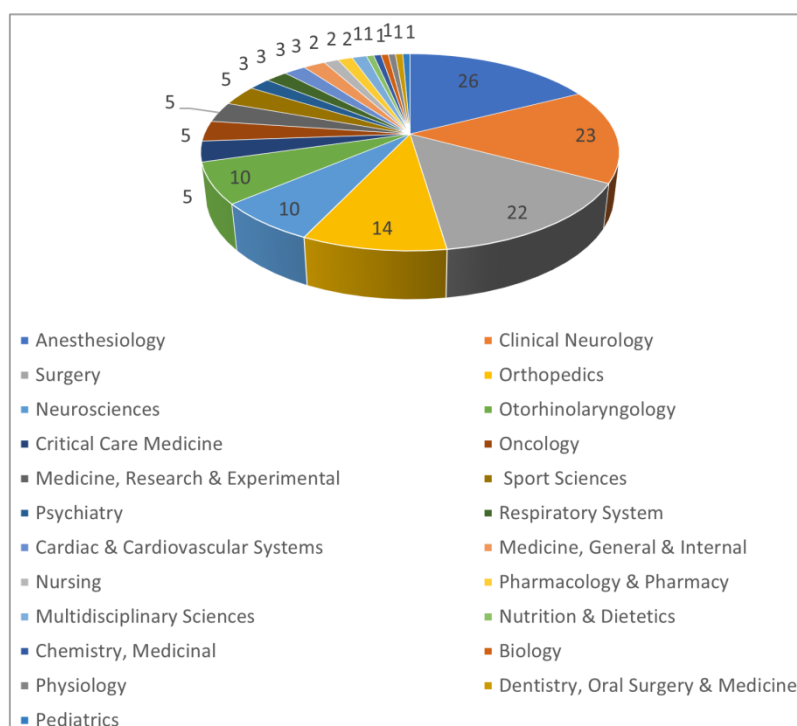
**Table 4.** The top-10 journals in terms of the number of citations.

Journal	Citations	Documents	Average citations	IF	JCR quartile
Current Opinion in Anesthesiology	217	3	72.33	2.5	Q3
Anesthesia and Analgesia	197	4	49.25	5.9	Q1
British Journal of Anaesthesia	176	3	58.67	9.8	Q2
JAMA Otolaryngology-Head & Neck Surgery	166	2	83.00	7.8	Q1
Journal of Clinical Sleep Medicine	134	3	44.67	4.3	Q2
Journal of Pain	132	3	44.00	4	Q2
Anesthesiology	120	1	120.00	8.8	Q1
Arthroscopy-The Journal of Arthroscopic and Related Surgery	107	3	35.67	4.7	Q1

Journal	Citations	Documents	Average citations	IF	JCR quartile
Critical Care	101	1	101.00	15.1	Q1
Laryngoscope	95	4	23.75	2.6	Q2

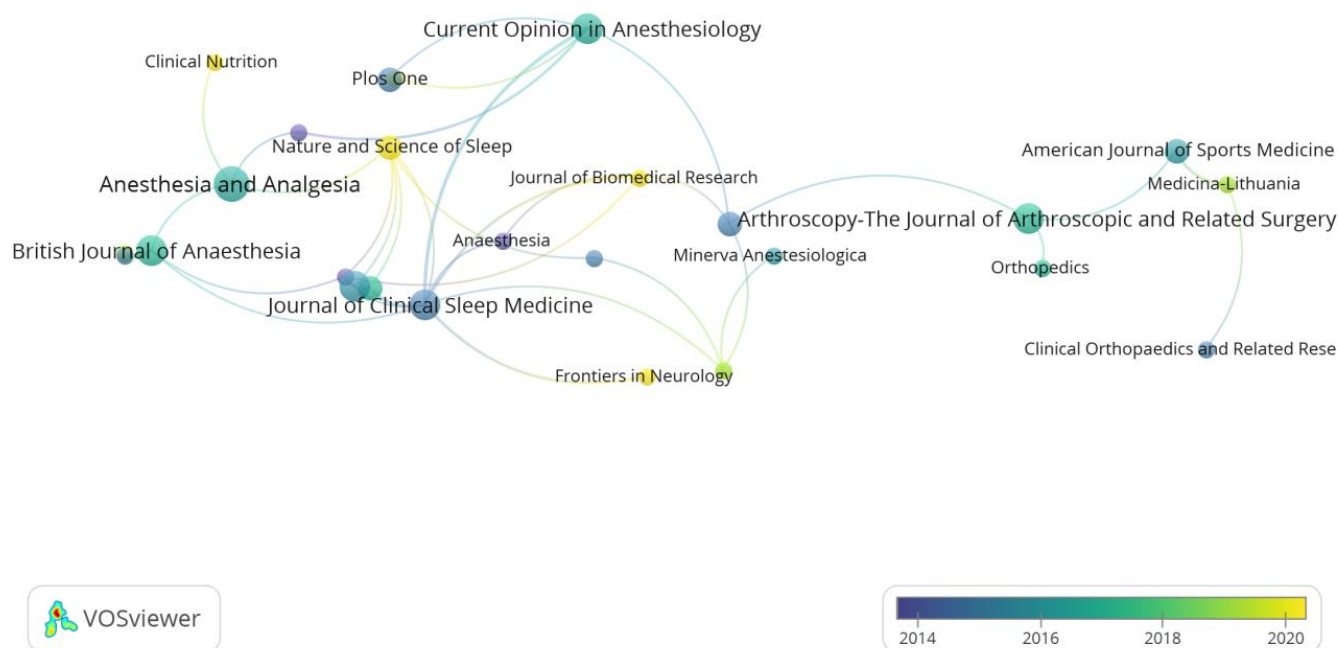


**Figure 1.** Citation analysis of the countries/regions. The relatedness of the items is based on the times they cited each other. The items that have no relatedness is not shown in the map.

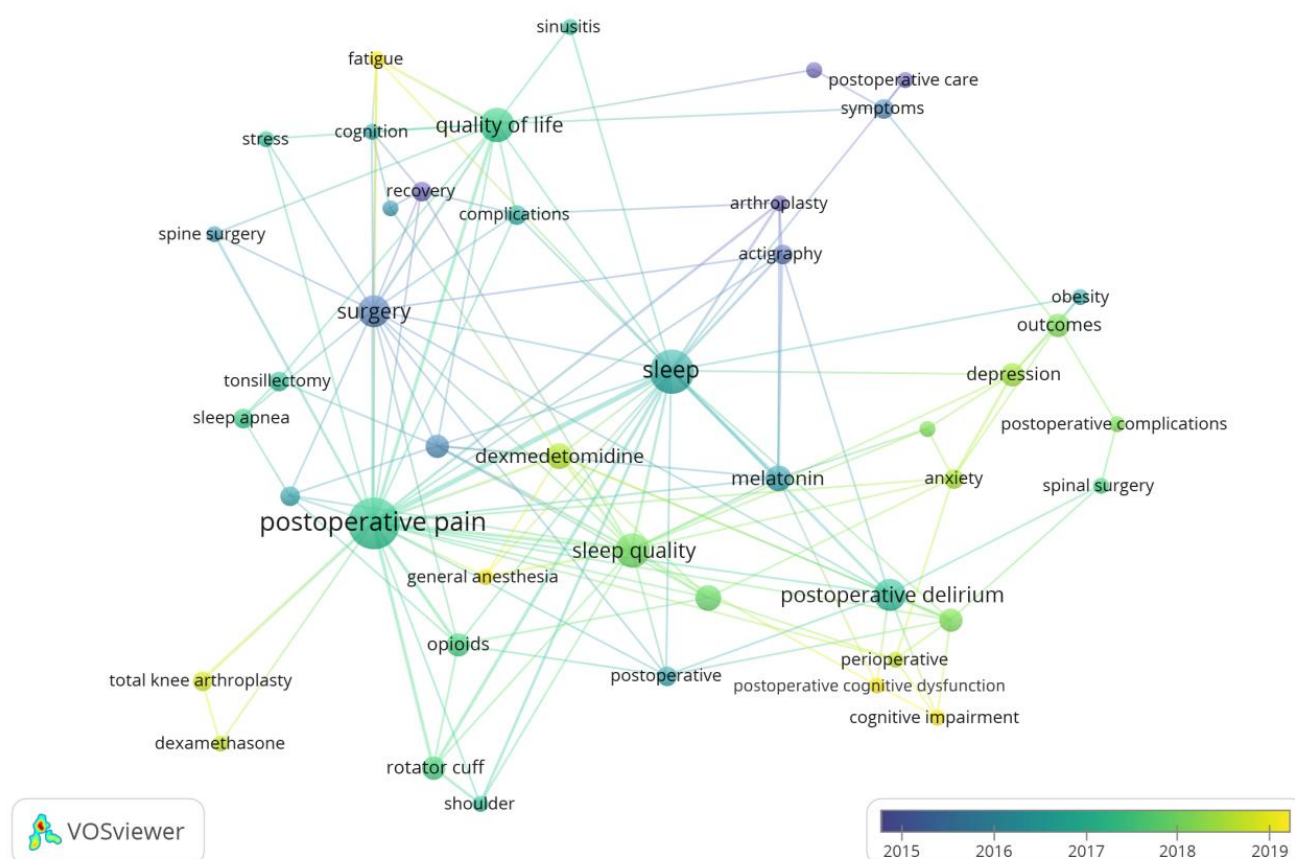


**Figure 2.** Discipline distribution of the journals recording the 100 articles.





**Figure 3.** Citation analysis of the journals. The relatedness of the items is based on the times they cited each other. The items that have no relatedness is not shown in the map.



**Figure 4.** Co-occurrence analysis of the keywords. The relatedness of the items is based on the times they occur together.

## Abbreviations

WoS: Web of Science

OSA: Obstructive Sleep Apnea

IF: Impact Factor

JCR: Journal Citation Report

## Author Contributions

RD and JT designed this study, RZ and JH collected the data, RD, JT, and RZ performed data analysis and interpretation, RD, JT, RZ, JH, DZ, XZ and LX drafted the article, RD and JT revised the article. All authors reviewed the manuscript and approved the final version to be published.

## Ethical Approval

All data were obtained and downloaded from an open database. This study did not involve any ethical issues requiring approval.

## Consent for Publication

Not applicable.

## Conflicts of Interest

The authors declare that there are no competing interests.

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