A bibliometric analysis of worldwide research on One Health from 2012 to 2022

Firdausy Kurnia Maulana1, Lailatul Maghfiroh1, Siti Shofiya Novita Sari1,2, and Fedik Abdul Rantam1,2

Background and Aim: Bibliometrics is a statistical method used to examine a collection of literature and its features, assess advancements in certain areas, and forecast future trends. To demonstrate global research trends in One Health and serve as a resource for potential future study and practice, we conducted a bibliometric analysis of articles related to worldwide research on One Health from Scopus database.

Materials and Methods: This study identified keywords related to One Health that were limited by the subject area to medicine, veterinary, and environmental science to identify and search for articles in the Scopus database, which included 1608 international research papers published from 2012 to 2022.

Results: The results showed a 10-year trend of rising publishing outputs and research interest in One Health. The most prolific One Health author is Zinsstag Jakob from Switzerland and the most productive journal on One Health was the International Journal of One Health journal. The institution with the most One Health research articles was the Centers for Disease Control and Prevention (USA). Coauthorship analysis revealed that the USA was the country with the greatest degree of affiliation, followed by the UK, Switzerland, and France. Four separate topic clusters were generated using the clustering algorithm within the network: (1) green: Veterinary; (2) blue: Zoonoses; (3) red: Antimicrobial resistance; and (4) yellow: Tropical disease.

Conclusion: This article provides an overview of further research related to One Health. There is a need to explore further research in the environmental sector, which is the least explored sector among the three sectors in relation to One Health. The limitations of the current study were that we used only Scopus database and excluded literature from other scientific databases.

Keywords: bibliometric analysis, One Health, scopus, VOSviewer.

Introduction

At present, outbreaks of infectious diseases occur continuously and threaten human health and socioeconomic development [1]. The COVID-19 pandemic is evidence of a more complex health challenge and forces us to focus on public health [2]. The COVID-19 pandemic is also proof that no scientific discipline, institution, organization, or country can single-handedly deal with complex and diverse global health problems like today [3]. Instead, a multisectoral, multidisciplinary, and cross-regional approach is needed to combat re-emerging infectious diseases [4]. The goal of the field of global health is to achieve health equity on a worldwide scale while concentrating on human health, which calls for the integration of humans, animals, and the environment, giving rise to the idea of One Health [5].

One Health is an integrated approach that aims to sustainably balance and optimize human, animal, and ecosystem health. The One Health approach mobilizes various disciplines, sectors, and communities in society to cooperate to promote prosperity, address threats to health, and ecosystems, and contribute to sustainable development [6]. The One Health idea has become increasingly popular in the fields of animal and public health in recent years. Many nations have actively implemented the One Health approach to global health governance, international health, and public health up to this point. Given the nascent nature of One Health, a thorough review of the literature is necessary to distill previous research hotspots and direct more in-depth investigations and methodologies [5].

Bibliometrics is a statistical method used to analyze a collection of literature and its characteristics, evaluate developments in a particular field, and predict future trends [7]. This method allows visualization of...
the structure and evolution of research areas through mathematical statistics and geographic knowledge to help set the direction of further research [8].

To demonstrate global research trends in One Health and serve as a resource for potential future study and practice, we conducted a bibliometric analysis of articles related to worldwide research on One Health from Scopus database.

Materials and Methods

Ethical approval

Ethical approval was not required for this study, because the study was based on bibliographic data. The research design was adapted as per the preferred reporting items for systematic review and meta-analysis guidelines and procedures [9] (Figure-1).

Study period and location

The research data for bibliometric analysis were obtained from the Scopus database in November 2022. The data were extracted at Universitas Airlangga, Surabaya, East Java, Indonesia.

Search criteria

In the Scopus database, the following keywords were applied: TITLE-ABS-KEY (“One Health”) AND PUBYEAR >2011 AND PUBYEAR <2023 AND (LIMIT-TO [DOCTYPE, “ar”]) AND (LIMIT-TO [SUBJAREA, “MEDI”]) OR LIMIT-TO [SUBJAREA, “VETE”) OR LIMIT-TO [SUBJAREA, “ENVI”) AND (LIMIT-TO [EXACTKEYWORD, “One Health”]) AND (LIMIT-TO [LANGUAGE, “English”]).

Inclusion criteria

This study identified keywords related to One Health that were limited by the subject area to the field of medicine, veterinary, and environmental science, published globally in the past 10 years (2012–2022). The document language was limited to English, and the document type was limited to articles.

Exclusion criteria

A manual review was conducted by reviewing the abstract and title. Articles that did not contain the words “One Health” in the title and abstract were not included. After manual review, 1608 articles were identified for analysis.

Statistical analysis

The VOSviewer version 1.6.19 tool and Scopus’s visualization search results function are both used in the scientometric analysis [10]. In this study, constructing and visualizing bibliometric networks in the form of affiliations/universities, authors, countries, subject areas, sources, annual publication growth, greatest citations, keyword maps, and author collaboration was performed using the VOSviewer tool [11].

Figure-1: Flow chart of literature search in the Scopus database.
Results and Discussion

This study aimed to analyze One Health articles published from 2012 to 2022. The Scopus database was searched for this purpose using the bibliometric analysis method. VOSviewer version 1.6.19 software was used to analyze and visualize various aspects of 1608 papers published from 2012 to 2020.

One Health publication growth

One Health publications gradually increased from 2012 to 2022 (10 years), as shown in Figure-2. Starting from 2012, there were only nine publication outputs, and until 2017, the annual publication was below 100. The number of publications gradually increased from 2014 to 2019 with an increase of 125 from the first number in 2012. From 2019 to 2020, there was a significant increase up to 99; however, a drastic growth was seen in 2021 with the number of publications reaching 461 and becoming the year with the most publications of One Health. The number of publications slightly decreased in 2022 but remained the second-highest with 429 publications. Within a decade, 1608 research publications on One Health have been published globally. The results showed a 10-year trend (from 2012 to 2022) of rising publication outputs, research interest in One Health, and an especially sharp increase in 2020–2021. It is fair to predict that the interest rate will continue to increase in the future.

The results of the study were comparable to a bibliometric analysis conducted by Humboldt-Dachroeden et al. [12], which focused on One Health publication trends in the WoS between 1998 and 2019. One Health publications have increased between 1998 and 2019, particularly after 2016, which is aligned with the exact time of the Ebola and Zika virus outbreaks. Our findings showed a dramatic increase in One Health publication in 2021, a year after the pandemic started. The rising number of One Health publications is in line with zoonotic disease outbreaks such as Ebola, Zika virus, and the current case of COVID-19.

Leading authors, top journals, and institutions

One Health’s 10 most prolific authors are connected to six countries, namely, the United Kingdom (three authors), Brazil (two authors), the United States (two authors), Australia (one author), Italy (one author), and Switzerland (one author) (Table-1). These 10 scholars authored 120 articles, and their first publications were published between 2012 and 2020. Based on the authors’ areas, One Health’s research was conducted in health, economics, agriculture, epidemiology, veterinary, and microbiology.

Based on the Scopus database, Zinsstag Jakob from Switzerland is the One Health author with the most publications, with 19 published articles, 49 h-index and 464 citations and 11 h-index and 539 citations. The authors in second and third place were Häsler, Barbara, Gray, and Gregory C., who published 15 and 14 papers, respectively. Similar findings from Humboldt-Dachroeden et al. [12] noted that Jakob Zinsstag and Häsler Barbara are among the top five most active One Health scholars from 1998–2019. The top 10 authors in this study have different affiliations even though they come from the same country. The authors from the United Kingdom were affiliated with the Royal Veterinary College University, the University of Glasgow, and the University of Liverpool. The authors from Brazil, Lincopan, Nilton, and Biondo, Alexander Welker, started their first One Health publication in 2020; nonetheless, it is impressive that they are included in the top 10 list.

The top 10 journals that have published the most articles on One Health during the past decade are listed in Table-2. These top 10 journals have published more than 35% (a total of 1163 articles out of 1608) of the extant publications on One Health. With 122 articles accounting for 6.97% of the total publications and 886 citations, One Health journal was the most productive among the top 10 journals. It was followed by Frontiers in Veterinary Science (5.60%), Antibiotics (3.86%), and Frontiers in Public Health (3.73%). The results also showed that four separate publishers own the top 10 most productive journals: Elsevier, Frontier, MDPI, and Wiley (Table-2).

The journal’s influence is indicated by its citation score. Four journals achieved a CiteScore of 5 or above, according to the CiteScore 2021 report. Transboundary and Emerging Diseases (8.6) and Frontiers in Microbiology (8.2) were the journals with the highest and second-highest CiteScore, respectively. Animals journal received the lowest CiteScore, which was 2.7. In addition, it should be emphasized that while it is obvious that the CiteScore of journals might be a key consideration for some authors when choosing which journal to publish their works in, it is not the only criterion. The most cited article is mostly associated with diseases in animals, such as COVID-19, rabies, leptospirosis, and antimicrobial resistance.

The Centers for Disease Control and Prevention had the most publications in One Health research, with 47 publications. The University of California, Davis, ranked second with 44 publications, which is the affiliation of the top 5 authors, Mazet, and Jonna A.K., with 11 publications. The third university with the most publications on One Health was the University...
Table-1: The top 10 most prolific authors in the One Health research area 2012–2022.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Scopus author ID</th>
<th>Year of 1st publication</th>
<th>Total publication</th>
<th>h-index</th>
<th>Total citation</th>
<th>Current affiliation</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinsstag, Jakob</td>
<td>7004623067</td>
<td>2012</td>
<td>19</td>
<td>49</td>
<td>464</td>
<td>Universitat Basel</td>
<td>Switzerland</td>
</tr>
<tr>
<td>Häslar, Barbara</td>
<td>13003457800</td>
<td>2016</td>
<td>15</td>
<td>26</td>
<td>316</td>
<td>Royal Veterinary College</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Gray, Gregory C</td>
<td>16425441400</td>
<td>2015</td>
<td>14</td>
<td>56</td>
<td>113</td>
<td>UT Medical Branch at Galveston</td>
<td>United States</td>
</tr>
<tr>
<td>Lincopan, Nilton</td>
<td>6506497254</td>
<td>2020</td>
<td>12</td>
<td>30</td>
<td>37</td>
<td>Universidade de São Paulo</td>
<td>Brazil</td>
</tr>
<tr>
<td>Mazet, Jonna A.K.</td>
<td>7005723108</td>
<td>2013</td>
<td>11</td>
<td>42</td>
<td>171</td>
<td>School of Veterinary Medicine, Davis</td>
<td>United States</td>
</tr>
<tr>
<td>Biondo, Alexander Welker</td>
<td>56008856900</td>
<td>2020</td>
<td>10</td>
<td>25</td>
<td>15</td>
<td>Universidade Federal do Paraná</td>
<td>Brazil</td>
</tr>
<tr>
<td>Cleaveland, Sarah</td>
<td>57191181727</td>
<td>2017</td>
<td>10</td>
<td>100</td>
<td>56</td>
<td>University of Glasgow</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Degeling, Chris</td>
<td>57202999059</td>
<td>2017</td>
<td>10</td>
<td>19</td>
<td>79</td>
<td>University of Wollongong</td>
<td>Australia</td>
</tr>
<tr>
<td>Mor, Siobhan M.</td>
<td>56412550100</td>
<td>2013</td>
<td>10</td>
<td>124</td>
<td>15</td>
<td>University of Liverpool</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Aragrande, Maurizio</td>
<td>56657485200</td>
<td>2017</td>
<td>9</td>
<td>7</td>
<td>206</td>
<td>Alma Mater Studiorum Università di Bologna</td>
<td>Italy</td>
</tr>
</tbody>
</table>

Table-2: The top 10 most productive journals on One Health research with their most cited article.

<table>
<thead>
<tr>
<th>Journal</th>
<th>TP (%)</th>
<th>Number of citations</th>
<th>Number of Publication</th>
<th>CiteScore 2021</th>
<th>The most cited article</th>
<th>Times cited</th>
<th>Publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Health</td>
<td>6.97</td>
<td>886</td>
<td>112</td>
<td>5.6</td>
<td>High prevalence of SARS-CoV-2 antibodies in pets from COVID-19+households</td>
<td>89</td>
<td>Elsevier</td>
</tr>
<tr>
<td>Frontiers in Veterinary Science</td>
<td>5.60</td>
<td>812</td>
<td>90</td>
<td>3.3</td>
<td>Elimination of dog-mediated human rabies deaths by 2030: Needs assessment and alternatives for progress based on dog vaccination</td>
<td>92</td>
<td>Frontiers</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>3.86</td>
<td>239</td>
<td>62</td>
<td>3.9</td>
<td>Antimicrobial usage and resistance in companion animals: A cross-sectional study in three European countries</td>
<td>44</td>
<td>MDPI</td>
</tr>
<tr>
<td>Frontiers in Public Health</td>
<td>3.73</td>
<td>326</td>
<td>60</td>
<td>4</td>
<td>A blueprint to evaluate One Health</td>
<td>58</td>
<td>Frontiers</td>
</tr>
<tr>
<td>Zoonoses and Public Health</td>
<td>3.11</td>
<td>417</td>
<td>50</td>
<td>5.2</td>
<td>Stabilizing dog populations and improving animal and public health through a participatory approach in indigenous communities</td>
<td>38</td>
<td>Wiley</td>
</tr>
<tr>
<td>Frontiers in Microbiology</td>
<td>2.67</td>
<td>451</td>
<td>43</td>
<td>8.2</td>
<td>Genome analysis of clostridium difficile PCR ribotype 014 lineages in australian pigs and humans reveals a diverse genetic repertoire and signatures of long-range interspecies transmission</td>
<td>96</td>
<td>Frontiers</td>
</tr>
<tr>
<td>Pathogens</td>
<td>2.36</td>
<td>156</td>
<td>38</td>
<td>3.5</td>
<td>Pathogens spillover from honey bees to other arthropods</td>
<td>21</td>
<td>MDPI</td>
</tr>
<tr>
<td>Transboundary and Emerging Diseases</td>
<td>2.18</td>
<td>254</td>
<td>35</td>
<td>8.6</td>
<td>Prevalence and molecular epidemiology of west nile and usutu virus infections in croatia in the 'One Health' context, 2018</td>
<td>47</td>
<td>Wiley</td>
</tr>
<tr>
<td>International Journal of Environmental Research and Public Health</td>
<td>2.11</td>
<td>255</td>
<td>34</td>
<td>4.5</td>
<td>Increasing incidence of canine leptospirosis in Switzerland</td>
<td>62</td>
<td>MDPI</td>
</tr>
<tr>
<td>Animals</td>
<td>1.93</td>
<td>135</td>
<td>31</td>
<td>2.7</td>
<td>Insights about the epidemiology of dog bites in a Canadian city using a dog aggression scale and administrative data</td>
<td>23</td>
<td>MDPI</td>
</tr>
</tbody>
</table>

MDPI=Multidisciplinary Digital Publishing Institute, SARS-CoV-2=Severe acute respiratory syndrome-associated coronavirus-2

of Sydney with 41 publications. Organization Mondiale de la Santé followed these institutions with 40 publications and the Universidade de São Paulo, with 41 publications (Figure-3).
Most influential countries/territories and their coauthorships

Figure-4 displays the distribution of nations/territories per region. This network includes 87 countries, 9 clusters, and 1054 links. In VOSviewer, the closer two countries are to one another, the closer they are related; and the thicker the line connecting them, the closer they are. Over the last decade, the One Health field has expanded quickly, and evidence of the phenomenon is related to One Health. Figure-4 shows the most productive countries in One Health. The outcomes are in line with those, as shown in Figure-3. With regard to the most publications, the United States was leading in the One Health sector. In addition, the results of the coauthorship demonstrated that the United States had the greatest number of affiliations, connected to 79 countries and territories. The UK had 74 links, Switzerland had 63 links, and France had 59 links. Note that these countries are located in the middle of Figure-4 and had strong ties to other countries and territories. European, African, Asian, and South American countries were seen to have a significant presence and link.

Coauthorship author’s network visualization

Cluster 1 (red color, 9 authors), Cluster 2 (green color, 6 authors), Cluster 3 (blue color, 6 authors), Cluster 4 (yellow color, 6 authors), Cluster 5 (purple color, 6 authors), Cluster 6 (tosca color, 6 authors), and Cluster 7 (orange color, 6 authors) were the seven groups that were most frequently and actively writing (Figure-5). Häslер Barbara from the UK had the strongest collaboration with Stärk Katharina D.C. from the UK and Rüegg Simon R. from Switzerland. While Zinsstag Jakob from Switzerland had the strongest collaboration with Daugla, Doumagoum Moto, Mindekem, Rolande, and Léchenne, Monique Sarah from Chad and Switzerland. Hasler Barbara has the highest collaboration, followed by Zinsstag Jakob and Stärk Katharina D.C. The three authors have collaborated at least with authors in two different clusters.

Keyword analysis and trend topics

Through keyword co-occurrence networks, the most popular subjects in the knowledge area over a specific period of time can be identified. Using VOSViewer, a network of co-occurring terms was generated containing 229 keywords, 4 clusters, and 2342 links. In this network visualization, keywords are represented by their labels. The label for each keyword in this network visualization serves as a representation. The weight of a keyword affects the size of its label. The higher the weight, the larger the label of the keyword in the visualization. The color of a keyword is determined by the cluster to which the item belongs. Links are indicated by lines between keywords. The top 10 frequently
used keywords were “One Health” (occurrence = 1242), “zoonoses” (occurrence = 286), “antimicrobial resistance” (occurrence = 188), “COVID-19” (occurrence = 91), “surveillance” (occurrence = 78), “public health” (frequency = 77), “antibiotic resistance” (occurrence = 62), “severe acute respiratory syndrome-associated coronavirus-2 (SARS-CoV-2)” (occurrence = 56), “epidemiology” (occurrence = 56), and “dogs” (occurrence = 47). The keywords “SARS-CoV-2” and “epidemiology” have the same occurrence number; however, the keyword “SARS-CoV-2” has a higher total link strength.  

Four separate topic clusters were generated by the clustering algorithm within the network (green: Veterinary; blue: Zoonoses; red: Antimicrobial resistance; and yellow: Tropical disease). According to Figure-6, the green “Veterinary” cluster, which connects to all other disciplines and has significant relationships inside and outside the cluster, is particularly central. The most central keywords of the veterinary cluster are One Health, animal health, education, policy, veterinarian, veterinary education, and health system. The network also has a significant emphasis on the blue cluster of zoonoses science, which has many connections to the other clusters, main central keywords are epidemiology, surveillance, SARS-CoV-2, COVID-19, infectious disease, pandemic, emerging disease, and vaccination. Another significant cluster in the network is the antimicrobial resistance cluster, with main keywords: Antibiotic resistance, *Escherichia coli*, food safety, multidrug resistance, and methicillin-resistant *Staphylococcus aureus*. The tropical disease clusters are the least prominent clusters.

The tropical disease cluster mainly consists of rabies, Asia, Ethiopia, anthrax, dog vaccination, *Babesia*, and *Taenia solium*. A study by Humboldt-Dachroeden et al. [12] had five distinct thematic clusters within the network: Microbiology, medical science, veterinary, public health management, and anthropology.

One Health is an approach that links the health of three sectors: Humans, animals, and the environment. According to reports from earlier studies, environmental perspectives are undervalued compared to epidemiological, microbiological, and public health perspectives. In addition, the occurrence of keywords simultaneously shows that the keywords related to the environment, ecology, and biodiversity are rare [12, 13]. In our research results, although there are not many keywords related to the environment, the antimicrobial resistance cluster can be linked to environmental health because it is closely related to its transmission through the environment.

The limitations of the current study were that we only used the Scopus database, and we excluded literature from other scientific databases such as Web of Science (WoS), Embase, or Cochrane Library and Limite, and we only included articles in English.

**Conclusion**

The bibliometric analysis demonstrated One Health’s potential and growing popularity. A bibliometric analysis of One Health is helpful for mapping studies related to One Health publications around the world. This study provides an overview of current research related to One Health. There is a need to
explore further research in the environmental sector as the least explored sector, which is among the three sectors in relation to One Health.

Authors’ Contributions

FKM and LM: Conceptualization and methodology. FKM and LM: Retrieved, analyzed, and interpreted the data. FKM, LM, SSNS, and FAR: Writing, reviewing, and editing. All authors have read, reviewed, and approved the final manuscript.

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Competing Interests

The authors declare that they have no competing interests.

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