



## Visualization and bibliometric analysis of occupational exposure among nurses in Asia

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### ABSTRACT

**Background:** Occupational exposure is of increasing concern, posing a serious threat to nurses, especially in the event of a public health emergency. Bibliometrics sheds novel light on the current state of research and factors influencing nurses' occupational exposures, illuminating hot topics and trends in the literature. Bibliometrics is essential to analyze the potential harm to nurses in Asia.

**Methods:** Data were extracted from the Web of Science Core Collection on August 6, 2022 with the following search terms: TS= (nurses) AND (TS= (occupational exposure OR occupational health)). CiteSpace and VOSviewer were used to analyze national and institutional collaborations, reference clustering, citations and co-citations of journals and keyword bursts, and HistCite was used to analyze the citation historiography map. To analyze the data and generate statistical charts, Origin and Microsoft Excel were utilized.

**Results:** A total of 1448 studies on nurses' occupational exposure in Asia were identified. China Medical University had the most publications among Asian institutions, and China had the largest share among Asian countries. Most articles on nurses' occupational exposure in Asia were in the *Journal of Occupational Health*, and the journal with the highest impact factor was the *Journal of Nursing Management*. The COVID-19 outbreak caused a substantial shift in the direction of studies on nurses' occupational exposure in Asia. Mental health is a current hot topic, while sharps injuries and bodily fluid exposure are long-term priorities for attention.

**Conclusions:** The hotspots of research on nurses' occupational exposure in Asia focus on mental health, burnout, blood exposure, infection, and sharps injury. Due to the COVID-19 pandemic, recent research has concentrated on personalized mental health care and the development of protective equipment, and cross-disciplinary collaboration may be a new trend in the future.

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## 1. Introduction

As time and society progress, the importance of occupational exposure has steadily increased along with people's knowledge of safety issues. Many professionals are at risk of occupational exposure, with health care workers more vulnerable to pathogen infection from various sources [1,2], such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) [3]. Nurses' occupational exposure also encompasses a wide range of aspects, such as occupational violence [4], bodily fluid exposure [5], radiation exposure [6], and needlestick injuries [7]. One study demonstrated that approximately 80,000 healthcare workers worldwide are infected by needlestick injuries annually [3]. Occupational exposure risks are higher in developing countries than developed countries due to lacking resources for implementing safety strategies [8,9].

Several disease outbreaks have significantly increased the risk of occupational exposure among nurses. For example, throughout the coronavirus disease 2019 (COVID-19) pandemic, health care workers showed high infection rates [10,11]; one study indicated more emotional symptoms in nurses than doctors. Moreover, female healthcare professionals demonstrated more frequent emotional symptoms than their male counterparts [12]. Coupled with the fact that women are more susceptible to harassment when engaged in the same profession as men, female nurses are consequently more prone to occupational exposure than their male counterparts [13]. In addition, confronted with the possibility of contracting infectious diseases, such as severe acute respiratory syndrome (SARS), nurses were concerned and afraid of infection [14]. Influenced by climatic and environmental factors, seasonal influenza outbreaks likewise affect occupational exposures among nurses [15–17]. Personal protective equipment plays a pivotal role in occupational exposure to pandemic diseases. Protective garments, masks, and gloves shield nurses from direct contact with pathogens. For example, during the COVID-19 pandemic, Italy witnessed pronounced occupational exposure due to a scarcity of protective equipment, resulting in elevated infection and mortality rates among healthcare personnel [18]. Overall, understanding the present state of occupational exposure in the nursing population and directing future research will be beneficial in preventing occupational exposure, enhancing prevention awareness, and promoting nurses' physical and mental well-being.

Bibliometrics quantifies knowledge vectors and integrates mathematics and statistics [19]. Bibliometric studies often investigate

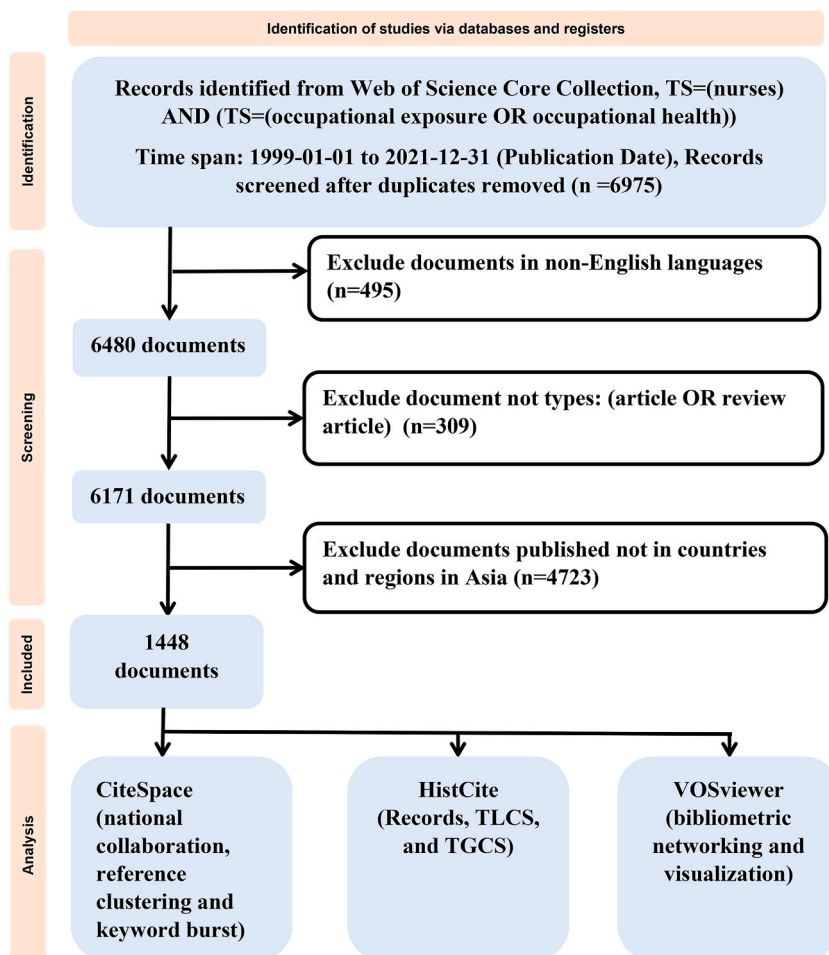


Fig. 1. Search flow of publications on occupational exposure.

the numerous research contributors to a field of study, such as authors, institutions, and nations [20,21]. Bibliometrics can offer new ideas for research on the topic of study through processing large volumes of literature to elucidate hot topics and emerging trends [22]. However, there are currently no studies on bibliometrics in the area of occupational exposure of nurses in Asia.

Here, this work systematically explores the occupational exposure research of nurses in Asia from 1999 to 2021 through bibliometric analysis, focusing on international cooperation, future development space, and hot topics in research by analyzing the contributions of nations, organizations, journals, and keywords, which offers a new starting position for subsequent studies. This research can also serve as a reference for academics, educators, clinical workers, hospital managers and interdisciplinary researchers who study occupational exposure.

## 2. Methods

It is worthwhile to establish a clear and comprehensive framework for understanding the occupational exposure of nurses in Asia through a bibliometric approach, which can enhance the quality of nursing management and safeguard clinical nurses' lives. This study was conducted in compliance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement to standardize the procedure and ensure the accuracy of the findings [23]. This study was not registered.

### 2.1. Data sources

The data source in this study was the Web of Science Core Collection (WoSCC), a sizable, extensive, transdisciplinary database of core journal citation indexes. Most bibliometric analyses are performed using the Web of Science database since it provides access to powerful bibliographic and citation data and covers multiple categories from sources worldwide [24].

### 2.2. Inclusion and exclusion criteria

Based on the study's goals and to make the analysis convenient, the following criteria were established: (1) documents published between 1999 and 2021, (2) documents in English, (3) articles or review articles, and (4) documents published in countries and regions in Asia. Articles that did not meet these inclusion requirements were disqualified.

### 2.3. Search terms

The following search terms were used to filter the relevant literature from the WoSCC: TS= (nurses) AND (TS= (occupational exposure OR occupational health)). Because literature on occupational exposure of nurses in Asia first appeared in 1999 and the search results could not include all articles published in 2022, January 1999 to December 2021 was selected as the time frame for this review. Only articles and review articles in English and by authors from Asian countries were included (Fig. 1). The authors of this study completed the search within August 6, 2022. To ensure that the findings were accurate and thorough, two researchers conducted the search and two others performed a final check. The data exported from WoSCC were in plain text format, with 500 records per export and 1448 records in total. All investigators involved in data retrieval, collection, and review worked independently. Data retrieval and verification were completed in one day.

### 2.4. Analysis

Many software programs and websites are available for science mapping. Here, CiteSpace (version 6.1.R3), HistCite (version Pro 2.1), and VOSviewer (version 1.6.18) were chosen. CiteSpace has the ability to support many kinds of scientometric studies, evaluating crucial literature or areas from multiple perspectives [25,26]. Thus, to examine international collaboration, reference clustering, and keyword bursts in this study, CiteSpace was used. VOSviewer plays an imperative role in bibliometric networking and visualization [27,28], providing three visualizations that analyze collaboration among institutions, relationships among journals, and the keyword frequency. In addition, the most important metric in HistCite is the total local citation score (TLCS). When a document has a high local citation score (LCS), it means that it has received much attention from the author's peers and is a significant publication in the field [29]. Moreover, the authors analyzed the resulting data using Microsoft Excel 2019 and Origin 2021 to produce statistical graphics.

### 2.5. Ethical considerations

Since this analysis used publicly accessible data and did not directly involve human-related experiments, ethical approval was not needed.

## 3. Results

### 3.1. Overall evolution and trends of the literature volume

Based on the search terms, 1448 articles, including 1351 articles and 97 review articles, were retrieved. The authors plotted the search results on a statistical graph (Fig. 2A) and discovered that the volume of documents published annually showed a trend from a

slow rise to a steady rise and finally to a rapid rise, and the cumulative number of documents rose each year. In addition, the search results revealed that 297 articles in total were published in 2021, 33 times more than in 1999.

Records (Recs), TLCS, and total global citation score (TGCS) are shown in Fig. 2B. The term “Recs” refers to the annual volume of articles, which has dramatically expanded during the last 23 years, particularly in the past 6 years. From 1999 to 2004, TLCS and TGCS showed fundamentally similar trends, even having coincident peaks. However, from 2006 to 2021, the difference between TLCS and TGCS widened overall. Over the past 23 years, TGCS has grown in waves, whereas TLCS first increased and then decreased gradually.

### 3.2. Analysis of institutions and countries

Between 1999 and 2021, a total of 112 institutions in Asia published at least five articles on the occupational exposure of nurses. The network visualization of interinstitutional collaboration (Fig. 3A) showed six clusters. As shown in Fig. 3B, which has zoomed in on the details of one of the sections, China Medical University has extensive connections with institutions such as National Taiwan University, Harbin Medical University, and Kaohsiung Medical University, while its cooperation with institutions in other countries is less extensive. Some institutions, such as King Saud University, Ministry of Health of Singapore, and Shiraz University of Medical Sciences, published their research later, and other institutions, such as China Medical University, Hong Kong Polytechnic University, and University of Tokyo, published their papers earlier (Fig. 3C). The results demonstrated that 8 institutions published more than 20 documents (Table 1). The largest numbers of institutions in the top 12 were located in Iran, with four, followed by Chinese institutions, with three.

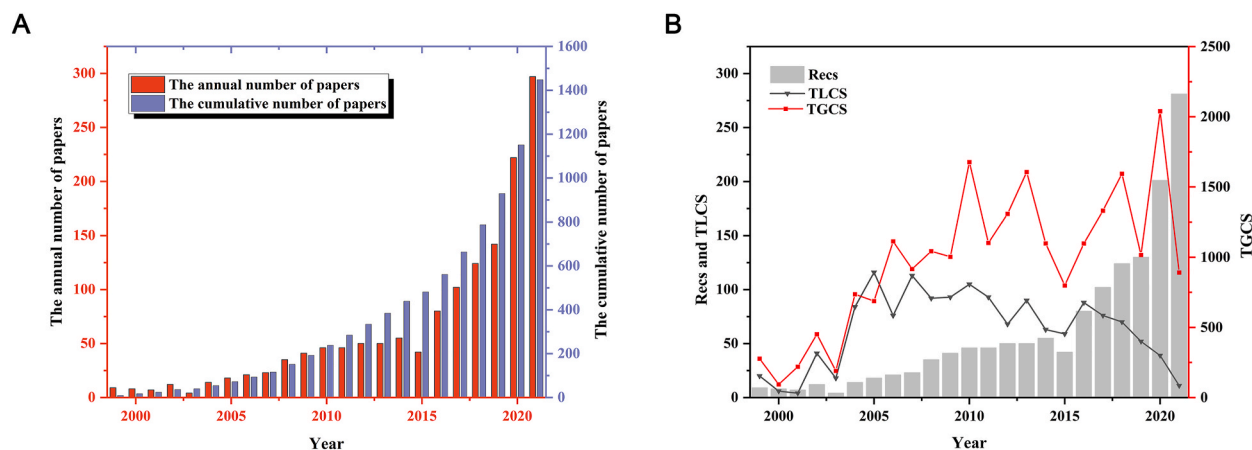
China ( $n = 277$ ) and Iran ( $n = 184$ ) had the most published articles (Supplementary Table S1), similar to the results of the institution analysis. China had the largest share of publications at 19%. Among the top 10 countries, Thailand had the latest time to first publish relevant literature, in 2005. China, India, and Jordan had more publications after 2016, while more articles were published before 2016 in Japan and Israel (Fig. 3D).

### 3.3. Journals and co-cited journals

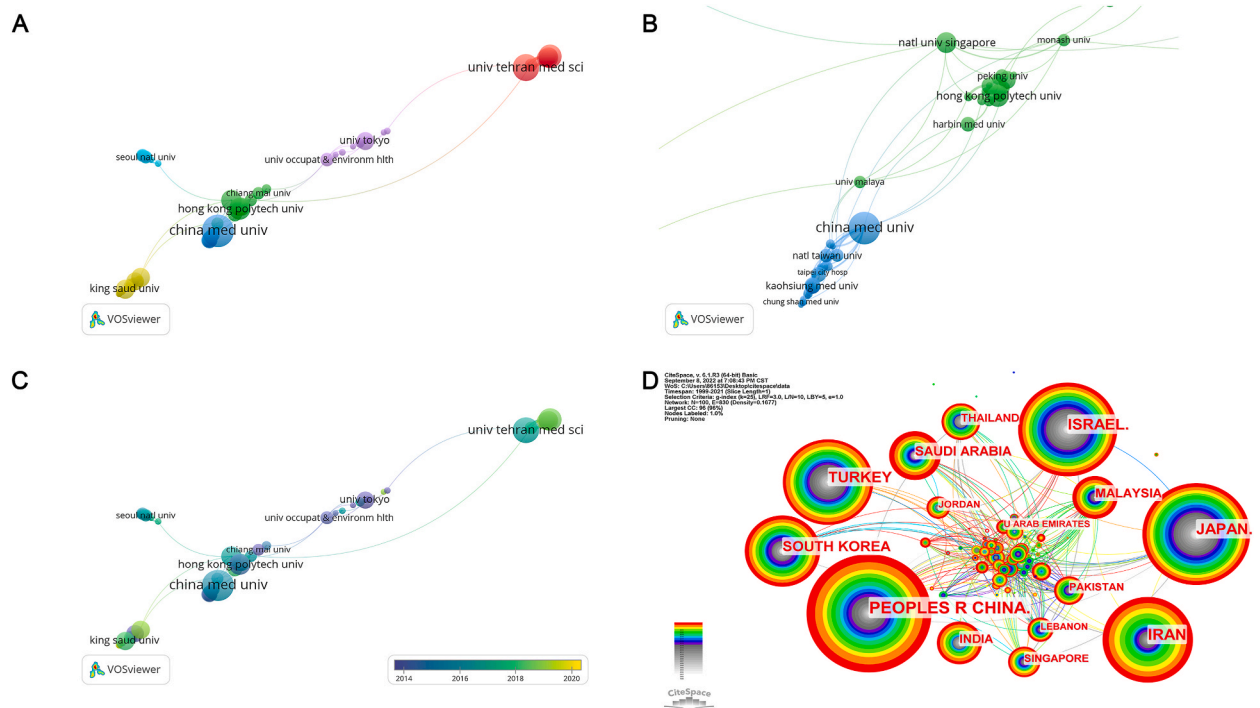
There were 1448 documents published in 551 journals, of which the *Journal of Occupational Health* ( $n = 51$ ) had the highest number (Table 2). Among the top 10 journals, the *Journal of Nursing Management* (IF = 4.680) had the highest impact factor. Clarivate’s Journal Citation Indicator (JCI), a new standardized metric that breaks through multiple constraints and can compare the impact of journals in different disciplines in related fields, was also applied [30]. The *Journal of Nursing Management* had the highest JCI, at 1.68. In addition, among these journals, three were located in the Q1 Journal Citation Reports (JCR) region. However, most were in England and the United States, and only two in Asian countries, namely, *Industrial Health* and *Journal of Occupational Health*. Fig. 4A shows the visualization map between journals, which had 33 clusters.

The most often co-cited journal, according to Supplementary Table S2, was the *Journal of Advanced Nursing* ( $n = 1056$ ). The network visualization showed that the top 1000 co-cited documents, divided into 8 clusters, formed 117,373 links, which also showed the most co-cited journals (Fig. 4B). Four of the top ten journals with the most co-citations were found in the Q1 JCR region. Moreover, half of the 10 journals were in England and only one, the *Journal of Occupational Health*, was Asian and located in Japan. The *International Journal of Nursing Studies* had the highest IF and JCI.

Table 3 displays the top 10 journals according to TLCS values. Among the 1448 articles retrieved, the mean of the 100 articles with the highest TLCS scores was 9.352, and the mean TGCS was 57.65. In line with the TLCS, the *International Journal of Environmental Research and Public Health* (TLCS = 198) was cited the most and was the most highly cited among the 1448 articles obtained from the Web of Science. The citation historiography graph showed 100 circles, each representing a document (Fig. 4C). Accordingly, this



**Fig. 2.** Overall trends in publications related to the occupational exposure of nurses in Asia, 1999–2021. (A) The quantity of articles published annually and overall. (B) The publications’ Recs, TGCS, and TLCS each year.



**Fig. 3.** The Asian institution and country collaborative network on the occupational exposure of nurses, 1999–2021. (A) Network visualization for organizations ( $n \geq 5$ ). Different colors represent different clusters; the institutions' collaboration relationship is represented by the connecting lines between nodes, and the level of collaboration is represented by the width of the connecting lines. (B) The co-occurrence detail of China Medical University. (C) Overlay visualization for organizations ( $n \geq 5$ ). Depending on the year of the first publication, a node's hue can vary from blue (the oldest) to yellow (the latest). (D) Network visualization for countries. The node's size indicates the quantity of documents, the lines connecting points denote a cooperative link between countries, and different color thicknesses encircling the nodes indicate the quantity of documents in different years. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

**Table 1**

Top 12 institutions in terms of publications on occupational exposure of nurses in Asia, 1999–2021.

Rank	Institution	Count	Total link strength	Country
1	China Medical University	42	31	China
2	Tehran University of Medical Sciences	33	29	Iran
3	Shiraz University of Medical Sciences	28	34	Iran
4	Hong Kong Polytechnic University	25	15	China
5	National University of Singapore	24	14	Singapore
6	Shahid Beheshti University of Medical Sciences	23	34	Iran
7	King Saud University	21	33	Saudi Arabia
8	Ministry of Health of Singapore	21	13	Singapore
9	Iran University of Medical Sciences	20	30	Iran
10	Sichuan University	20	12	China
11	Tel Aviv University	20	1	Israel
12	University of Tokyo	20	21	Japan

analysis revealed that ID121, ID79, ID47, ID129, and ID75 played a significant role in the field of occupational exposure of nurses in Asia (Fig. 4C and Supplementary Table S3).

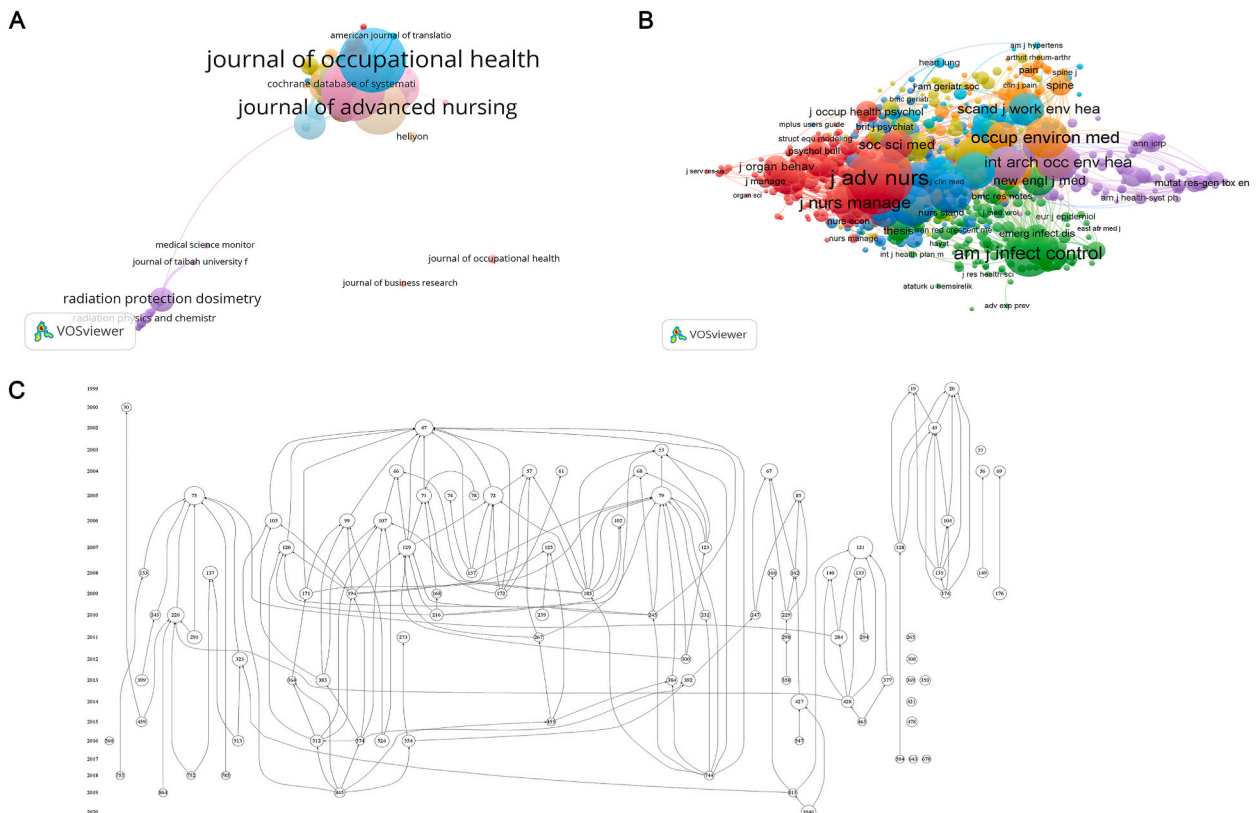
### 3.4. Analysis of references

Table 4 demonstrates the nine main clusters. A silhouette value greater than 0.7 was generally considered to indicate high homogeneity in the cluster members. All nine clusters exhibited high homogeneity, with cluster # 20 having the highest homogeneity. These clusters selected by the log-likelihood ratio test method (LLR) formed a map (Fig. 5) with a modularity value higher than 0.3, implying a noticeable cluster structure. The cluster with the largest size was cluster # 0, which was labeled COVID-19. The authors sorted out the articles with over 10 counts (Table 5). The top article was published in *JAMA Network Open* and written by Lai et al. The article indicates that throughout the COVID-19 pandemic, Chinese medical professionals in Wuhan were at significant risk of

**Table 2**  
Top 10 journals related to occupational exposure of nurses in Asia, 1999–2021.

Rank	Journal	Documents	IF(2021) <sup>a</sup>	JCR (2021) <sup>a</sup>	JCI(2021) <sup>a</sup>	Country
1	Journal of Occupational Health	51	2.570	Q3	0.60	Japan
2	International Journal of Environmental Research and Public Health	47	4.614	Q2	0.93	Switzerland
3	Journal of Advanced Nursing	38	3.057	Q1	1.32	England
4	Journal of Nursing Management	31	4.680	Q1	1.68	England
5	Journal of Clinical Nursing	29	4.423	Q1	1.62	England
6	Industrial Health	28	2.707	Q3	0.45	Japan
7	PLOS One	27	3.752	Q2	0.88	USA
8	Workplace Health & Safety	27	2.338	Q2	1.01	USA
9	American Journal of Infection Control	19	4.303	Q2	0.82	USA
10	WORK-A Journal of Prevention Assessment & Rehabilitation	19	1.803	Q4	0.44	Netherlands

<sup>a</sup> Journal Citation Indicator (JCI), Impact Factor (IF) and Journal Citation Reports (JCR) region were from the 2021 Journal Citation Reports.



**Fig. 4.** Map of journals and co-cited journals connected to nurses’ occupational exposure, 1999–2021. (A) Network visualization for journals. (B) Network visualization for co-cited journals. (C) Citation historiography map of the top 100 TLCS. A document’s serial number is represented by the number in the middle. The more lines emanating from the circle the larger the circle is, and the more important the document.

experiencing negative mental health results, especially women, nurses, and frontline workers [31]. The highest centrality among the top 8 papers was the article published in *BMJ Open* by Jiao et al. regarding workplace violence encountered by Chinese nurses [32].

### 3.5. Analysis of keywords

From the 1448 documents, a total of 4537 keywords were extracted. Fig. 6A shows the visualization of the top 1000 keyword co-occurrences, with 13 clusters in total. The top five nodes were “nurses”, “health”, “occupational stress”, “burnout”, and “stress” (Table 6), and the most studied areas were mental health, burnout, and occupational stress. Similarly, some high-frequency keywords indicated that research focusing on blood-bodily fluid exposure and acute injuries should not be neglected. Through overlay visualization (Fig. 6B), some keywords that have appeared in recent years deserve attention, such as COVID-19, coronavirus outbreak, and acute respiratory syndrome.

Burst keywords are frequently cited terms over time, indicating future research directions and increasing interest [33]. CiteSpace



**Table 3**

Top 10 most active journals related to occupational exposure of nurses in Asia, 1999–2021.

Rank	Journal	TLCS	TGLS	Records
1	International Journal of Environmental Research and Public Health	198	1693	38
2	Journal of Occupational Health	130	1241	51
3	American Journal of Infection Control	113	483	19
4	Journal of Nursing Management	64	790	31
5	International Journal of Nursing Studies	63	814	17
6	Journal of Clinical Nursing	57	591	29
7	Industrial Health	41	470	28
8	Journal of Hospital Infection	37	257	12
9	Occupational Medicine-Oxford	32	345	15
10	American Journal of Industrial Medicine	23	151	6

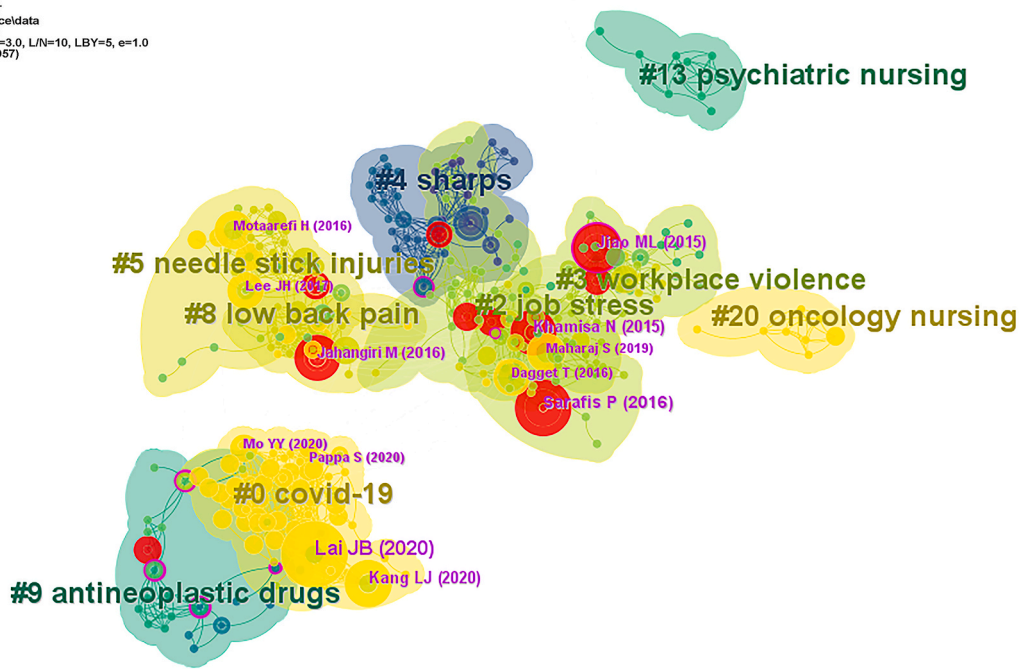
**Table 4**

Main clusters of references on occupational exposure of nurses in Asia, 1999–2021.

Cluster ID	Size	Silhouette	Average year	Label (LSI) <sup>a</sup>	Label (LLR) <sup>a</sup>	Label (MI) <sup>a</sup>
0	83	0.963	2007	occupational stress	COVID-19	sleep disturbances
2	62	0.931	2014	mental health	job stress	work environment
3	57	0.942	2014	workplace violence	workplace violence	different types of violence
4	43	0.951	2002	sharps	sharps	needle stick/sharp injuries
5	37	0.961	2016	occupational exposure	needle stick injuries	occupational infection
8	22	0.927	2016	low back pain	low back pain	upper quadrant
9	22	0.965	2009	antineoplastic drugs	antineoplastic drugs	cyclophosphamide
13	12	0.958	2011	psychological stress	psychiatric nursing	South Africa
20	8	1.000	2017	occupational health	oncology nursing	qualitative research

<sup>a</sup> LSI: latent semantic indexing; LLR: log-likelihood ratio; MI: mutual information.

CiteSpace, v. 6.1.R3 (64-bit) Basic  
 September 13, 2022 at 6:35:17 PM CST  
 WoS: C:\Users\88153\Desktop\citespaceldata  
 Timespan: 1999-2021 (Slice Length=1)  
 Selection Criteria: g-index (k=25), LRF=3.0, L/N=10, LBY=5, e=1.0  
 Network: N=924, E=2411 (Density=0.0057)  
 Largest CC: 488 (52%)  
 Nodes Labeled: 1.0%  
 Pruning: None  
 Modularity Q=0.913  
 Weighted Mean Silhouette S=0.9602  
 Harmonic Mean(Q, S)=0.936

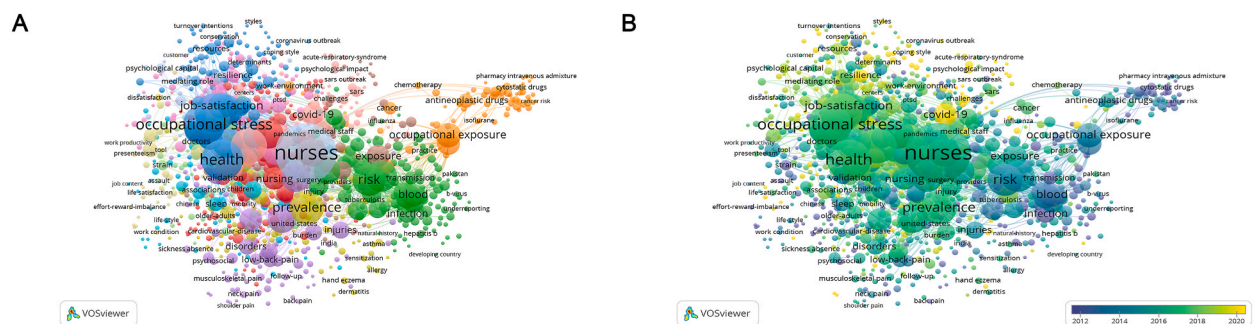


**Fig. 5.** Reference co-citation clusters related to occupational exposure of nurses, 1999–2021. Different clusters are shown in different colors; landmark references are labeled in purple. Nodes with purple circles around them have centralities larger than 0.1, and red nodes represent citation bursts. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

was set by default to analyze the keywords in these 1448 documents, and the top 10 burst keywords were filtered and ranked by strength (Fig. 6C). The top-ranked keywords included risk (strength, 13.82; time span, 2002–2010), infection (10.24, 2002–2014), sharps injury (6.96, 2008–2012), and blood (6.85, 2002–2011).

**Table 5**  
Top 8 cited references on occupational exposure of nurses in Asia, 1999–2021.

Rank	Count	Centrality	Year	Title of cited reference	DOI	Cluster #
1	33	0.03	2020	Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019	10.1001/jamanetworkopen.2020.3976	0
2	17	0.00	2016	The Impact of Occupational Stress on Nurses' Caring Behaviors and Their Health Related Quality of Life	10.1186/s12912-016-0178-y	2
3	14	0.01	2020	The Mental Health of Medical Workers in Wuhan, China Dealing With the 2019 Novel Coronavirus	10.1016/S2215-0366 (20)30047-X	0
4	14	0.03	2015	Work Related Stress, Burnout, Job Satisfaction and General Health of Nurses	10.3390/ijerph120100652	2
5	13	0.12	2015	Workplace Violence Against Nurses in Chinese Hospitals: a Cross-Sectional Survey	10.1136/bmjopen-2014-006719	3
6	11	0.04	2005	Needlestick and Sharps Injuries Among Nursing Students	10.1111/j.1365-2648.2005.03526.x	1
7	10	0.03	2007	Needlestick Injuries Among Nurses of Fars Province, Iran	10.1016/j.annepidem.2007.07.106	1
8	10	0.08	2016	Needle Stick Injuries and Their Related Safety Measures Among Nurses in a University Hospital, Shiraz, Iran	10.1016/j.shaw.2015.07.006	5



**Top 10 Keywords with the Strongest Citation Bursts**

Keywords	Year	Strength	Begin	End	1999 - 2021
risk	1999	13.82	2002	2010	
infection	1999	10.24	2002	2014	
sharps injury	1999	6.96	2008	2012	
blood	1999	6.85	2002	2011	
occupational exposure	1999	6.41	2004	2010	
health care worker	1999	6.09	2005	2010	
medical student	1999	6.01	2005	2012	
effort reward imbalance	1999	5.94	2012	2014	
needlestick injury	1999	5.11	2005	2013	
questionnaire	1999	5.04	2012	2018	

**Fig. 6.** Map of keywords related to the occupational exposure of nurses, 1999–2021. (A) Network visualization for keywords. (B) Overlay visualization for keywords. (C) Top 10 burst keywords for nurses' occupational exposure. Blue bars represent 1999–2021; red bars indicate that this keyword is cited frequently over the time period. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

#### 4. Discussion

Here, documents about the occupational exposure of nurses in Asia over 23 years were analyzed using bibliometric-based scientific production analyses. The study of bibliometrics allows researchers to track themes throughout their propagation in the literature or characterize frequently cited journals and articles to identify emerging research directions [34]. This study analyzed the bibliometric characteristics of the literature related to the field of occupational exposure among nurses in Asia, finding that China, Iran, and Japan were the most vital contributors in terms of article number. Due to the COVID-19 epidemic, much of the research on occupational exposure among nurses in Asia has focused on mental health, while sharps injury, infection, and blood exposure are still hot topics for future research.

The authors extracted 1448 articles from the WoSCC and found a rapid growth trend in the past 6 years, especially in 2020 and



**Table 6**  
Top 30 keywords on occupational exposure of nurses in Asia, 1999–2021.

Rank	Keyword	Occurrences	Total link strength
1	Nurses	482	4005
2	Health	221	1952
3	Occupational stress	218	1941
4	Burnout	202	1916
5	Stress	170	1487
6	Prevalence	150	1341
7	Risk	140	1155
8	Health-care workers	135	1114
9	Work	116	1073
10	Care	114	980
11	Nurse	110	869
12	Occupational health	108	905
13	Risk-factors	104	931
14	Impact	96	888
15	Depression	91	836
16	Workers	90	724
17	Job-satisfaction	89	845
18	Occupational exposure	81	541
19	Job stress	79	714
20	Mental-health	79	736
21	Satisfaction	79	733
22	Blood	70	632
23	Nursing	69	590
24	Occupational-exposure	69	611
25	Exposure	68	506
26	Symptoms	67	631
27	Hospital nurses	62	621
28	Performance	62	560
29	Sharps injuries	62	519
30	COVID-19	60	414

2021. Moreover, some scholars in their fields of study also appear to reveal a similar trend [35–38]. The COVID-19 outbreak is the primary cause of this growth and has significantly increased occupational exposure risk among nurses and the explosion of research in many related fields. Moreover, among the 1448 articles, “COVID-19” significantly influenced both the cluster analysis of references and the frequency analysis of keywords. Notably, in the future, mental health will become a research focus, particularly the impact of work stress and exhaustion [39–41].

Among Asian countries, China and Iran dominate occupational exposure studies among nurses. Institutions that publish a high number of articles tend to collaborate more with one another. Interestingly, however, researchers were found to collaborate closely across institutions in the same country and region and less with institutions in different countries and regions. This may be because the similarities in geography, economic conditions, and culture make it easier to establish collaborations with nearby institutions.

Regarding journals and co-cited journals, the impact factor was generally low (Table 2 and Supplementary Table S2). Moreover, less than half of the journals and co-cited journals belonged to JCR Q1. This finding suggests that research on the occupational exposure of nurses in Asia is not yet sufficiently influential and impactful studies are lacking. However, it is possible that this is due to the existence of Asian articles published in non-English languages and language barriers that prevent such articles from being widely circulated and cited [42]. A new standardized indicator, JCI, introduced in this study may better measure the quality of an article. Although some documents have a relatively low IF, they have a high JCI score. Among the co-cited journals, the *International Journal of Nursing Studies* has a high JCI score, which is twice the average value of 1.0, demonstrating the journal’s enormous influence in its field. Therefore, researchers should not focus on increasing the IF at the expense of article quality [43], and the IF is not the only indicator to evaluate the quality of an article.

This research analyzed the publications with the top 100 TLCS (Fig. 4C and Supplementary Table S3) and found that crucial documents concerned occupational burnout and its predictors [44], nursing students’ sharps injuries [45], and needlestick injuries among nurses [46,47]. The analysis of keyword frequency and burst keywords also showed similar results. While most articles focused on pathogenic infections, sharps injuries, and blood-bodily fluid exposure, psychological issues arising from nurses’ occupational exposures have also received increasing attention. The themes of these articles reflect the most common causes of occupational exposure among Asian nurses and indicate the vital aspects of occupational exposure prevention in this population. Another study on occupational health among health care workers found similar common research foci [48], such as mental health, infection control, and occupational injuries. However, areas such as HIV, HBV, and tuberculosis were not the focus of the studies we retrieved.

The COVID-19 outbreak caused a substantial shift in the direction of study related to nurses’ occupational exposure in Asia. Mental health problems are associated with close exposure to risk factors such as COVID-19 and the psychologically damaging nature of such exposure in an epidemiological setting [49]. As a result, many recent studies with significant impact have focused on the medical personnel’s mental health throughout the epidemic [49,50]. Meanwhile, widespread outbreak of this pandemic has led to an explosion of research on occupational protection [51–53]. The international community and nursing managers must prepare for such large-scale

problems, and more attention should be given to psychological treatment, education about public health emergency preparation and personal protection of nurses during pandemics [54]. Furthermore, we speculate that personalized mental health care and the development of complete, safe and comfortable personal protective equipment may be the direction of future research.

Overall, it will be important for different countries and institutions to strengthen cooperation, remove academic barriers, and jointly support research in this field. Most of the studies are quantitative; thus, qualitative studies are lacking, and further in-depth excavation of the phenomenon is required. At present, research on occupational exposure still has a long way to go, and individuals can learn from each other through interdisciplinary exchange and cooperation to investigate new and effective protection tools to encourage the nursing discipline's development.

This research has some limitations. First, the WoSCC provided all of the data for our research, which was not extensive enough. However, the most widely utilized collection of data for bibliometrics is the Web of Science [55,56]. Second, during the search process, the authors restricted the language of the articles to English, which would cause the omission of non-English publications. Finally, some terms in the data utilize various phrasing but have similar meanings. Even by merging the same nodes and standardizing some words, some information was inevitably overlooked.

## 5. Conclusion

This study bibliometrically analyzed the research on nurses' occupational exposure in Asia for the first time. Many quantitative but few qualitative studies have been conducted on occupational exposure among Asian nurses; thus, some phenomena require further investigation and analysis. Moreover, the impact factors of these articles are generally low, indicating a lack of more influential articles in the field of occupational exposure in Asia. More high-quality studies will emerge in the future if there is closer cooperation between countries and regions and more frequent academic exchanges. In the face of sudden public health problems, such as COVID-19, the design and development of new and effective protective equipment, the enhancement of psychosocial training for nurses, and the strengthening of the training of specialized nurses are indispensable to prevent occupational exposure among nurses. Given the COVID-19 pandemic, there will be more studies on occupational exposure protection in the future, and the trend of cross-collaboration among disciplines will become increasingly obvious.

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## Data availability statement

Data will be made available on request.

## CRedit authorship contribution statement

**Xiaorui Zhang:** Data curation, Formal analysis, Methodology, Writing – original draft. **Yunzhe Zhou:** Formal analysis, Supervision, Writing – original draft. **Chunmei Fan:** Funding acquisition, Resources, Software, Supervision, Validation. **Xueying Huang:** Formal analysis, Investigation, Visualization. **Linna Long:** Formal analysis, Investigation, Visualization. **Siying Yu:** Formal analysis, Investigation, Visualization. **Honghong Wang:** Conceptualization, Writing – review & editing. **He Huang:** Conceptualization, Funding acquisition, Writing – review & editing.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2023.e21289>.

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