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Mapping Research on Chronic Pulmonary Aspergillosis: A Bibliometric Analysis from 1992 to 2024

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Abstract

Background: *Aspergillus* is an environmental fungus that causes chronic pulmonary aspergillosis (CPA), a chronic lung infection that frequently affects people with underlying lung conditions like bronchiectasis, COPD, and tuberculosis. Significant morbidity is caused by CPA, which increases the risk of complications and makes early diagnosis challenging due to its frequently nonspecific symptoms. This disease has a worldwide burden, particularly in nations where tuberculosis is highly prevalent. More research is required to create easier diagnostic techniques and efficient treatment strategies to enhance clinical outcomes and lessen the impact on public health due to the growing azole resistance and the scarcity of available therapeutic options.

Aims: This research aims to map the research landscape on chronic pulmonary aspergillosis (CPA) and identify trends, key contributors, research gaps, and emerging topics.

Study design: A bibliometric analysis

Methodology: 778 Scopus documents on chronic pulmonary aspergillosis were retrieved. After applying exclusion criteria, 531 documents remained. The data were extracted in CSV format and analyzed using Biblioshiny and VOSviewer 1.6.19.

Results: There was a growth of publications on CPA despite decline citations, with Denning DW and the United Kingdom as the most frequent authors and the leading country on chronic pulmonary aspergillosis publications, respectively. Mycoses was a journal with the highest number of publications on chronic pulmonary aspergillosis. The most frequent keyword was chronic pulmonary aspergillosis itself, though the trend topic was *Aspergillus* nodule. The most frequent keyword based on co-occurrence keyword analysis was chronic pulmonary aspergillosis.

Conclusion: For the first time, this study provides an overview of the growth in chronic pulmonary aspergillosis publications through bibliometric analysis. We recommend further research on *Aspergillus* nodule, the epidemiology of chronic pulmonary aspergillosis, particularly in countries with high tuberculosis cases, and treatment to address azole resistance. We hope there will be easier diagnostic methods for chronic pulmonary aspergillosis and more appropriate treatment.

Keywords: chronic pulmonary aspergillosis, *Aspergillus*, bibliometric analysis

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Introduction

Chronic respiratory infections are common in both adults and children, and they increase morbidity, mortality, as well as financial burden on healthcare systems [1–5]. Chronic pulmonary aspergillosis (CPA) is a form of persistent respiratory infection. It is brought on by the environmental fungus *Aspergillus*, which infects healthy human lungs and causes serious health issues [6,7]. Aspergillus nodule(s), chronic cavitary pulmonary aspergillosis, subacute invasive aspergillosis, chronic fibrosing pulmonary aspergillosis (CFPA), and single aspergilloma are the five subtypes of CPA [8–11]. CPA can present in humans, either asymptomatic or symptomatic. The symptoms of CPA are usually unspecific, such as hemoptysis, productive cough, fatigue, and weight loss, causing a challenge to diagnose [8,12–14]. Hence, delayed treatment and worsening condition of patients [15].

CPA mainly presents in people with underlying lung diseases, including tuberculosis (TB), chronic pulmonary obstructive disease, non-tuberculous mycobacterium infections, allergic bronchopulmonary aspergillosis, bronchiectasis, pulmonary sarcoidosis, asthma, and lung cancer [7,8,16,17]. In 2007, 372.000 cases of CPA are thought to have occurred globally due to pulmonary TB cases. Using worldwide TB data from the World Health Organization from 2020, the most recent CPA model calculates 1.837.272 CPA cases resulting annually from prior pulmonary TB cases [7]. Globally, the prevalence of CPA is around 42 per 100.000 population. In Japan, despite the incidence of CPA falls from 3,5 to 2,1 per 100.000 person-years, the frequency remains constant at 9,0 to 9,5 per 100.000 and is associated with poor prognosis [6,18]. In Indonesia, the incidence rates of CPA are 3%, 8%, and 22%, respectively, based on three multicenter studies. It is thought that Indonesia has a high burden of CPA due to common TB infection [19].

Massive hemoptysis is one of the complications caused by CPA, which is life-threatening. Although bronchial arteries may be responsible for the majority of the damaged arteries, other non-bronchial systemic arteries, such as intercostal, axillary, subclavian or internal thoracic arteries, may occasionally be charged. Bronchial artery embolization may be considered to stop the bleeding [20,21]. Secondary infections can also complicate CPA, such as bacterial pneumonia, TB, or invasive fungal disease [15,22]. In addition, untreated CPA may lead to extensive lung fibrosis and reduced lung function. This condition is termed CFPA [8,23].

Improving patient outcomes and creating efficient treatment strategies require an understanding of the complexity of CPA. Because CPA has serious health consequences, especially for people with pre-existing lung diseases, research on the disease is essential [24]. By using quantitative analysis to figure out what has been discussed in preceding publications on a particular topic, bibliometric analysis helps research teams, and experts comprehend the current status of the research field so that it motivates them to conduct additional studies into unexplored and highly contested areas in order to maximize their future contributions and ultimately improve clinical practice [25–30]. A bibliometric analysis of invasive pulmonary infection was aimed at providing a succinct synopsis of the field's traits, primary research topics, advancements, and trends [31]. However, bibliometric study of CPA research from 1992 - 2024 has not yet been conducted. In order to determine the existing research on CPA as well as possible future research, we will perform a bibliometric study on the subject.

Research Problem

The research problem addressed in this article is the lack of comprehensive understanding of the research landscape, trends, and influential contributors in the field of CPA. Despite the growing number of publications on CPA, there is limited insight into how research has evolved, who the key contributors are, and where the research gaps exist. This study aims to fill this gap by conducting a bibliometric analysis to map the development of CPA research from 1992 to 2024, identify key trends, and provide a clearer picture of the current state of research, ultimately helping guide future studies and clinical practices in CPA management.

Research Focus

The focus of this research is on mapping the development of CPA research through a bibliometric analysis. This includes examining publication trends, identifying influential authors and journals, understanding collaborative networks, and highlighting emerging research topics and gaps. The study aims to provide a comprehensive overview of the research landscape on CPA to better understand its progression and inform future research directions.

Research Aim and Research Questions

This study aims to conduct a bibliometric analysis of CPA research from 1992 to 2024 to identify key research trends, influential contributors, research gaps, and emerging topics in the field. This analysis will contribute to a better understanding of the current state of CPA research and provide insights that can help shape future studies and clinical practices.

Research Methodology

General Background

A systematic search was conducted in the Scopus database using the title, keywords, and abstract fields on November 22, 2024, to gather literature related to chronic pulmonary aspergillosis (CPA). The search yielded a total of 778 articles without any time restriction. The search query used was as follows: TITLE-ABS-KEY ("Chronic pulmonary aspergillosis") AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (PUBSTAGE, "final")) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (LANGUAGE, "English")). The results were filtered to include only completed publications in journal articles written in English. After conducting exclusion criteria, we got 531 articles. All 531 articles were exported in CSV format for further analysis. The metadata obtained was visualized and analyzed using Scopus Analyze Result, VOSviewer 1.6.19, and Biblioshiny. VOSviewer and Biblioshiny were specifically used to generate visual networks of journals, authors, and publications. Two popular applications for bibliometric analysis and visualization are VOSviewer and Biblioshiny. These tools help in identifying influential authors, institutions, and research clusters. Using these tools, we mapped the co-occurrence of keywords to identify emerging trends and research gaps in CPA literature. The author's keywords were used as the basis for ensuring consistency in the network analysis. Scopus Analyze Result was used for initial descriptive statistics of the dataset, including publication trends over time and geographical distribution of research. A summary of the study identification process is illustrated in Fig. 1. Initially, 778 papers were retrieved. After applying the inclusion and exclusion criteria, 247 articles were eliminated, resulting in a final dataset of 531 articles for analysis.

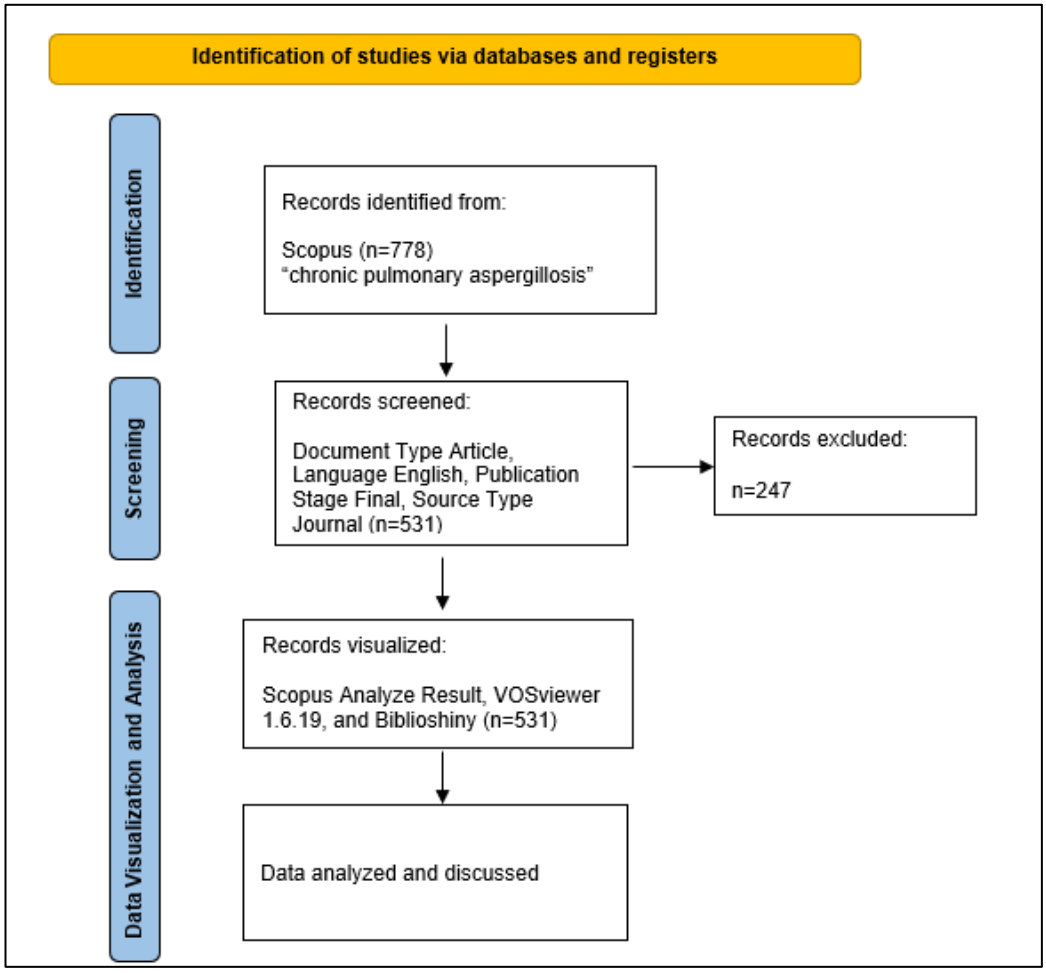

Fig. 1. Identification of the study using the current article's database on chronic pulmonary aspergillosis

Research Results

Growth of publication

Every item was released from 1992 to 2024 (Fig. 2). With the year of publication on the x-axis and the number of articles on the y-axis, Fig. 2a depicts the number of papers published throughout time. Only one article was released in 1992, the first year of publication. The years 1994–2002 and 2004–2005 had the fewest publications, at zero. The

average annual number of citations for publications about CPA is displayed in Fig. 2b. In this case, the y-axis displays the average citation rate, while the x-axis indicates the year of citation. In 2003, the year with the greatest average citation rate was 21.5. However, 1992 had the least average citation rate, which was 0.1%.

The first article on this subject that we could find was published in 1992, reporting a rare case of chronic invasive pulmonary aspergillosis happened to an 18-year-old girl. From histological biopsy, it was known that *Aspergillus flavus* was the cause of the infection. After receiving some therapies such as amphotericin B, rifampicin, and low-dose corticosteroid, the girl's condition deteriorated and she eventually died because of pulmonary hypertension and post-operative bleeding [32]. This article had 2 citations and was the only published article on CPA until 2003. Publications on this subject have increased virtually continuously since 2008, reaching a peak of 63 publications in 2022 and 2023, respectively. Biblioshiny's analysis of a publication's citation count showed an inclination to decrease even when the number of publications increased.

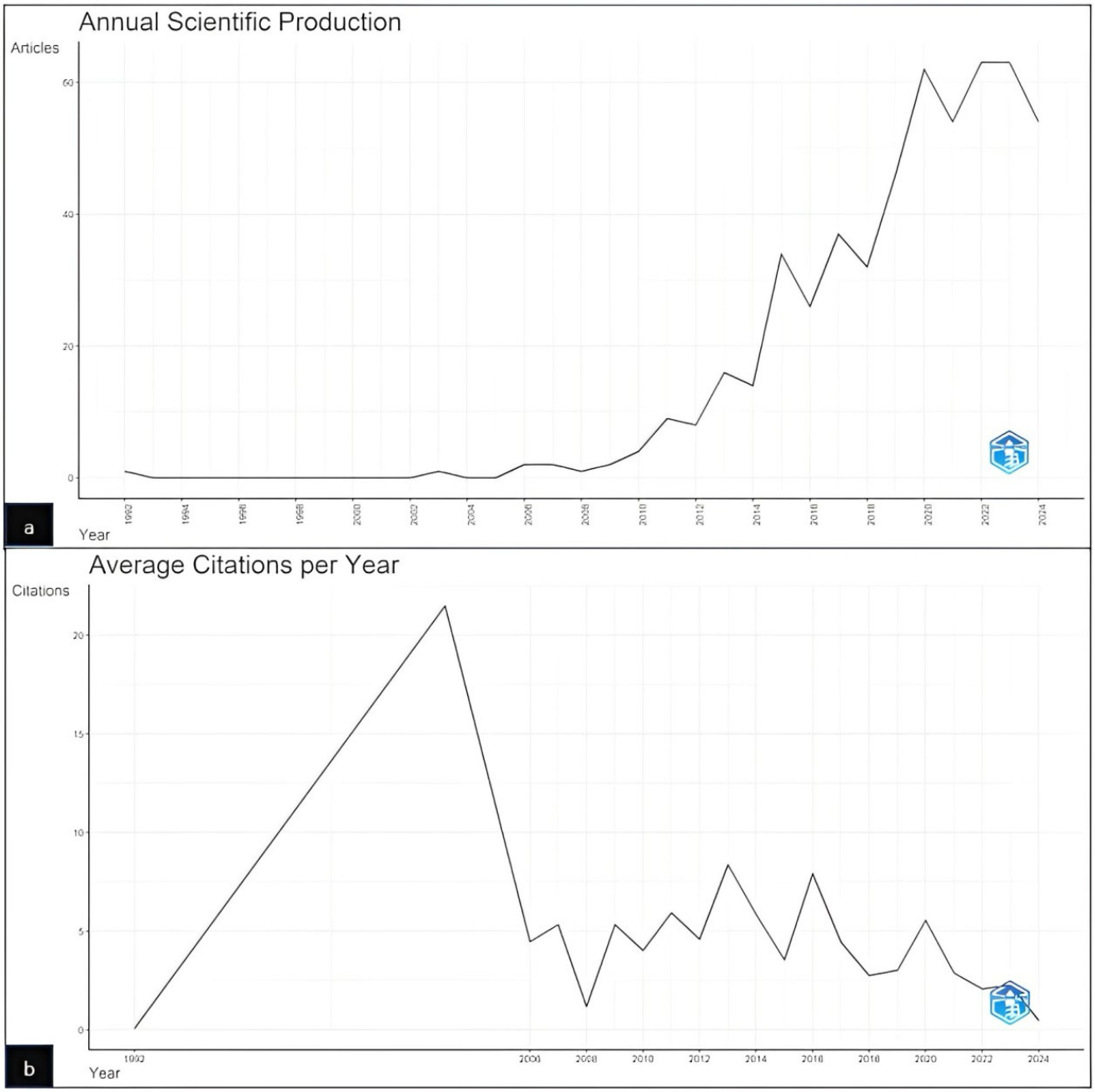

Fig. 2. Biblioshiny data on average citations and publication growth for 531 journals. (a.) Annual scientific production in chronic pulmonary aspergillosis. (b.) Average citations of chronic pulmonary aspergillosis per year

Authors analysis

There are around 2551 authors in the current topic. In Fig. 3a, Denning DW is the most frequent author on the list with 146 articles published between 2003 and 2024. Fig. 3b shows that Denning DW, Kosmidis C, and Bongomin F

have strong connection and have collaborated together. Dhooria S, Chakrabarti A, Agarwal R, Aggarwal AN, and Sehgal IS also have collaborated together.

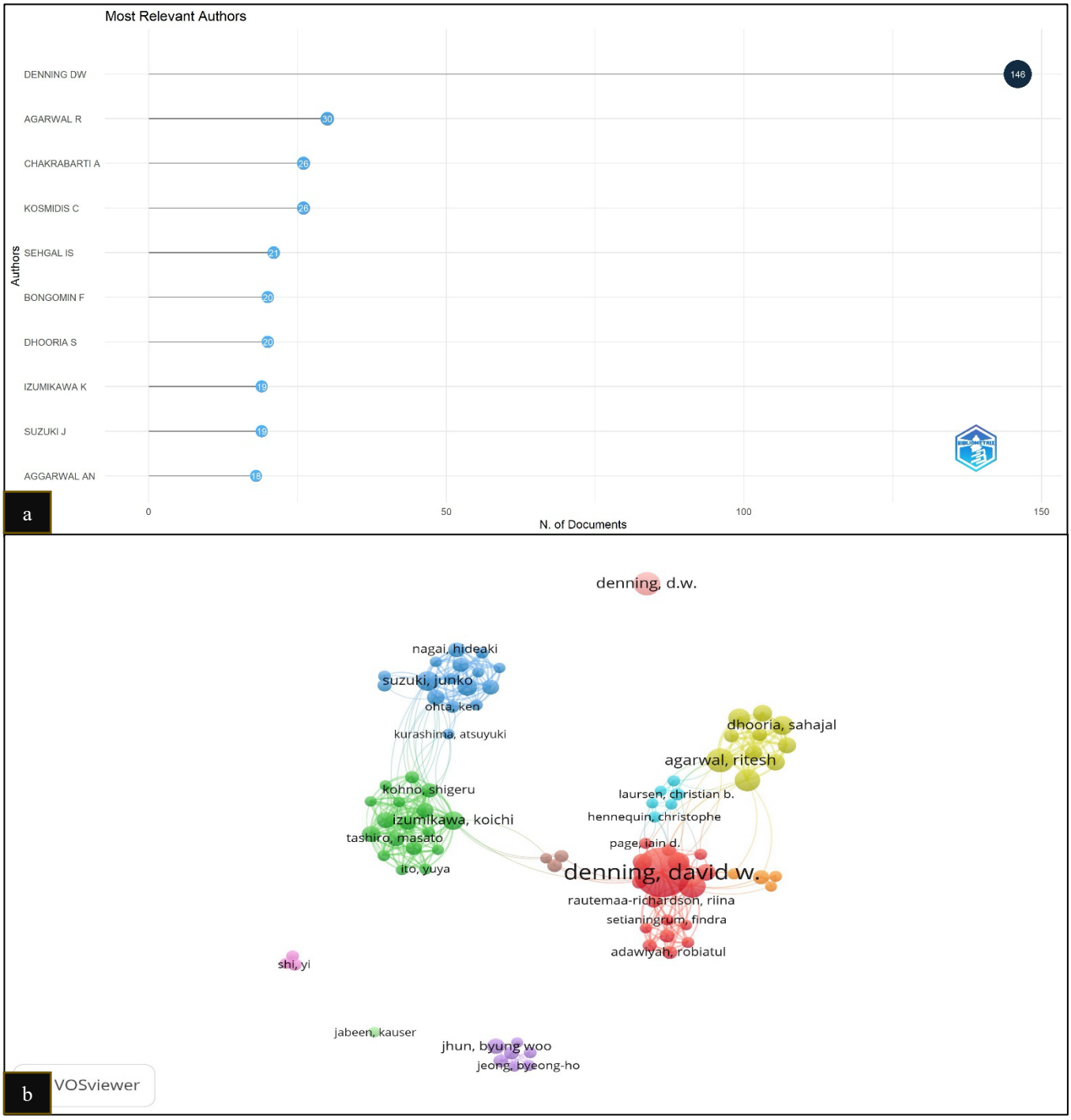

Fig. 3. Analysis of authors with the highest article publications and collaboration networks in chronic pulmonary aspergillosis. (a) Top 10 authors with the highest article publications. (b.) Collaboration networks among authors of the topic

Analysis of journal

Topics on CPA were published in 186 various journals. In Fig. 4, Mycoses has the highest number of publications, H-index, and G-index of this topic (n = 50, H-index = 18, G-index = 28). The published article of other top journals: Journal of Fungi (n = 49, H-index = 14, G-index = 19), European Journal of Clinical Microbiology and Infectious Disease (n = 19, H-index: 14, G-index = 19), Medical Mycology (n = 17, H-index = 10, G-index = 17), Internal Medicine (n = 13, H=index = 5, G-index = 13), Mycopathologia (n = 12, H-index = 4, G-index = 8), Plos One (n = 11, H-index = 9, G-index = 11), Seminars in Respiratory and Critical Care Medicine (n = 11, H-index = 4, G-index = 11), Journal of

Infection and Chemotherapy (n = 10, H-index = 7, G-index = 10), and Respiratory Medicine (n = 10, H-index = 6, G-index = 10). Although Mycoses had the highest number of articles, H-index, and G-index, European Journal of Clinical Microbiology and Infectious Disease had the highest total citation (TC = 1679).

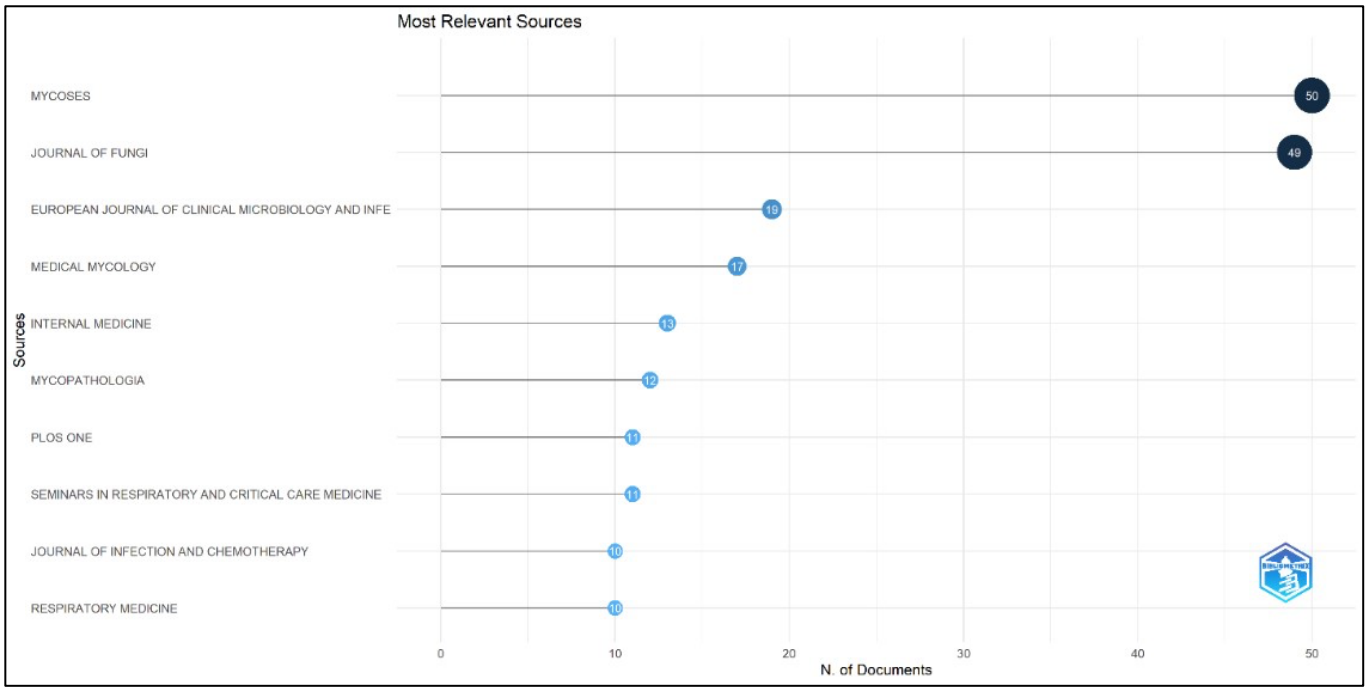

Fig. 4. **Analysis of journals with the highest article publications in chronic pulmonary aspergillosis**

Countries analysis

The United Kingdom has taken the lead with 182 articles on CPA (Fig. 5). The other countries with the highest articles of CPA are as follows: Japan (n = 90), India (n = 60), The United States (n = 53), China (n = 42), France (n = 33), Switzerland (n = 28), South Korea (n = 24), Germany (n = 23), and Brazil (n = 18).

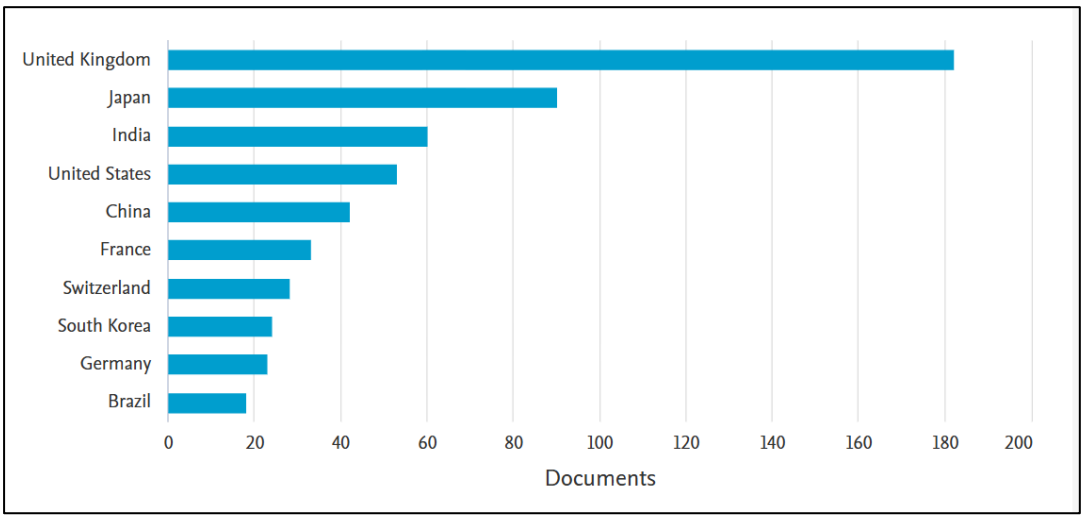

Fig. 5. **Analysis of countries with the highest article publications of chronic pulmonary aspergillosis**

Keywords and topic trends

The keyword analysis's settings are: the time period is 1992–2024, the average number of keywords each year is 3, and the minimum word frequency cutoff is 5. Each size of area in Fig. 6a reflects its frequency, with wider area showing up more frequently. The size of each circle in Fig. 6b indicates the frequency of a keyword, whereas the line indicates the years it appeared (Fig. 6).

Fig. 6a displays the author's keyword to depict their substance of research article. The most frequent term was chronic pulmonary aspergillosis [n = 161]. Whereas, the least terms were candida (n = 6), cryptococcosis (n = 6),

fibrosis (n = 6), and fungal (n = 6). Fig. 6b shows that aspergillus nodule has gained attention since 2020 (n =5). There is still ongoing research about aspergillus nodule. Chronic cavitary pulmonary aspergillosis (n = 12) has been a matter of discussion since 2014. However, it does not appear again in 2024. The term chronic pulmonary aspergillosis (n = 160) and cpa (n = 22) refer to the same thing. It suggests that chronic pulmonary aspergillosis or cpa has been a subject of discussion between 2018 to 2023. The term tuberculosis (n = 28) has gained attention in 2019 to 2022. However, the term pulmonary tuberculosis (n = 11) has started to gain attention in 2022 to 2023. The term surgery has gained attention since 2020 to 2023.

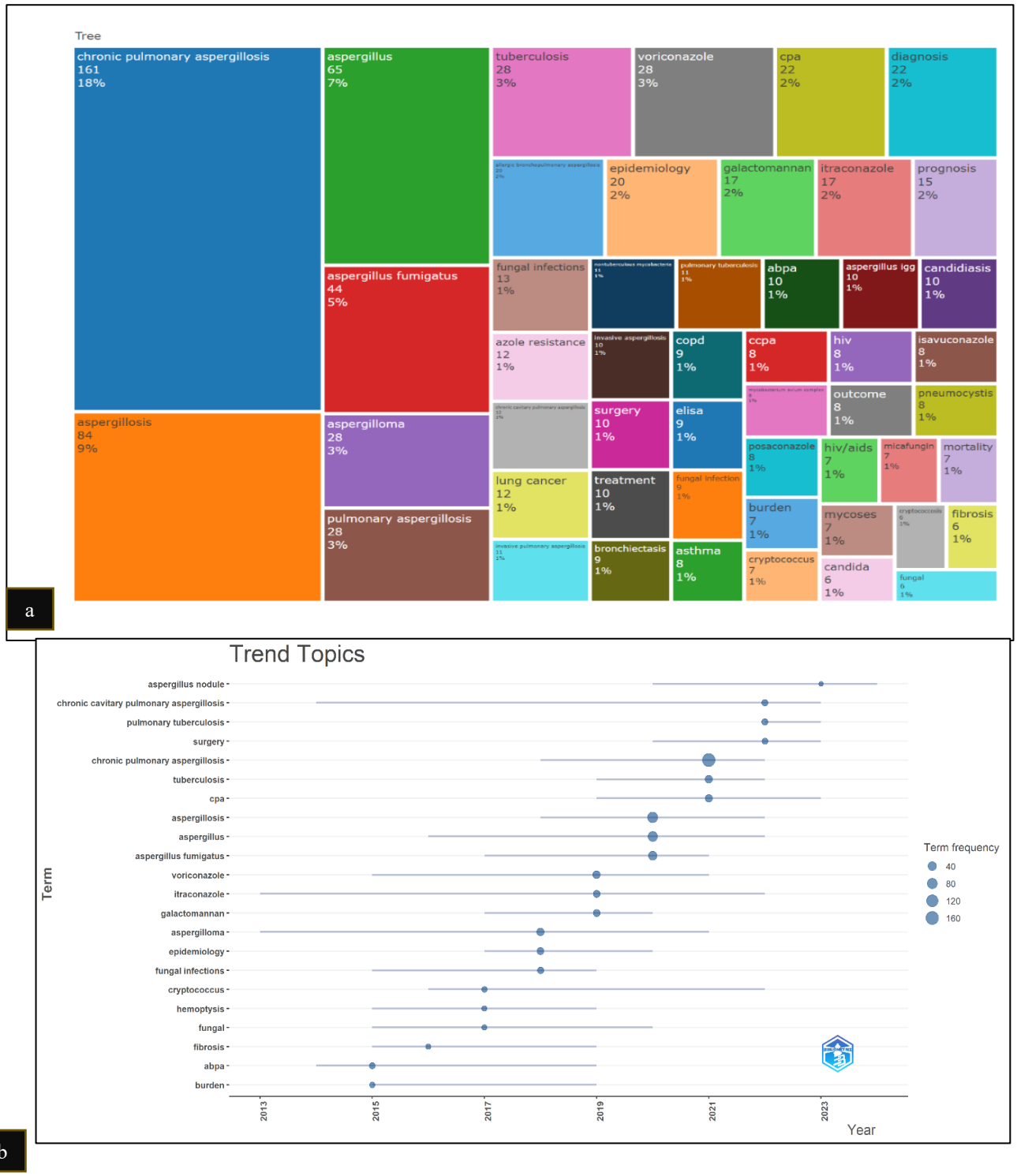

Fig. 6. The author's keywords used in Biblioshiny analysis. (a.) Top 50 TreeMap keywords used by authors in papers associated with chronic pulmonary aspergillosis. (b.) Trend Topics in chronic pulmonary aspergillosis

Co-occurrence cluster

We conduct a bibliometric analysis using VOSviewer to display network and presentations for research on CPA. Using an emphasis on the author's keywords, we decided to use a co-occurrence analysis using a comprehensive counting method. The analysis includes terms that appeared at least five times, and 66 out of the 912 keywords

satisfied this requirement. A repulsion value of 0 and an attraction value of 2 were defined in the layout settings. The resolution was set to 1.00 and minimum cluster size was set to 1 as well (Fig. 7).

The co-occurrence network of the author's keywords consists of 7 clusters. [Fig. 7a]. Cluster 1 [red] consists of 17 keywords, cluster 2 [green] consists of 15 keywords, cluster 3 [dark blue] consists of 12 keywords, cluster 4 [yellow] consists of 9 keywords, cluster 5 [purple] consists of 6 keywords, cluster 6 [blue] consists of 4 keywords, and cluster 5 [orange] consists of 3 keywords. The average years of article publication and the average number of citations for each term are shown in Figs. 7b and c, respectively.

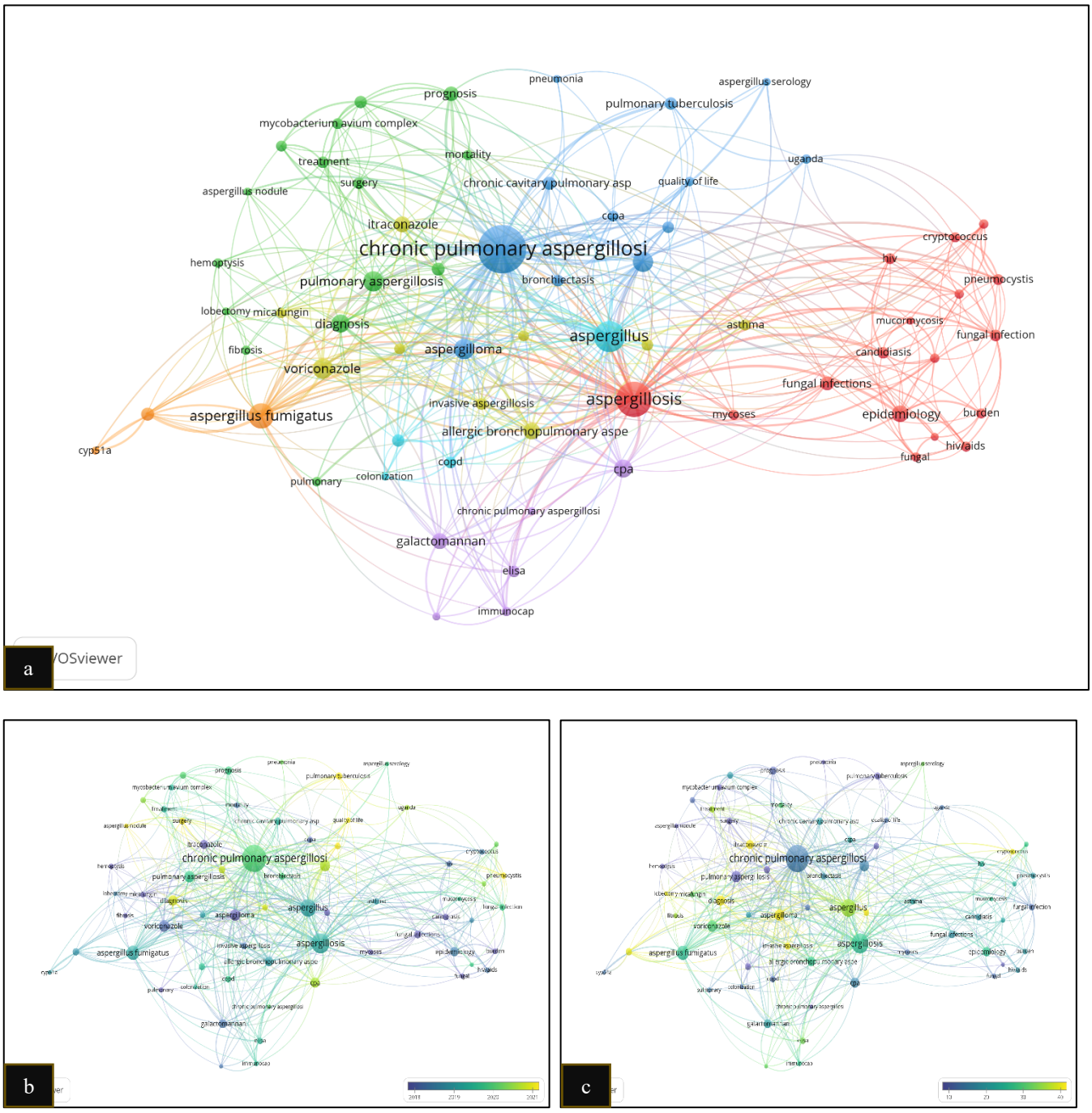

Fig. 7. Co-occurrence of author keywords on publications about CPA is visualized as a network. (a.) Clusters of co-occurrences according to the author's keyword. (b.) Keyword mapping based on average frequency of appearance from 2018 to 2021. (c.) Keyword mapping based on the average number of citations for each keyword.

Discussion

Growth of publication

Based on the analysis graph in Fig. 2a, the increase in publications of CPA has occurred almost consistently since 2008. There are several possibilities to explain this phenomenon. First, it may be because CPA has begun to be identified as a significant worldwide public health concern, mainly in developing countries [33]. The epidemiology of CPA shows its association with other chronic lung diseases such as tuberculosis [TB], which has a high prevalence in many regions [34–39]. Second, CPA has been known to have a poor prognosis, with a five-year mortality rate around 40–50% in cases that are not well treated [15]. This significant clinical impact leads more research to maximize early diagnosis, treatment, as well as prevention. Third, diagnostic techniques include thoracic imaging (CT scan) and biomarker tests such as galactomannan and *Aspergillus* antibodies have advanced significantly since 2008. The precision and effectiveness of these instruments, which are essential in the diagnosis of CPA, are the subject of considerable [8]. Fourth, one of the main challenges in CPA treatment is resistance to antifungal medications, particularly azoles such as itraconazole [13,40–42]. This phenomenon calls for more research to comprehend its underlying mechanism and discover alternative treatments.

Publications about CPA are expected to slightly decrease in 2024. Although it will not be significant compared to the peak of publication in 2022 and 2023, we hope there will be many research and publications of CPA in the future considering its challenging diagnosis and treatment especially in low- and middle-income countries [43–46].

Author analysis

Denning DW has published far more articles on CPA compared to other authors. He was a professor of infectious disease, global health, and medical mycology at Wythenshawe Hospital and the University of Manchester in 2005. In 1980, he received his medical degree from Guy's Hospital in London. He subsequently received training in Glasgow and London in internal medicine as well as infectious disease. Prior to completing a three-year fellowship in diagnostic microbiology and infectious diseases at Stanford University in 1990, he served as a Senior Registrar in Infectious Diseases at Northwick Park Hospital and Medical Research Council research laboratories from 1985 to 1987 [47].

His first article publication on CPA was in 2003 entitled "Chronic Cavitary and Fibrosing Pulmonary and Pleural Aspergillosis: Case Series, Proposed Nomenclature Change, and Review". In this article he reported 18 non-immunocompromised patients with CPA with duration of the disease varied from several months to more than 12 years. Management of each patient according to their conditions, it could be medical therapy such as itraconazole and amphotericin B or surgical treatment. This article highlighted the importance of early diagnosis and individualized management of each patient [48].

His latest article publication on CPA was in 2024 entitled "Fungal disease incidence and prevalence in Iraq – Preliminary estimates". This article aimed at investigating, computing, and estimating the prevalence and burden of fungal infections, including CPA, in Iraq. It was known that the annual burden of CPA in Iraq was 11,7 per 100.000 [49].

As one of top 10 authors of CPA, Denning DW also collaborated with the other top 10 authors of CPA. An article entitled "Twelve-month clinical outcomes of 206 patients with chronic pulmonary aspergillosis" was written by collaboration between Denning DW (n = 146), Kosmidis C (n = 26), Bongomin F (n = 21) and the other authors. This article aimed at evaluating the efficacy of medical treatment of 206 patients with CPA in National Aspergillosis Center, Manchester. After 12 months, there was significant improvement of the patients' quality of life. This article highlighted the importance of choosing appropriate antifungal therapy as well as the duration of treatment [50].

The other top 10 authors: Dhooria S (n = 20), Chakrabarti A (n = 26), Agarwal R (n = 30), Aggarwal AN (n = 18), and Sehgal IS (n = 21) also have collaborated together. An article entitled "The minimal important difference of one-minute-sit-to-stand test in subjects with chronic pulmonary aspergillosis" was written by them and the other authors. This article aimed at assessing treatment response in CPA using one-minute-sit-to-stand test. The minimal important difference for this test in subjects with CPA was 2 repetitions [51].

There were many collaboration articles written by them. We hope that those authors can continue to collaborate in the future. Thus, we hope for new findings related to CPA in the future that can be useful for many people.

Journal analysis

Mycoses is a scientific journal that focuses on research and studies about fungal infections, covering various aspects of clinical mycology, including epidemiology, pathogenesis, diagnosis, and treatment of fungal infections. This journal is now ranked first among journals with the most publications on CPA as well as the highest H-index and G-index.

The latest article publication about CPA in Mycoses was entitled "Neglected Pulmonary Infection Caused by Exophiala dermatitidis Misidentified as Rhodotorula spp.". This article showed 11 patients suspected pulmonary

infection due to *E.dermatitidis* initially thought to be caused by *Rhodotorula spp*.. Among the patients, there were cases of CPA, indicating co-occurring chronic pulmonary infection. This study emphasizes the importance of accurate identification of fungal pathogens, especially in patients with chronic pulmonary conditions [52].

By knowing the top 10 journals with the most publications along with their H-index and G-index, we hope that authors can more easily decide where to publish their articles related to CPA.

Countries analysis

The United Kingdom emerges as the country with the most article publications of CPA. There may be several reasons behind it. One of the reasons is The United Kingdom has leading research centers such as the National Aspergillosis Centre in Manchester, which focuses on the diagnosis and treatment of CPA. This center has become a primary reference for research and the care of patients with CPA [50].

The achievements that have been made by the United Kingdom are expected to motivate other countries in conducting research related to CPA, especially countries with high rates of TB. This is because most of CPA patients have underlying pulmonary TB infection [53]. India, China, Indonesia, the Philippines, Pakistan, Bangladesh, Nigeria, and the Democratic Republic of the Congo (DRC) are responsible for about two-thirds of all TB cases worldwide, according to the most important results from the Global TB Report 2023 [54]. It is suggested for these countries to conduct research about CPA besides TB.

Keywords and topic trends

Fig. 6b shows the trending topic is aspergillus nodule. Aspergillus nodule is an uncommon subtype of CPA especially if being found in immunocompetent patient [55]. Aspergillus nodule may present with one or more nodular lung lesions less than 3 cm. Histologically, there is no tissue invasion which differentiate it from subacute invasive aspergillosis, another subtype of CPA [56]. However, Aspergillus nodules have nonspecific clinical and radiological manifestations, making it difficult to distinguish this kind of fungal infection from other nodular pulmonary diseases, notably lung cancer [57]. Until nowadays, the first-line treatment of pulmonary aspergillus nodule is surgical resection [58].

Although aspergillus nodule is classified as a rare case, easier diagnosis as well as effective and efficient management are very much needed. With the increasing cases and research related to aspergillus nodule up to this year, we hope that in the future researchers can find the best diagnosis and management methods for patients.

Keyword co-occurrence cluster

The prominent keyword in cluster 1 (red) is “aspergillosis”. The main keyword highlighted in this cluster revolves around pulmonary fungal infections like “aspergillosis”, “candidiasis”, “cryptococcosis”, “mucormycosis”, and “pneumocystis”. The other terms related to pulmonary fungal infections are also included, such as “epidemiology”, “prevalence”, and “burden”. As we all know, any infection caused by pathogens, whether viruses, bacteria, fungus, or parasites, has an impact on community life. The primary focus of this cluster, aspergillosis, is not immune to the aforementioned. If an infectious occurrence is not controlled, the disease burden carried by society will rise.

The prominent keyword in cluster 2 (green) is “pulmonary aspergillosis”. This keyword is related to “diagnosis”, “treatment”, “surgery”, “outcome”, “prognosis”, and “mortality”. The other terms related to pulmonary aspergillosis are also included, such as “hemoptysis”, “fibrosis”, “lung cancer”, “mycobacterium avium complex”, and “nontuberculous mycobacteria”. As we know, both hemoptysis and fibrosis are the complications of pulmonary aspergillosis. On the other hand, lung cancer and infection may be the risk factors of pulmonary aspergillosis.

The prominent keyword in cluster 3 (dark blue) is “chronic pulmonary aspergillosis”. This keyword is related to its subtype like “aspergilloma” and “chronic cavitary pulmonary aspergillosis” as well as its risk factors such as “tuberculosis”, “pulmonary tuberculosis”, and “bronchiectasis”.

The prominent keyword in cluster 4 (yellow) is “voriconazole”. This cluster revolves around medical therapies for CPA such as “voriconazole”, “itraconazole”, “micafungin”, “isavuconazole”, and “posaconazole”. It is important for us to understand current medical therapies used in patients with CPA. Current medical treatments for CPA are triazoles, amphotericin B, and echinocandins. However, resistance of triazoles has begun to increase [59]. Therefore, the appropriate treatment of CPA remains a challenge for us.

The prominent keyword in cluster 5 (purple) is “cpa”, which stands for chronic pulmonary aspergillosis. This cluster revolves around various serological diagnostic methods of CPA, such as “bronchoalveolar lavage”, “elisa”, “galactomannan”, and “immunocap”. A class of polysaccharides known as galactomannan [GM] is made up of a mannose backbone and a variable amount of galactofuran side chains. The majority of Aspergillus species' cell walls are composed of GM [60]. CPA can be serologically diagnosed either from serum GM or bronchoalveolar lavage GM (BALF-GM). However, BALF-GM has higher sensitivity and specificity compared to GM. So, BALF-GM is superior for diagnosing CPA [61]. For decades, the enzyme-linked immunosorbent test (ELISA) also has been used to identify *Aspergillus* antibody IgG. Although there are different types of ELISA, the competitive and sandwich varieties are

the most widely used [22]. Compared to BALF-GM, *Aspergillus* antibody IgG is more sensitive and specific for diagnosing CPA [62].

The prominent keyword in cluster 6 (blue) is "aspergillosis". This keyword is connected to "copd" and "colonization". This cluster highlights COPD as the risk factor of aspergillosis. The lung alveoli are susceptible to *Aspergillus* conidia. However, the immunocompetent host's innate immune system often eliminates these conidia quickly, so they cannot spread illness. However, in people with chronic obstructive pulmonary disease (COPD), *Aspergillus* spores can evade destruction by both professional phagocytes and epithelial cells and germinate because the airway defences are less successful at eliminating them [63]. This explains why people with COPD are prone to colonization of *Aspergillus*.

The prominent keyword in cluster 7 [orange] is "aspergillus fumigatus". It is connected to "azole resistance" and "cyp51a". This cluster highlights drug resistance of aspergillosis due to cyp51A gene mutation. The cyp51A gene encodes the enzyme 14α-demethylase, the main target of azole drugs such as itraconazole, voriconazole, and posaconazole. Mutations in this gene alter the enzyme structure, reducing azole affinity, thereby increasing resistance [64]. In order to deal with the rise of resistance, more research on aspergillosis treatment is much-needed.

Limitations

Readers need a fundamental understanding of the subject for better comprehension, even though the bibliometric research approach provides an overview of discussions on CPA. We used just one database in the current bibliometric analysis. Even though Scopus is the biggest and most well-known database, the quantity of articles included may compensate for missing keywords, which could still lessen the results' robustness. Furthermore, non-English articles were not included because they could induce bias and limit the generalizability.

Conclusions and Implications

For the first time, this study provides an overview of the growth in CPA publications through bibliometric analysis. Aspergillus nodule, subtype of CPA, is the trending topic in 2024. We recommend that research on aspergillus nodules continue in order to discover easier diagnostic methods and appropriate management for patients. One of the main risk factors for CPA is TB. Based on the analysis of countries with the highest number of CPA publications, only India and China are among the countries with the largest number of TB cases in the world. Therefore, we recommend other countries with a high number of TB cases to conduct research related to CPA. Although not on the trending topic, we also recommend further research on alternative drugs to address azole resistance. Overall, we hope there will be much easier diagnosis and effective treatment of CPA especially in low- and middle-income countries.

Suggestions for Future Research

Future research is expected to develop more sensitive and specific biomarker-based diagnostic methods, such as the development of point-of-care devices that can be applied in resource-limited countries. In addition, combination drug therapy and the exploration of new antifungal agents effective against azole resistance are greatly needed. The epidemiology of CPA in populations with high TB prevalence, including the dynamics of the disease in vulnerable groups such as patients with comorbidities, also needs to be studied more in-depth. This effort is important to create more comprehensive and globally relevant clinical guidelines, as well as to improve patient access to healthcare services.

Declarations

Author Contributions

Conceptualization, GG and SM; methodology, GG; software, GG; validation, SM; formal analysis, GG; investigation, GG; resources, GG and SM; data curation, GG; writing original draft preparation, GG; writing—review and editing, SM; visualization, GG; supervision, SM; project administration, GG. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

The data presented in this study are openly available in Scopus.

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Institutional Review Board Statement

This study did not involve any experiments on human or animal subjects, and therefore did not require approval from an Institutional Review Board [IRB]. The study involved the analysis of bibliometric data that is publicly available through the Scopus database, which poses no ethical risks to individuals or animals.

Informed Consent Statement

Informed consent was not required for this study as it did not involve human participants or the collection of any individual data. The research is based solely on previously published articles that are publicly accessible.

Conflicts of Interest

The author declares that there is no conflict of interests regarding the publication of this manuscript. In addition, ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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