
Article

A Bibliometric Analysis of Syphilis Research in Last Hundred Years in Scopus Database (1921-2021)

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Simple Summary: The bibliometric analysis of syphilis has been carried out in this paper. Presently there is a dearth of consolidated literature available regarding syphilis. Herein, this study aims to compile the literature of last one century from 1921-2021. This piece of work conveyed the significant contributing authors, Institutions, funding organizations, and journals. Therefore, this study considerably contributes for the future leaders, researcher & specialist/ clinicians of the domain.

Abstract: Sexually transmitted infections encompass considerable effect on human sexual and reproductive health. Its presence is ubiquitous despite of decades of prevention and management. The present study has been conducted to provide an insightful bibliometric analysis of the syphilis based on the Scopus repository. Therefore, given the dearth of a consolidated bibliometric analysis on Syphilis, this investigation aimed to compile the literature of last one century (1921-2021) to gain an insight about the publications pertinent on the burden, diagnosis, treatment and management of Syphilis. In this study, we have provided the year-wise, and subject-wise publications, type of the articles, country, funding organizations, institutions, citations, H-index. The data obtained from the Scopus database was exported to CSV file format and then converted to Microsoft Excel version for analysis to curtail the chances of error in the information. It has been evidenced that USA possesses highest track of proven publications. Therefore, this study considerably contributes for the future leaders, researcher & specialist/ clinicians of the domain.

Keywords: Bibliometric analysis; Scopus database; Syphilis; Sexually Transmitted Infections; Public Health; Research; Global

1. Introduction

Sexually transmitted infections (STIs) have a considerable effect on human sexual and reproductive health [1]. The problem of STI is rising and fetching a public health interest globally [2]. STIs is ubiquitous in our society, regardless of decades of prevention and management campaigns. The centers for disease control and prevention (CDC), the prevalence of STIs is 110 million globally, with about 20 million cases occurring annually [3-5]. In 2020, the World Health Organization (WHO) enlisted Chlamydia, gonorrhea, syphilis and trichomoniasis as the most prevalent STIs across the globe [6]. It has been demonstrated from the literature, that amongst the STIs syphilis is the most prevalent in Indian scenario [2]. Syphilis is also an acronym as “the great imitator” for the enormity of its varied subtle clinical presentations [7,8]. Syphilis is caused by *Treponema pallidum* responsible for causing bejel or endemic syphilis [9]. It is evident that the four members of the bacterial family cannot distinguish with their ultrastructure, chemical or immunological techniques [10]. Regardless of the actuality that the syphilis and its management

has been grabbing attention from earlier days, but now the disease is a global public health predicament.

The present study has been conducted to provide an insightful bibliometric analysis of the syphilis related research. Bibliometric analysis is a statistical methodology which involves the quantitative analysis of the research papers about one particular topic through mathematical approach [11]. The technique involves accessing the studies based on their quality, the key areas of the research along with development of a future route map [12]. However, there is no scientific literature on bibliometric analysis of the publications related to Syphilis till date. Therefore, given the dearth of a consolidated bibliometric analysis on Syphilis, this investigation aims to compile the literature of last one century (1921-2021) to gain an insight about the publications pertinent on the burden, diagnosis, treatment and management of Syphilis. The bibliometric study plays a noteworthy role in the erstwhile to oversee the policy making and an insight in future research including the STIs [12]. It has been evidenced that other disease has bibliometric analysis like cardiovascular diseases [13], diabetes [14], coronary heart disease [15], breast cancer [16], and digestive system disease [17]. Herein this work, we have provided the comprehensive information regarding the syphilis and its management. From this study, we have provided the erstwhile years of research in a broad spectrum which is not yet available in the literature to the best of our knowledge. Herein, in this study, we have provided the year-wise publication, subject-wise publications, type of the articles, country, funding organizations, institutions, citations, H-index, etc. Therefore, this study considerably contributes for the future leaders, researcher & specialist/ clinicians of the domain.

2. Methods

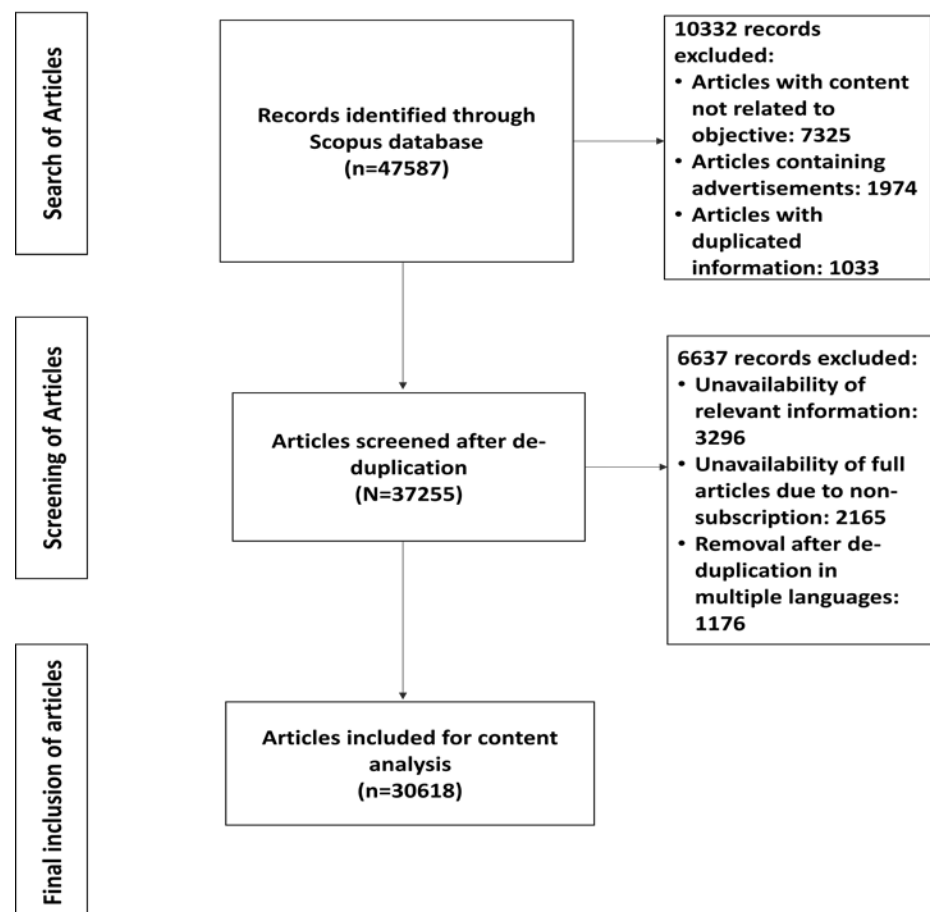


Figure 1. Showed the schematic representation of the search strategy. .

2.1. Selection of a database and user interface

In the bibliometric study, it is important to identify the appropriate repository to be used to retrieve the relevant documents [18]. Scopus is largest abstract citation database in comparison to other scientific databases such as Web of Science, Embase, IndMed, etc [19]. Presently, Scopus is having 17 million researcher profiles, 81 million curated documents, 80,000 institution profiles and 7000 publishers [20]. Being a user friendly search engine, it was easy to collect the data from Scopus. This database was searched with two types of query: first a basic search and second an advanced search in which complex and long search queries were made to retrieve the literature as per objectives higher validation. It allowed us to search titles, abstracts, name of the journal, authors and affiliations, article title, abstract and keywords with the help of key words [21]. Furthermore, it also enabled researchers to search history and save searches to track the papers for any future research. Therefore, we decisively chose Scopus data to execute a literature search for investigation of Syphilis bibliography from 1st January 1921 till 31st December 2021 across the world.

2.2. Search strategy

The investigative approach played a significant role in the bibliometric analysis in the current study to create a valid search query that retrieved all the possible documents along with minimum false positive results. The keywords included in the literature search in the study were, "syphilis" or "syphilis diagnosis and treatment" or "syphilis treatment" or "syphilis diagnosis" or "Sexually transmitted infections" or "STI". Other nonspecific key words were also incorporated in the search strategy in the present study. The query string employed by the authors in the study in literature search was: TITLE-ABS-KEY ("SYPHILIS") AND PUBYEAR >1921 AND <2021. A thorough and comprehensive search query to retrieve the desired data was developed by a team of multidisciplinary authors for this study. After employing the string for the literature search, the number of the articles, year wise publications, thematic areas, type of documents and language publications was retrieved.

2.3. Inclusion and exclusion criteria

All the articles and documents related to Syphilis or its management, written in English language and published in peer-reviewed journals were included in our predefined time frame. However, monographs, reports and conference publications were excluded in this investigative research. Additionally, inaccessible, full text articles were also excluded.

2.4. Corroboration approach

After the literature was compiled using the search strategy, the corroborative approach was employed which relied on two approaches. First, the top 50 cited articles in the domain of syphilis and related literature were reviewed to ensure that the data matched the aims and scope of the present study. In the secondary approach, the definite number of documents authored by an individual author obtained from the author's Scopus profile was compared with the number of the documents obtained by the search query for active authors. This approach ensured a thorough quality check of the data retrieved from the literature review as false positive results were removed, which could hamper the results in the analysis by causing deviations.

2.5. Data representation and analysis

The data obtained from the Scopus database was exported to CSV file format and then converted to Microsoft Excel version for analysis to curtail the chances of error in the information. Data mining was done as a screening step by the authors prior to the analysis. The following information was collected for the bibliometric analysis: 1) Top 20 authors who contributed the most research on syphilis; funding sources and their affil-

iations; 2) Article content which included the article type, themes of publications, content; 3) bibliometric content such as the impact factor, citation score and h-index.

Additionally, word clouds were created for providing a visual representation of the word frequencies in the following aspects: a) Titles of the top 100 most cited articles; b) Titles of the articles which revolved around the theme was diagnosis treatment and management of syphilis (n=223). The size of each word in the word cloud reflected the frequency of its appearance which was useful in understanding the kind of studies which were conducted till date pertaining to Syphilis.

3. Results

3.1. *The different themes associated with syphilis research*

This section provides the information regarding the thematic areas where the syphilis and its management articles has been published. From the literature, it has been manifested that the articles has been published in 28 different categories of the themes of the journals. The themes consist of different categories like medicine, immunology & microbiology, social sciences, pharmacology, toxicology & Pharmaceutics, Neurosciences, Psychology, etc. Furthermore, this kind of data also suggests the robustness of the Scopus database where all the information is archived. However, It has been observed from the data that there are some undefined subjects where the articles have been published. This might be due the previous research was conducted, but due to unavailability of the information there has been remarked as Undefined. The detailed information has been provided in the supplementary data [Figure S1].

3.2. *Distribution of the various categories of published article*

The articles on syphilis and management were classified by type of published article, it was observed that various types of article like research articles (82%), review articles (7.97%), letter (4.2%), research note (2.6%), editorial (1.49%), and short survey (1.1%) were published. This information will be beneficial for those researchers who will be working in the domain of syphilis and its management. Herein our present study, the leading 20 authors possessing the highest number of articles published in the last 100 years (1921-2021) in the domain of syphilis were prepared based on the data retrieved from the Scopus database. Apart from the number of publication citations, percentage, and h-index have been incorporated as well. From this comprehensive information, future researcher, clinician, and specialist get an insightful information about the domain experts and their work. Table S1 shows the top 20 authors syphilis paper published 1921-2021. The detailed information has been provided in the supplementary.

3.3. *Global contributing enlisted countries*

The retrieved data were also analyzed for the information about the countries possesses substantial contribution in this arena. The data were categorized as per the proportion of publications to comprehend the contribution of the specific country regarding syphilis and its management. From the Scopus repository, it has been delineated that 159 countries have substantially contributed n=47857 articles in the domain of syphilis keywords string search. Lately, in this list we have exhibited top 20 leading countries, but based on the retrieved literature, it has been manifested that some unidentified regions exist where there is no sources to find the exact location of that article. This might be due the fact that in previous years or initial days of the research some information were not archived.

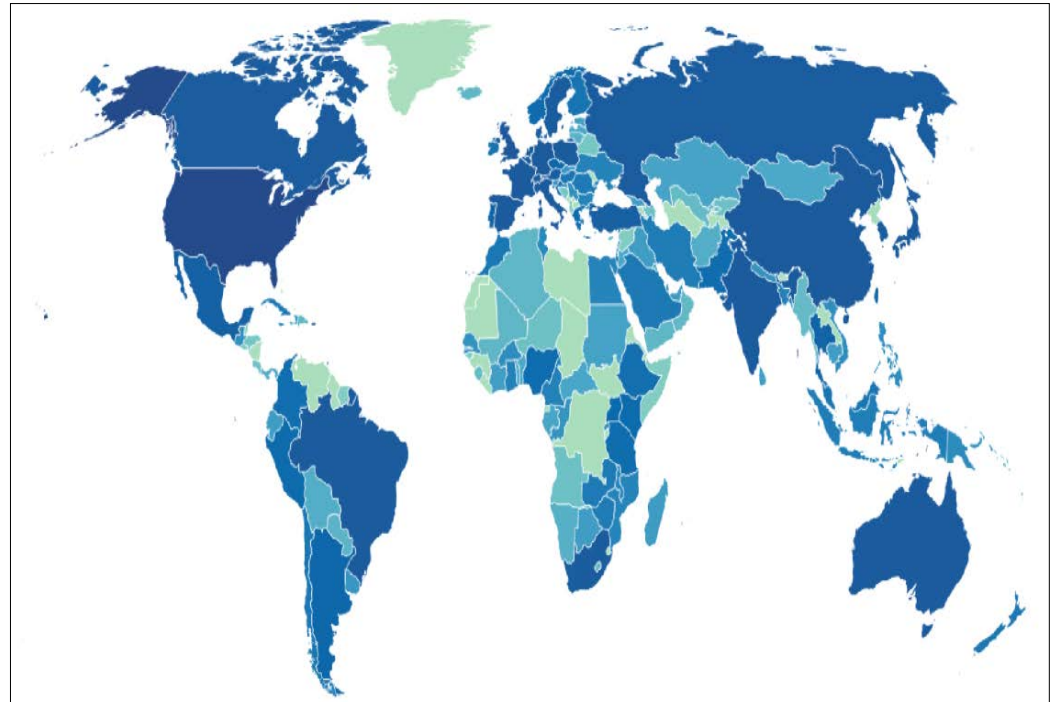


Figure 2. Shows the world heat map on research articles on syphilis in the last 100 years 1921-2021. (United States- 11542, United Kingdom- 2862, Germany- 1787, China- 1564, France- 1366, India-1271, Brazil- 1191, Japan- 932, Italy- 929, Spain-905, Australia- 898 Canada- 829, Switzerland- 696, Poland- 491, South Africa- 640, Netherlands- 622, Russian Federation- 326, Denmark- 313, Belgium- 429, Undefined- 56).

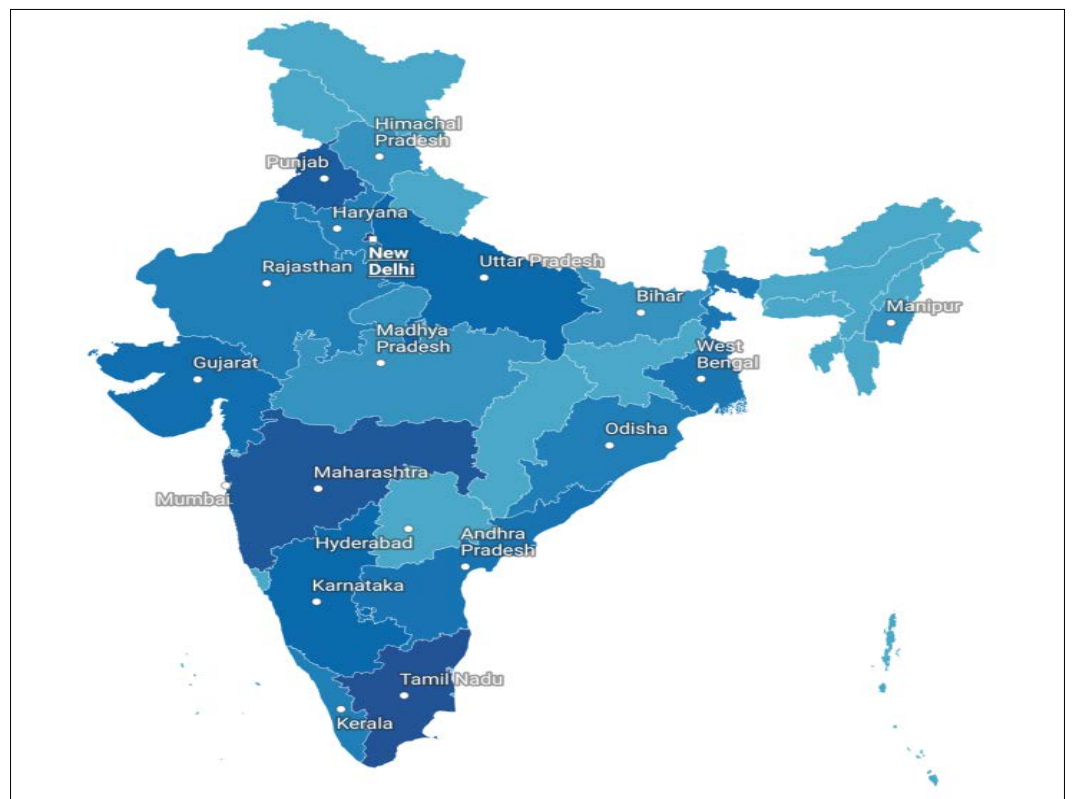


Figure 3. Shows a heat map of India published research in India on syphilis in last 25 years.

Table 1. Shows the top 20 journals and their Impact Factor (2022).

Sr No	Journals	No. of Publications % (N=7830)	Impact Factor
1	Sexually Transmitted Diseases	1187 (15.2)	3.868
2	Sexually Transmitted Infections	790 (10.1)	4.199
3	International Journal of STD And AIDS	729 (9.3)	1.456
4	British Journal of Venereal Diseases	658 (8.4)	NF
5	Archives of Dermatology And Syphilology (JAMA DERMATOLOGY)	527 (6.7)	11.82
6	Lancet	525 (6.7)	79.32
7	Journal of The American Medical Association	453 (5.8)	157.3
8	Przegląd Dermatologiczny	410 (5.2)	0.36
9	Plos One	324 (4.1)	3.752
10	British Medical Journal	307 (3.9)	93.33
11	American Journal of Syphilis Gonorrhea And Venereal Diseases	304 (3.9)	NF
12	Clinical Infectious Diseases	268 (3.4)	9.079
13	New England Journal of Medicine	262 (1.1)	91.24
14	Southern Medical Journal	212 (2.7)	0.924
15	Journal of Clinical Microbiology	207 (2.6)	5.897
16	Journal of Infectious Diseases	186 (2.4)	5.226
17	International Journal of Dermatology	180 (2.3)	1.312
18	AIDS	179 (2.3)	4.177
19	Genitourinary Medicine	171 (2.2)	NF
20	Medical Journal of Australia	131 (1.7)	7.738
	Total	7830	

3.4. Distribution of output in journals

The data were also searched for journals that contributed significantly in the article's publication on syphilis and its management. From the literature, it has been suggested that 148 journals have syphilis publications. Out of these, the top 20 journals, published around 16% of total published articles from the information collected. The Sexually Transmitted Diseases and Sexually Transmitted infections were the two leading journals. The details of top 20 journals published syphilis content from 1921 to 2021 listed in the table 1.

3.5. Distribution of the institutions

Herein, this section we have provided the list of the countries involved in syphilis and its management. From the literature, it has been manifested that the USA has a proven track record of highest number of publications. This study will help the beginners to understand which institutes is working on which domain and its substantial contribution globally. Table S2 showed the top 20 institutions depicting the publication of syphilis. The Table S2 provided in the supplementary information. The information related to the funding institutions globally were checked (Table S3). From the literature, it has been observed that 159 funding agencies have funded the syphilis management study global-

ly. The Scopus repository stated that the National Institute of health provided the maximum number of the funding in the syphilis and its management. The information has been provided in supplementary data.

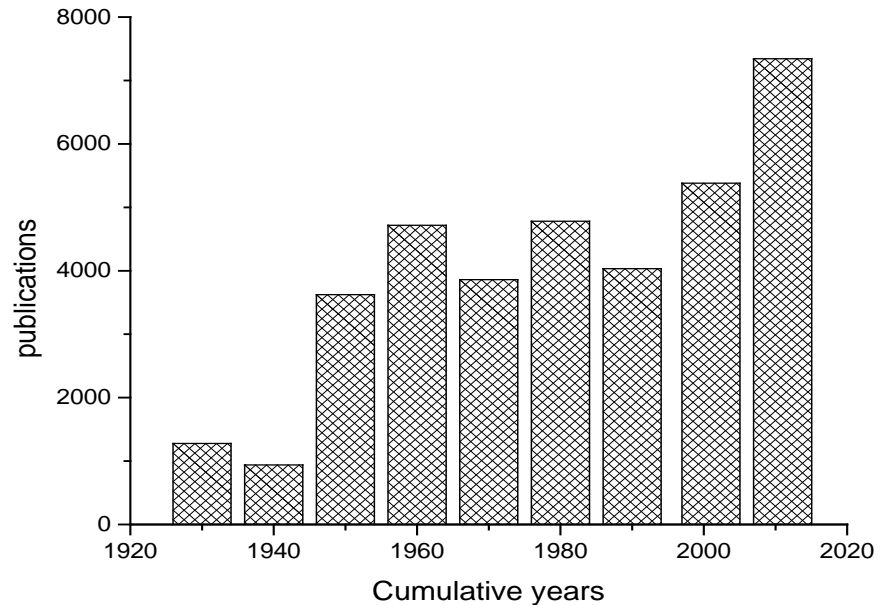


Figure 4. Showed the year-wise syphilis publication from 1921-2021.

3.6. Distribution of year-wise publications

We collected data from the year 1921 to 2020 regarding the syphilis and its management. From the literature, it has been demonstrated that articles are archived in the Scopus database prior to our allocated year. Decade wise data analysis was conducted for better understanding and presentation. From figure 4 it is clearly evident that It has shown a continues growth of research in this area. Interestingly, in the last decade (2010-2020) syphilis research has shown a significant evolution in terms of number.

3.7. Word cloud visualization of the content of the articles

A word cloud serves as a suitable way of measuring and gauging the changes in the popularity of an item. We conducted word cloud analysis for identification of the relevant and frequently occurring words in the titles of 100 most cited articles and titles of 223 articles for diagnosis and management of syphilis, respectively illustrated in figure 5 and figure 6. In figure 5, the words "prevalence", global burden", "burden of disease", "incidence estimates", "systematic review" were the most frequently occurring words in the titles cited the most by the researchers while collating and disseminating literature on Syphilis. In terms of relevance of the words, "burden of disease" scored 0.99 followed by "global burden" (0.758) and "disease study" (0.66) in the current investigation.

Figure 6. The word cloud of research titles suggesting diagnostic and management of Syphilis (n=223).

4. Discussion

The current study employed the Scopus database to retrieve the literature pertinent to the theme and it shows that comprehensive information is available in the literature, but it was not exhibited by any researcher in a simplified manner erstwhile. We have framed the layout of the paper, citing the top 20 categories in this study. The reason behind citing the top 20 as it has been manifested from the literature seldom article have provided the top 20, the erstwhile researchers have limited to top 10 only in different categories of bibliometric analysis. This work will provide compact and comprehensive information for the readers of this article.

In this paper, we have provided the year-wise publication which suggests the insightful information regarding the trends of the articles and direction of the research along with the management of the syphilis. Here in this piece of work, we have provided the comprehensive information regarding the theme areas where the syphilis and its management articles has been published. Furthermore, it has been evidenced from the literature the articles has been published in 28 different categories of the themes of the journals. It has been observed from the data that there are some undefined subjects where the articles have been published. This might be due the previous research was conducted, but due to unavailability of the information there has been remarked as undefined. This type of inclusive information is seldom available to the best knowledge of the authors. From the literature, it has been demonstrated that unquestionably, the syphilis have grabbed the attention of researchers and the academicians from an array of disciplines, ensuing in multidisciplinary research themes. Moreover, this study contains the types of the articles archived in the Scopus database are original research article, review articles, letter, note, editorial, short survey, conference paper, erratum, book, data paper and some articles marked as undefined. From the list of categories of the articles, conference paper, erratum, book and undefined articles has not been included. The reason behind its non inclusivity is owing to its repeatability and lack of reproducibility. The undefined content showed might due to reason of previous work archived, but due to the unavailability of the required complete information. Furthermore, in this piece of work we have incorporated the authors possessing the highest number of articles published in the last 100 years (1921-2021) in the domain of syphilis and its management. Apart from the number of publication citations, percentage, and h-index have been incorporated as well. From this comprehensive information, future researcher, clinician, and specialist get insightful information about the domain experts and their work.

Nextly, we have talked about the countries possess substantial contribution in this arena. Herein, we have provided number of publications and the percentage as well to comprehend the contribution of the specific country regarding syphilis and its management. From the literature, it has been manifested that the journal's posses' noteworthy role in initiating any research or study. However, without knowing the journal it is not possible for any researcher to work in any field. So, in this study the list of the journals has been provided which consists of the top 20 journals, including the number of the publications, percentage along with the available impact factor which states the substantial contribution in the domain of the syphilis and its management. Furthermore, we have incorporated the enlisted countries involved in syphilis and its management. From the literature, it has been manifested that the USA has a proven track record of highest number of publications. Moreover, to conduct the research funding organizations plays a pivotal role. From the literature, it has been demonstrated that 159 funding organizations have funded the syphilis and its management as the topic is of great concern. It has been evidenced from the literature that syphilis distress the people who are suffering from this disease. It further creates trauma and panic for them. Although, it has been evidenced that syphilis is a global public health predicament and its elimination is the bottleneck issue for the researchers, clinician and specialists.

In the present study, the authors have provided illustration in the form of word clouds for identification of the relevant and frequently occurring words in the titles of the most cited articles and in research articles related to diagnosis and management of syphilis, respectively. The word cloud based on the titles of the articles in the present study indicated that the type of research conducted included prevalence studies, incidence rate recording and systematic review, which in the last century has contributed to larger scope which was estimation of the global burden of the disease i.e. Syphilis. Additionally, the visual representation of titles related to diagnosis and treatment management indicated towards the various infection management strategies which were employed globally for treatment and containment of syphilis and disseminated through scientific literature. The word clouds are also evidently representing the thematic content of articles revolving around the guidelines on the establishment and management of networks of laboratories for surveillance and treatment of Syphilis. The word cloud representation will benefit the readers of the articles to address the predicament of the issues and give a highlight of the broad areas of the scope of research in disease management related to syphilis.

The effectiveness of this article taken into account of an extensive bibliometric search of the inclusive pragmatic literature and its analysis of keywords used in this present study. Nevertheless, seldom shortcomings should be acknowledged. The search strategy was conducted via electronic database only one (i.e Scopus) and we have not involved any other repository like Web of Science. Therefore, might be some chances of missing a few of the articles. Although, it has been acknowledged that Scopus possess the largest curated database. Furthermore, in our present study, we didn't include the study prior to 1921 although literatures are available. The reason behind not included the erstwhile study is that we have design 100 years of time frame and from the literature, it has been manifested prior to our designed year noteworthy articles are seldom to the best of our knowledge. Furthermore, we have not incorporated the conference paper, monographs, and the articles owing to its repeatability & reproducibility. The motive of choosing the English language is that the quality contents are more likely in this language. Therefore, the language constraint is provided as a screening tool for the present study, which is considered a good substitute that reflect the quality of the paper. Consequently, it is difficult to make sure 100 % enclosure of the literature. Nevertheless, the authors have done their best to embrace all the pertinent literature amidst minimum irrelevant documents. The authors embraced relevant keywords to remain the manuscript focused on the pertinent topic of interest. The reason of embracing the specific terms was to retrieve literature talk about syphilis, diagnostic and management.

5. Conclusions

Herein, our aim of the present study was to carry out a comprehensive bibliometric analysis of the Sexually transmitted diseases focused on syphilis literature. From the literature, it has been demonstrated that there is a dearth of comprehensive information regarding the syphilis management. Our primary focus is to provide the comprehensive information regarding the syphilis owing to its prevalence and seldom literature is available in an inclusive manner. Therefore, the Scopus database has been utilized to investigate 47587 retrieved documents from 1921 to 2021. From the literature, it has been demonstrated that amongst top 20 countries USA publishes the most articles pertinent to syphilis and its management. Our present investigation provides an inclusive information regarding the papers published in the last 100 years. Furthermore, we have exhibited the top 20 leading authors based on their number of publications, citations and h-index. Accordingly, herein we have incorporated the top 20 active countries are working on this predicament. We have integrated the top 20 institutions, top 20 funding sources as well. This piece of work substantially contributes for the future leader, researcher and specialist/clinicians of the domain who can get an insightful information about their domain in the last 100 years and further can envisage blueprint of their work.

From the literature, it has been demonstrated that undeniably, the syphilis have engrossed the attention of researchers and the academicians from an array of disciplines, resulting in multidisciplinary research themes.

Supplementary Materials: The following supporting information can be downloaded at: www.mdpi.com/xxx/s1, Figure S1: Shows the distribution of the different thematic areas of publications; Table S1: Shows the top 20 authors syphilis paper published 1921-2021; Table S2: Showed the top 20 institutions depicting the publication of syphilis; Table S3: Showed the top 20 funding institutes.

Authors' contribution: Conceptualization, Sumit Aggarwal; Data curation, Sagnik Chakraborty, Nupur Mahajan, Sivaraman Balaji, Formal analysis, Sumit Aggarwal, Sagnik Chakraborty, Nupur Mahajan,; Methodology, Sagnik Chakraborty, Nupur Mahajan, Sivaraman Balaji, Kuldeep Nigam, Project administration, Sumit Aggarwal; Resources, Sumit Aggarwal; Data retrieve, Sagnik Chakraborty, Nupur Mahajan, and Kuldeep Nigam; Supervision, Sumit Aggarwal; Writing – original draft, Sagnik Chakraborty, and Nupur Mahajan; Writing – review & editing, Sumit Aggarwal, Sagnik Chakraborty, Nupur Mahajan. All the authors have approved regarding the submission of this article to the journal.

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