



Review

One Health and planetary health research landscapes in the Arab world

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ABSTRACT

This review explored research trends in One Health and planetary health in the Arab world, a region confronting major sustainability challenges. These fields are crucial in combating global pressing concerns like infectious diseases, biodiversity loss, antimicrobial resistance, climate change, and air pollution. The COVID-19 pandemic stressed their significance to global health and sustainable development. This analysis assessed the Arab world's contributions to these concepts applying performance analysis and visualization mapping, revealing that One Health outperformed planetary health in terms of productivity and number of contributed countries. Egypt, Saudi Arabia, and the United Arab Emirates have emerged as leading contributors to One Health and planetary health research in the Arab world. Meanwhile, the United States and the United Kingdom, as non-Arab nations, play a pivotal role in fostering collaborative efforts with the region. The trajectory of One Health research has indeed shown remarkable exponential growth, especially since the beginning of the COVID-19 pandemic in 2019, which is an indication of increasing relevance in the address of global health challenges. Conversely, planetary health presents an irregular growth pattern, with a strong point in the development of this area standing out in 2023. The unique set of social, cultural, governance, and agricultural attributes of the Arab region are joined by major environmental challenges that define the focus of both One Health and planetary health research efforts. Climate change, environmental contexts, and public health feature prominently in both One Health and planetary health, with One Health focusing mainly on infectious diseases and planetary health addressing the implications of climate change on human health. Advancing these concepts demands the establishment of a regional governing body to oversee an integrated One Health and planetary health strategy, foster regional research communities and alliances, secure political will and funding, and ensure the integration of these concepts into policy and academic frameworks.

1. Introduction

The One Health and planetary health concepts are recognized as comprehensive and collaborative strategies with tremendous potential for handling global challenges associated with anthropogenic activities and infectious diseases, affording intriguing avenues for advancing the sustainable development agenda. The COVID-19 pandemic, which has transcended its designation as solely a health emergency [1], together with anthropogenic disturbances, has revitalized the One Health and planetary health concepts, placing them as fundamental components

within the discourses of global health and sustainable development [2]. It further has emphasized some of the critical determinants of planetary health, such as climate change, biodiversity loss, and population growth, among others, which contribute to the emergence and proliferation of this pandemic and other infectious diseases [3].

In principle, the concepts of One Health are not fresh. They had initially been dedicated to zoonotic diseases but have subsequently advanced and been revised. In 2021, the One Health High Level Expert Panel, serving as the advisory group to the Quadripartite Organizations—the Food and Agriculture Organization of the United Nations

Abbreviations: FAO, the Food and Agriculture Organization of the United Nations; UNEP, United Nations Environment Programme; WHO, World Health Organization; WOA, World Organisation for Animal Health; SARS, severe acute respiratory syndrome; MENA, Middle East and North Africa; GDP, gross domestic product; NCDs, non-communicable diseases; UNICEF, the United Nations agency for children; UNSIC, United Nations System Influenza Coordination; EU, European Union; UN, United Nations; OIE, OFFICE INTERNATIONAL des Épidémiologies; CDC, center for disease control and prevention; AMR, antimicrobial resistance; RVF, Rift Valley fever; AMS, antimicrobial stewardship; MERS-CoV, Middle East respiratory syndrome coronavirus; IHR JEE, International Health Regulations-Joint External Evaluation.

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(FAO), United Nations Environment Programme (UNEP), World Health Organization (WHO) and World Organisation for Animal Health (WOAH)—redefined One Health as “an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent. The approach mobilizes multiple sectors, disciplines, and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for healthy food, water, energy, and air, taking action on climate change and contributing to sustainable development.” [4–6]. The scholarly references indicate that the term “One Health” was first employed after the severe acute respiratory syndrome (SARS) outbreak occurred in early 2003 [7]. It was then reinforced and expanded through the strategic principles known as the “Manhattan Principles” in 2004 for the advancement of a more holistic approach to global health issues [8,9].

Planetary health, in contrast, is an emerging concept fueled by evolving concerns regarding human wellness, civilization's sustainability, and the impacts of human disturbances on the ecology of the environment. These pressing concerns have significantly influenced the birth of the planetary health movement [10,11]. The Rockefeller Foundation-Lancet Commission on Planetary Health introduced the planetary health concept in 2015, articulating it to mean ensuring overall health and equity by managing both human systems and Earth's environmental boundaries [12]. The planetary health field undertakes an integrated study of the complex and interconnected relationships between global environmental changes, the burdens they place on natural ecosystems, and the ensuing consequences these changes have on human

health and well-being at different levels: global, regional, and local [13]. By underlining the linkages between human health and environmental changes, it fosters holistic thinking about interrelated problems and integrated solutions for current and future generations [13]. Fig. 1 displays a timeline highlighting significant figures and milestones in One Health history [14–17]. Additionally, it outlines the key milestones in the development of planetary health [10,12,18–23].

While the One Health and planetary health concepts are gaining ground in global academic discourses and policy development, they remain short of realization regarding the extent of research dedicated to these concepts in the Arab world. The region, made up of 22 countries in the Middle East and North Africa (MENA), is confronting huge sustainability challenges [24,25]. Hosting more than 400 million inhabitants, the region represented 5.5 % of the world's population and contributed 3.2 % to the world's gross domestic product (GDP) in the year 2019 [24]. While these countries share cultural and linguistic ties, they significantly differ in areas like education, economic development, and infrastructure [24,25]. Notably, sustainable development in this region is strongly linked with the Water-Food-Climate Nexus [26].

Among the major challenges to the sustainable development of the Arab world is the threat to the viability of the ecological systems that nurture human habitations. Population dynamics, ecosystem degradation, and resource scarcity couple with unsustainable development policies and geopolitically and economically unstable conditions—each structures an environment in which prospects for sustainability and resilience within the region are weakened [27]. The Arab world is under increased health threats resulting from sociopolitical instability, urbanization, and resource scarcity that fragment healthcare systems and reduce access [28]. Environmental issues, such as water scarcity and

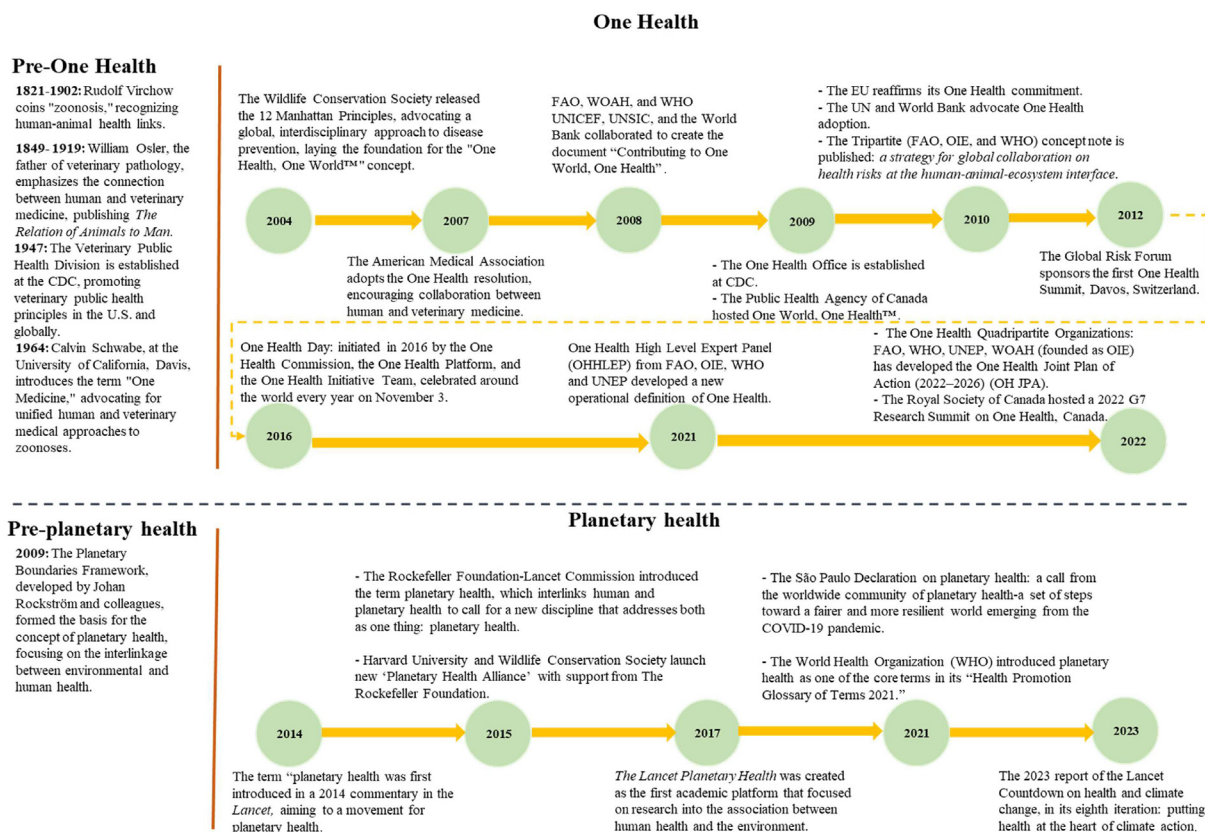


Fig. 1. Timeline: major events in One Health and planetary health. Abbreviations: FAO, the Food and Agriculture Organization of the United Nations; UNEP, United Nations Environment Programme; WHO, World Health Organization; WOAH, World Organisation for Animal Health; UNICEF, the United Nations agency for children; UNSIC, United Nations System Influenza Coordination; EU, European Union; UN, United Nations; OIE, OFFICE INTERNATIONAL des Épidémiologies; CDC, center for disease control and prevention.

Table 1

A comparative overview of One Health and planetary health concepts.

Aspect	One Health	Planetary health
Focus	The interconnectivity of human, animal, and environmental health, focusing primarily on research into health outcomes	Sustainable development and ecosystem resilience: its research focus is on the holistic exploration of human health, environmental resilience, and societal well-being in the pursuit of sustainable development
Challenges addressed	It covers zoonotic diseases, antimicrobial resistance, food safety, and emerging issues related to urbanization, climate-related stressors, and agricultural practices	Deals with climate change, water scarcity, pollution, resource depletion, urbanization, biodiversity loss, etc.
Approach	Collaborative efforts among human, veterinary, and environmental health sectors that deliver short-term, impactful interventions in managing the most pressing issues	Incorporates interdisciplinary strategies by embedding public health, environmental science, and sustainable development to create long-term strategies that promote sustainability and equity
Major stakeholders	Veterinarians, environmental scientists, public health experts, and local policymakers	Policymakers, global health professionals, social scientists, agriculture and energy specialists, and ecologists
Scale of impact	Mainly local or regional, targeting particular outbreaks and health crises	Global in scale, ranging from planetary systems to long-term impacts on health and sustainability
Collaborative potential	Provides timely solutions and applied research while promoting broader goals of planetary health	Comprises strategic foresight and policy impacts to complement One Health
Principal goal	Hands-on solutions for real-world emergencies, mainly prevention and control of diseases at the human-animal-environment interface	Preparing sustainable strategies for future generations-by assuring the stability of Earth's systems and human health through sustainable practices

climate change, increase air pollution and augment the transmission of zoonotic diseases [29]. There is an increased need for sustainable health strategies based on the dual burden of infectious and non-communicable diseases (NCDs) [28].

The unique cultural, environmental, and economic contexts of the Arab region offer a promising opportunity for the amalgamation of One Health and planetary health methodologies. Considering the major characteristics of the two concepts, as retrieved from the literature and depicted in Table 1, which outlines the aspects of the One Health concept [4–6,29–33] alongside the major aspects of planetary health concept [2,10,12,13,31], the two concepts significantly differ in some major aspects, but both recognize the connection of human health with ecosystems, putting emphasis on environmental impacts, interdisciplinary collaboration, and sustainability [31]. Building on these frameworks within the Arab world's traditions of community and resource stewardship, there is alignment with regional governance and values. The diversity among the two concepts should be viewed as a source of inspiration to collaborate and not a division or at the level of competition [34]. Taken together, One Health and planetary health represent complementary domains of research with high potential for policy impact and practical application [2]. They can make a full proof strategy to deal with the region's crises and prepare for the upcoming generations.

In the present review, a bibliometric analysis based on the Scopus database has been carried out with the aim of highlighting the contribution of the Arab world in furthering the global effort toward both One Health and planetary health. The current work searches for commonalities and specific features of both concepts in the Arab context, highlighting complementarity, common goals, distinctive features, and regional relevance. This will also provide a panorama of research domains, leading countries and institutions, collaboration networks, and key knowledge dissemination channels that may inform the definition of research priorities, support informed decision-making, optimize future investments, and foster collaborative initiatives.

2. Methods

2.1. Search strategy

On 25 August 2024, the Scopus database by Elsevier—one of the most detailed literature databases that offers intelligent analytical, screening, and search capabilities—was searched for the terms “One Health,” “OneHealth,” or “One-Health” in the titles, abstracts, and keywords of research works in journals, excluding all other sources like books, book series, and conference proceedings. The same strategy was applied for

planetary health, except incorporating the term “planetary health.” The period of inquiry was maintained, with no constraints on either the start or end timeframe. Errata and retracted articles were omitted if applicable. The inquiry was subsequently narrowed down to publications from the Arab world, determined by their appearance in the list of participating countries. This methodology is intended at retrieving studies that explicitly cited the “One Health” and “planetary health” terms, dismissing records that were conceptually relevant to these concepts yet lacked them in the titles, abstracts, or keywords.

2.2. Selection strategy

The inquiry for One Health-related content yielded 14,402 records globally, spanning all categories and sources. When journals were solely considered, the total dropped to 13,292 documents and further to 13,231 documents following omitting errata (57 documents) and retractions (4 documents). Filtering the outcomes for Arab countries returned 512 documents. These were meticulously screened to eliminate any that featured “one” as a (e.g., one health-care center, sixty-one health professionals, one health facility, one health district). This exercise came up with a final collection of 436 documents linked directly to the One Health concept. The preliminary inquiry for planetary health yielded 2345 documents globally of all types and sources, dropping to 2149 journal documents. After omitting 98 errata documents, the global figure was 2051 documents. Restricting the results to Arab countries revealed 63 studies. Fig. 2 displays the strategy used to retrieve the data for the present analysis, along with the inclusion and exclusion criteria.

2.3. Bibliometric and performance analysis

A bibliometric and performance analysis was conducted on 436 One Health documents and 63 planetary health documents originating from or contributed to by Arab scholars. The analysis considered both quantitative and qualitative bibliometric indicators [35], involving research development (studying publication years and spatial evolution), the origin of studies (recognizing regions, countries, and territories), productivity (analyzing the productivity of countries, dominant institutions, and primary sources), and research impact (evaluating citation figures, top cited works, and Hirsch index).

2.4. Visualization analysis

VOSviewer software version 1.6.20, developed by the Center for Science and Technology Studies at Leiden University in the Netherlands, is

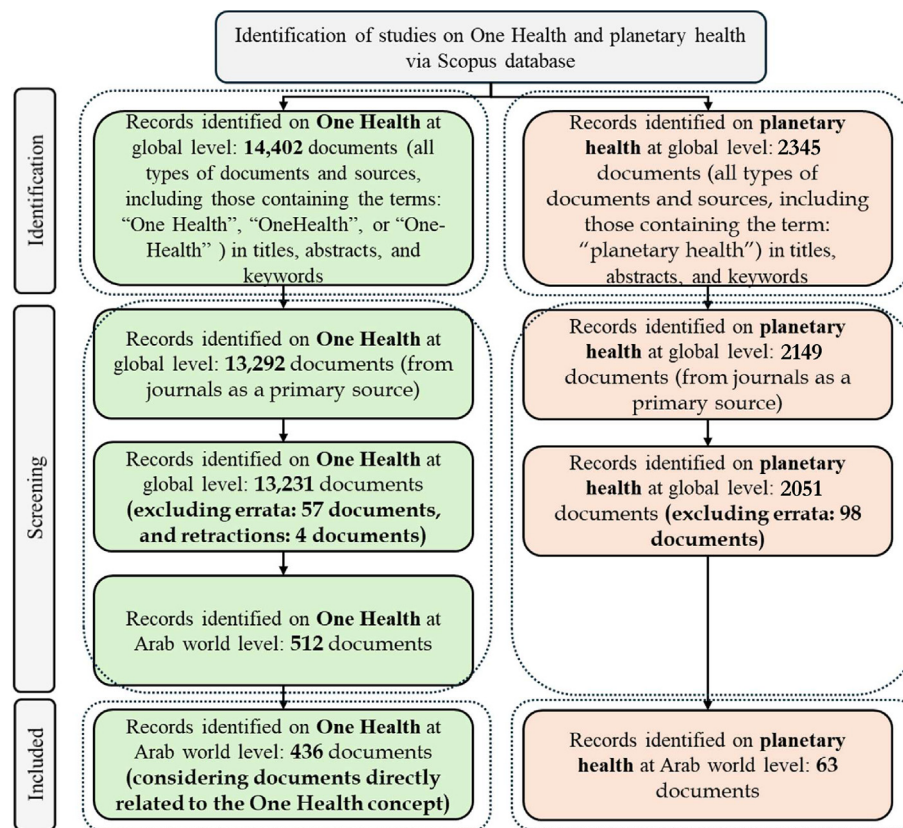


Fig. 2. Flowchart for inclusion and exclusion of studies on One Health and planetary health in the Arab world.

used to create network visualizations that illustrate collaboration among countries through co-authorship links, co-citation analysis of sources, and the identification of key research topics based on keyword co-occurrence analysis [36]. Co-authorship analysis facilitated by VOSviewer is based on similarity mapping and clustering algorithms. This technique allows the establishment of a two-dimensional bibliometric map representing collaboration patterns among countries. The distance between any two countries on the map detects the strength of connection and scientific collaboration intensity; a smaller distance between countries expresses stronger partnerships. The map also divides the nations into marked clusters, each with its own different color; nations that are often cooperating are grouped together within the same cluster [37].

To evaluate the conceptual links and impact of journals in One Health and planetary health, co-citation analysis was accomplished with VOSviewer. This analysis examines shared citations to figure out how journals relate to each other. For example, if a document in journal A cites material originating from journals B and C, it suggests an association between B and C. The greater the association, the more frequently other sources cite both B and C, with closer positions on the map exhibiting this strength. This analysis further benefits researchers in recognizing pertinent sources and comprehending disciplinary structures, as clustered sources imply closely related domains [36].

In keyword co-occurrence analysis, VOSviewer shows every term as a node, with the node's size correlated with the total number of documents that comprise that term. To recognize major topics, terms in titles and abstracts are considered, applying a relevance score to eliminate general terms and prioritize those with stronger significance. The closeness of nodes reveals the extent of the association between terms, with closer terms implying a higher frequency of joint occurrence. Nodes in the center of visualization advocate for terms that emerge extensively with other terms. Terms are further grouped into clusters according to their associations, and each cluster is characterized by a distinct color [2].

3. Results

3.1. Trends in productivity, collaboration, and institutional contributions in One Health and planetary health research

The analysis shows that the Arab world is more successful in One Health, producing 436 documents compared to 63 documents in planetary health, with nearly the same share of global productivity in both fields (about 3.9 % of global output for One Health and 3.0 % for planetary health). The evolution of One Health possesses an appealing exponential trend, especially after 2019 with the outbreak of the COVID-19 pandemic, and it keeps evolving, with 2024 still eligible for potential contributions. Conversely, planetary health has experienced an inconsistent growth pattern, with a significant surge in 2023 (Fig. 3). An interesting point is that the period during which Arab scholars engaged with planetary health, whose current principles were introduced in 2015 and adopted by Arab scholars in 2018, was shorter than the period for engaging with One Health. The current principles of One Health were introduced in 2003, with Arab scholars beginning their engagement in 2011.

In One Health, 21 Arab countries in different capacities, headed by Egypt (137 documents; 31.4 %), Saudi Arabia (79 documents; 18.1 %), and the United Arab Emirates (66 documents; 15.1 %), partnered with 152 non-Arab countries, principally the United States (103 documents; 23.6 %) and the United Kingdom (67 documents; 15.4 %) (Table 1 and Fig. 4). Regarding planetary health, 13 Arab countries, most notably the United Arab Emirates (21 documents; 33.3 %), Egypt (13 documents; 20.6 %), and Saudi Arabia (10 documents; 15.9 %), partnered with 71 non-Arab countries, with the United Kingdom (36 documents; 57.1 %) and the United States (33 documents; 52.4 %) leading in the number of publications (Table 2 and Fig. 4). Fig. 5A presents a visualized map of One Health collaborations among Arab countries and between Arab and non-Arab countries, focusing on nations with at least 20 published

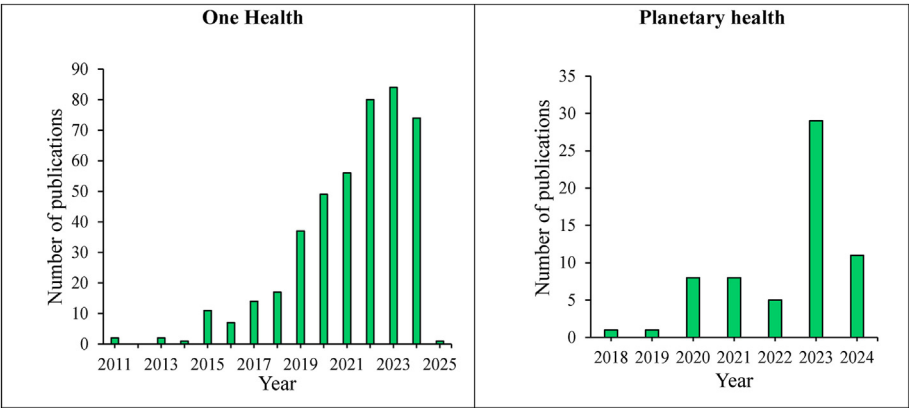


Fig. 3. Evolution of One Health and planetary health research in the Arab world. Timeline of One Health and planetary health publications emerging from the Arab world and/or resulting from cooperation with non-Arab countries was retrieved from the Scopus database.

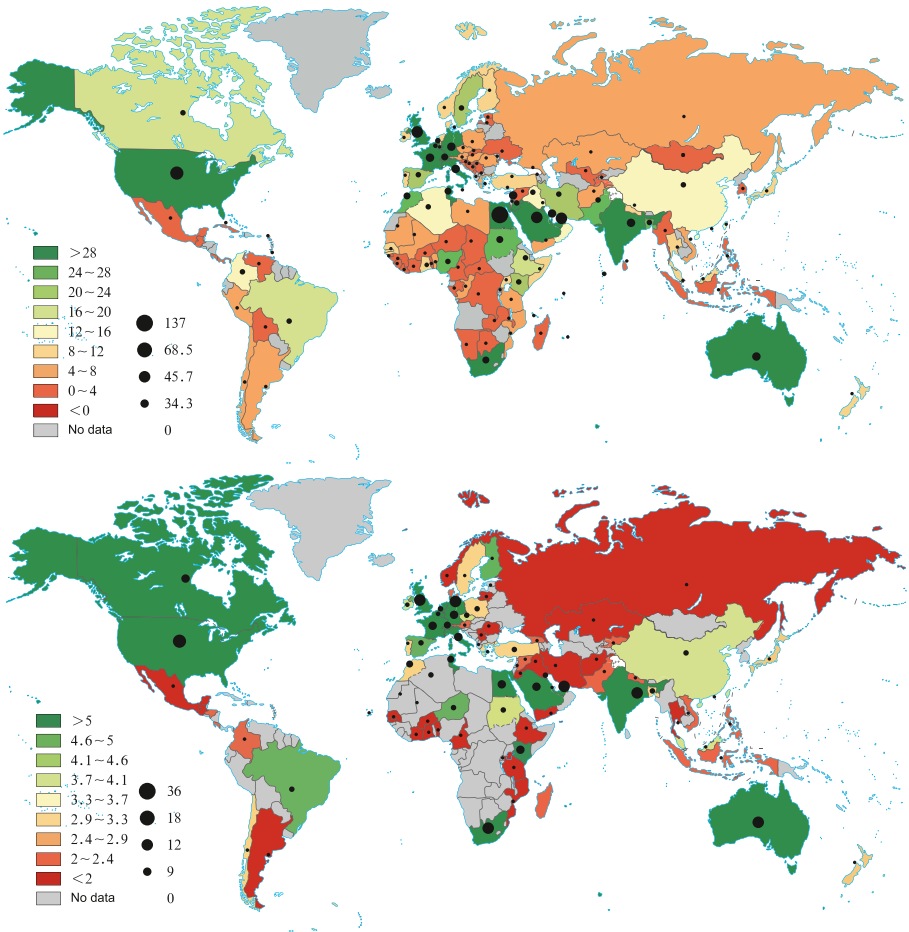


Fig. 4. A worldwide perspective on nation-level research output in One Health and planetary health. National and regional activity was visualized on the world map. Black circle size denotes productivity (larger circle implies higher productivity). The map was developed applying StatPlanet Interactive Mapping and Visualization Software version 1.0 (<http://www.statsilk.com>, free license).

documents. The visualization draws our attention to two main observations. The first is that the strongest co-authorship relationship within the Arab world is between Egypt and Saudi Arabia, reflecting their roles as prime knowledge contributors in various scientific fields. The second is that countries classified as developed, such as the United States, the United Kingdom, Germany, France, and Italy, are primary partners in cooperation with Arab countries. Fig. 5B pinpoints the countries with at least five published documents each in the field of planetary health

research. A total of 19 countries fell under this category, which were grouped into three major clusters. The map portrays the central position of the United Kingdom, the United States, and Australia on planetary health with contributions from the Arab world. At the institutional level, the largest contribution to One Health was made by the United Arab Emirates University and United Arab Emirates, which contributed 31 documents (7.1 %) of the total number (Table 3). Egypt has the highest number of contributing institutions with six of the

Table 2
Contributions of Arab world countries to One Health and planetary health research.

One Health				Planetary health			
Rank	Country	Number of publications	%	Rank	Country	Number of publications	%
1	Egypt	137	31.4	1	United Arab Emirates	21	33.3
2	Saudi Arabia	79	18.1	2	Egypt	13	20.6
3	United Arab Emirates	66	15.1	3	Saudi Arabia	10	15.9
4	Lebanon	41	9.4	4	Tunisia	6	9.5
5	Tunisia	31	7.1	5	Kuwait	5	7.9
6	Jordan	29	6.7	6	Sudan	4	6.3
7	Qatar	28	6.4	7	Morocco	3	4.8
8	Morocco	27	6.2	8	Bahrain	2	3.2
8	Sudan	27	6.2	8	Lebanon	2	3.2
10	Algeria	15	3.4	10	Syrian Arab Republic	2	3.2
11	Bahrain	13	3.0	11	Iraq	1	1.6
11	Iraq	13	3.0	11	Jordan	1	1.6
11	Palestine	13	3.0	11	Yemen	1	1.6
14	Oman	12	2.8	14	Algeria	–	–
15	Somalia	10	2.3	15	Comoros	–	–
16	Kuwait	8	1.8	16	Djibouti	–	–
17	Libya	6	1.4	17	Libya	–	–
18	Yemen	5	1.1	18	Mauritania	–	–
19	Mauritania	4	0.9	19	Oman	–	–
20	Syrian Arab Republic	3	0.7	20	Palestine	–	–
21	Comoros	1	0.2	21	Qatar	–	–
22	Djibouti	–	–	22	Somalia	–	–

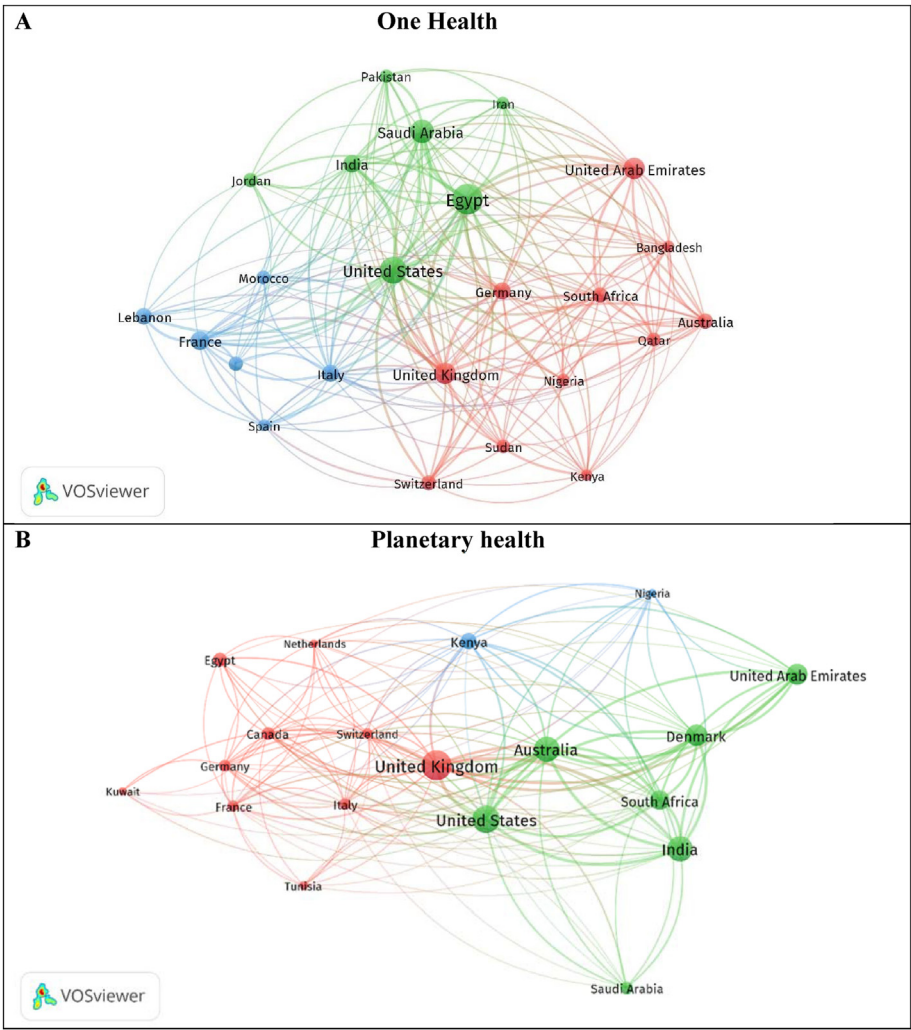


Fig. 5. Network visualization map of research collaboration on One Health and planetary health. Full counting is employed, where each co-authorship link is assigned equal weight. For each of the qualified country, the total strength of the co-authorship links with other countries was calculated. The countries with the greatest total link strength were selected. **(A)** Network visualization map of research collaboration on One Health with a minimum research output of 20 documents/country. Of the 152 countries, 24 met this threshold. The map categorized the most frequently collaborated countries into 3 clusters with distinctive colors: cluster 1 in red (11 countries; the United Kingdom acquired the strongest link strength: 219 out of 1454, while the United Kingdom and Germany acquired the greatest number of links: 23 each out of 249); cluster 2 in green (7 countries; the United States acquired the strongest link strength: 288 out of 1454); cluster 3 in blue (6 countries: France acquired the strongest link strength: 147 out of 1454 and, along with Italy, recorded the greatest number of links: 23 out of 249). **(B)** Network visualization map of research collaboration on planetary health with a minimum research output of 5 documents/country. Of the 71 countries, 19 met this threshold. The map categorized the most frequently collaborated countries into 3 clusters with distinctive colors: cluster 1 in red (10 countries; the United Kingdom acquired the strongest link strength: 195 out of 794, and the greatest number of links: 18 each out of 144); cluster 2 in green (7 countries; the United States acquired the strongest link strength: 188 out of 794); cluster 3 in blue (2 countries: Kenya acquired the strongest link strength: 91 out of 794 and recorded the greatest number of links: 17 out of 144). The map was created using VOSviewer software version 1.6.20.

Table 3
Top 10 productive institutions in One Health and planetary health research.

One Health			Planetary health		
Rank	Institution, Country	Number of publications %	Rank	Institution, Country	Number of publications %
1	United Arab Emirates University, UAE	31	7.1	Ain Shams University, Egypt	6 9.5
2	National research Centre, Egypt	19	4.4	Université de Tunis El Manar, Tunisia	5 7.9
3	Kafrelsheikh University, Egypt	17	3.9	United Arab Emirates University, UAE	3 4.8
3	Ministry of health, Saudi Arabia	17	3.9	Alexandria University, Egypt	3 4.8
3	Alexandria University, Egypt	17	3.9	King Abdulaziz University, Saudi Arabia	2 3.2
3	Université Libanaise, Lebanon	17	3.9	Gulf University for science and Technology, Kuwait	2 3.2
7	Animal health research Institute, Egypt	16	3.7	University of Sfax, Tunisia	2 3.2
8	Jordan University of science and Technology, Jordan	15	3.4	Lebanese American University, Lebanon	2 3.2
9	Zagazig University, Egypt	14	3.2	Khartoum University, Sudan	2 3.2
9	Cairo University, Egypt	14	3.2	Arabian Gulf University, Bahrain	2 3.2
9	University of Sharjah, UAE	14	3.2	Université Tichrine, Syrian Arab Republic	2 3.2

Abbreviation: UAE, United Arab Emirates.

Table 4
Prominent journals with over five documents in One Health research.

Rank	Source	Number of publications	%	IF ^a	CiteScore ^b
1	<i>One Health</i>	26	6.0	4.1	8.1
2	<i>Pathogens</i>	15	3.4	3.3	6.4
3	<i>Frontiers in Veterinary Science</i>	13	3.0	2.6	4.8
4	<i>Animals</i>	12	2.8	2.7	4.9
4	<i>Journal of Infection and Public Health</i>	12	2.8	4.7	13.1
4	<i>Microorganisms</i>	12	2.8	4.1	7.4
7	<i>Antibiotics</i>	11	2.5	4.3	7.3
8	<i>Frontiers in Public Health</i>	8	1.8	3.0	4.8
9	<i>Acta Tropica</i>	6	1.4	2.1	5.4
9	<i>Frontiers in Microbiology</i>	6	1.4	4.0	7.7
9	<i>PLoS One</i>	6	1.4	2.9	6.2
9	<i>Veterinary World</i>	6	1.4	1.7	3.6
12	<i>Future Microbiology</i>	5	1.1	2.5	4.9
12	<i>PLoS Neglected Tropical Diseases</i>	5	1.1	3.4	7.4
12	<i>Travel Medicine and Infectious Disease</i>	5	1.1	6.3	19.4

^a The Impact Factor measures the average number of citations received in a particular year by papers published in the journal during the two preceding years. 2023 Journal Citation Reports (Clarivate Analytics, 2024).

^b CiteScore 2023 counts the citations received in 2020–2023 to articles, reviews, conference papers, book chapters and data papers published in 2020–2023, and divides this by the number of publications published in 2020–2023.

11 listed among the most productive institutions. For planetary health, Ain Shams University in Egypt led with six documents, which is 9.5 % of the total (Table 3). Egypt and Tunisia both had the most contributing institutions in this field with two institutions each among the 11 most productive institutions.

3.2. Major sources in One Health and planetary health based on productivity and co-citation analysis

The *One Health* journal was the most important platform for One Health research, having published 26 documents (26.0 %) from Arab world, as presented in Table 4, which details the top productive sources for more than five documents in One Health research. In the field of planetary health, *OMICS A: Journal of Integrative Biology* was the most prominent with 9 documents (14.3 %) from Arab world, as shown in Table 5. Since the total output in the One Health field was higher than that in planetary health field, this led to a more significant number of prominent journals publishing more than five documents. In One Health, there were 15 such journals, compared to only two in planetary health. Top journals in the two fields are characterized by their high impact, as represented by their respective impact factors and CiteScores.

In One Health co-citation analysis, the minimum citation threshold was fixed at 100, and 10 out of 7331 sources satisfied this condition (Fig. 6). These sources were categorized into two clusters: cluster 1 (red) featuring seven sources and cluster 2 (green) with three sources. The

Table 5
Prominent journals with over five documents in planetary health research.

Rank	Source	Number of publications	%	IF ^a	CiteScore ^b
1	<i>OMICS A: Journal of Integrative Biology</i>	9	14.3	2.2	6.0
2	<i>Lancet Planetary Health</i>	6	9.5	24.1	28.4

^a The Impact Factor measures the average number of citations received in a particular year by papers published in the journal during the two preceding years. 2023 Journal Citation Reports (Clarivate Analytics, 2024).

^b CiteScore 2023 counts the citations received in 2020–2023 to articles, reviews, conference papers, book chapters and data papers published in 2020–2023, and divides this by the number of publications published in 2020–2023.

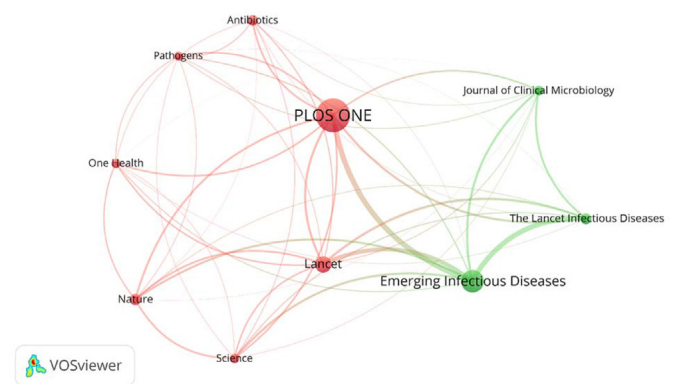


Fig. 6. Network visualization map of co-citation analysis of sources on One Health. The minimum number of citations of a source was set as 100. Of the 7331 sources, 10 met the threshold. Full counting is employed, where each co-citation link is assigned equal weight. For each of the 10 sources, the total strength of the co-citation links with other sources was calculated. The sources with the greatest total link strength were selected. The map categorized the most co-cited sources into 2 clusters with distinctive colors: cluster 1 in red (seven sources), and cluster 2 in green (three sources). *Emerging Infectious Diseases* and *PLoS One* journals exhibited the strongest link strength, with values of 1999 and 1674, respectively, out of a total link strength of 5161. The map was created using VOSviewer software version 1.6.20.

most notable associations were observed respectively between *PLoS One* and *Emerging Infectious Diseases*, *The Lancet Infectious Diseases* and *Emerging Infectious Diseases*, and *The Lancet* and *Emerging Infectious Diseases*, as displayed on the map by the thickest lines of connections between sources. The total number of links was 45, with each journal having one link to each of the other nine journals. In planetary health, the required citation threshold was set at 20, and 12 of 1607 sources satisfied this condition (Fig. 7). These sources were categorized into four clusters: cluster 1 (red) comprises five sources, cluster 2 (green), having three

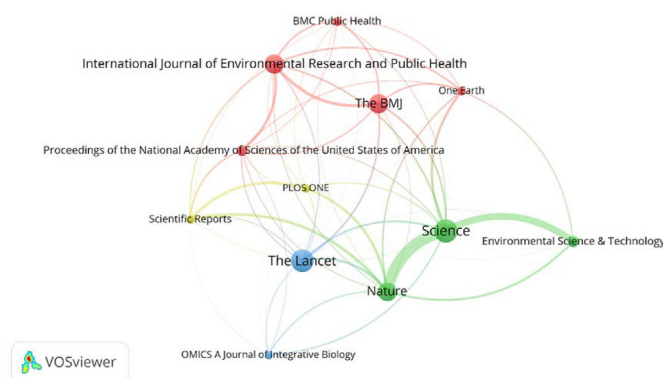


Fig. 7. Network visualization map of co-citation analysis of sources on planetary health. The minimum number of citations of a source was set as 20. Of the 1607 sources, 12 met the threshold. Full counting is employed, where each co-citation link is assigned equal weight. For each of the 12 sources, the total strength of the co-citation links with other sources was calculated. The sources with the greatest total link strength were selected. The map categorized the most co-cited sources into four clusters with distinctive colors: cluster 1 in red (five sources), cluster 2 in green (three sources), cluster 3 in blue (two sources), and cluster 4 in yellow (two sources). *Science* and *Nature* journals exhibited the strongest link strength, with values of 766 and 667, respectively, out of a total link strength of 1893. The map was created using VOSviewer software version 1.6.20.

sources, cluster 3 (blue) with two sources, and cluster 4 (yellow) with two sources. The strongest associations were between *Science* and *Nature*, and *Science* and *Environmental Science and Technology*, as evidenced by the thickest lines connecting these sources. The total number of links was 58, with *Nature*, *Science*, *The Lancet*, *PLoS One*, and *The BMJ* journals each having 11 links. This analysis, which discloses a discipline's intellectual network and significant journals, revealed the vitality of *Emerging Infectious Diseases* and *PLoS One* in One Health field. The two journals have the highest link strengths: the first one has a link strength of 1999 out of a total of 5161, while the second has a link strength of 1674. In planetary health, *Science* and *Nature* had the highest link strengths: 766 out of a total of 1893 for *Science*, and 667 out of 1893 for *Nature*.

3.3. Top-cited works in One Health and planetary health research

One Health publications acquired a total of 1181 citations, with an average of 2.71 citations per document and an h-index of 15. For planetary health, there were 687 citations, with an average of 10.9 citations

per document and an h-index of 12. Table 6 displays the top 10 cited works on One Health research [5,38–46]. This list comprises seven articles and three reviews, with citation counts ranging from 111 to 450. Table 7 shows the top 10 most cited documents in planetary health, including six articles, four reviews, and one note, with citation counts ranging from 13 to 107 [47–57].

3.4. Major themes on One Health and planetary health research based on keyword co-occurrence analysis

Keyword co-occurrence analysis of titles and abstracts of works published about One Health, and planetary health was performed using VOSviewer. Fig. 8 points out some key themes that have been associated with One Health. The network visualizes several themes by mapping the co-occurrence of terms that occur at least 15 times. Of the 12,030 identified terms, 100 passed the threshold with a relevance of 60 % and have been grouped in three major clusters. Each cluster has a different color, showing the terms relevant to a particular domain of research. One Health's investigations centered mostly on zoonotic diseases like COVID-19 (cluster 1 in red), examination of antimicrobial resistance (AMR) genes in organisms in agricultural, clinical, and environmental contexts for the sake of food safety and public health (cluster 2 in green), and the value of domestic livestock in reducing zoonotic risks (cluster 3 in blue).

In planetary health, the network visualizes themes by mapping co-occurring terms that appear at least three times (Fig. 9). Out of 1671 terms, 46 met the threshold with a relevance score of 60 % and were categorized into two distinct clusters. The first cluster, highlighted in red, focuses on the impacts of air pollution and climate change on biodiversity and human health. In contrast, the second cluster, shown in green, emphasizes leveraging knowledge and innovation to address public health and ecological challenges, particularly those exacerbated by COVID-19.

4. Discussion

4.1. COVID-19: driving One Health research in the Arab world

This study is the first regional descriptive cross-sectional analysis of One Health and planetary health in the scope of the Arab world. The study aims to track progress in research, identify gaps present, highlight significant contributors, assess measures of collaboration, and explore the priorities and intersections between these two fields along with the complementary roles these two fields play for one another. The Arab world's academic community has shown significant activity, evident in the growing number of research publications, particularly in the field of One Health, following the COVID-19 pandemic. This pandemic, which is

Table 6
Top 10 cited works on One Health research.

Rank	Authors	Year	Title	Source title	Cited by	Document type
1	Y.A. Helmy et al.	2020	The COVID-19 pandemic: A comprehensive review of taxonomy, genetics, epidemiology, diagnosis, treatment, and control	<i>Journal of Clinical Medicine</i>	450	Article
2	M.T. Rahman et al.	2020	Zoonotic diseases: Etiology, impact, and control	<i>Microorganisms</i>	303	Article
3	M.E. El Zowalaty and J.D. Järhult	2020	From SARS to COVID-19: A previously unknown SARS- related coronavirus (SARS-CoV-2) of pandemic potential infecting humans – Call for a one health approach	<i>One Health</i>	294	Article
4	W.B. Adisasmito et al.	2022	One health: A new definition for a sustainable and healthy future	<i>PLoS Pathogens</i>	264	Article
5	A.M. Algammal et al.	2020	Methicillin-resistant staphylococcus aureus (MRSA): One health perspective approach to the bacterium epidemiology, virulence factors, antibiotic-resistance, and zoonotic impact	<i>Infection and Drug Resistance</i>	223	Article
6	N. Ramadan and H. Shaib	2019	Middle east respiratory syndrome coronavirus (MERS-COV): A review	<i>GERMS</i>	186	Review
7	S. Harbarth et al.	2015	Antimicrobial resistance: One world, one fight!	<i>Antimicrobial Resistance and Infection Control</i>	166	Article
8	K. Dhama et al.	2020	SARS-CoV-2 jumping the species barrier: Zoonotic lessons from SARS, MERS and recent advances to combat this pandemic virus	<i>Travel Medicine and Infectious Disease</i>	159	Review
9	O.A. Dar et al.	2016	Exploring the evidence base for national and regional policy interventions to combat resistance	<i>The Lancet</i>	126	Review
10	G. Benelli et al.	2018	Mosquito control with green nanopesticides: Towards the one health approach? A review of non-target effects	<i>Environmental Science and Pollution Research</i>	111	Article

Table 7
Top 10 cited works on planetary health research.

Rank	Authors	Year	Title	Source title	Cited by	Document type
1	O.E. Omrani et al.	2020	Envisioning planetary health in every medical curriculum: An international medical student organization's perspective	<i>Medical Teacher</i>	107	Article
2	H. Khraishah et al.	2022	Climate change and cardiovascular disease: Implications for global health	<i>Nature Reviews Cardiology</i>	96	Review
3	F.O. Mardones et al.	2020	The COVID-19 pandemic and global food Security	<i>Frontiers in Veterinary Science</i>	83	Article
4	H.-O. Pörtner et al.	2023	Overcoming the coupled climate and biodiversity crises and their societal impacts	<i>Science</i>	80	Review
5	D. Pizzol et al.	2021	Pollutants and sperm quality: a Systematic review and meta-analysis	<i>Environmental Science and Pollution Research</i>	42	Review
5	P. Asrani et al.	2020	Molecular basis of Pathogenesis of Coronaviruses: A comparative Genomics approach to planetary health to Prevent zoonotic outbreaks in the 21st Century	<i>OMICS A Journal of Integrative Biology</i>	42	Article
7	S.M. Abdelbasir et al.	2018	Graphene-Anchored Cuprous oxide nanoparticles from Waste Electric Cables for Electrochemical Sensing	<i>ACS Sustainable Chemistry and Engineering</i>	36	Article
8	T. Haahtela et al.	2019	Helsinki by nature: The nature step to respiratory health	<i>Clinical and Translational Allergy</i>	33	Review
9	M.O. Owolabi et al.	2023	Global synergistic actions to improve brain health for human development	<i>Nature Reviews Neurology</i>	32	Article
10	A. Kyriazis et al.	2021	Physical distancing, children and urban health: The COVID-19 crisis' impact on children and how this could affect future urban planning and design policies	<i>Cities and Health</i>	13	Article
10	Z. Zeinali et al.	2020	A roadmap for intergenerational leadership in planetary health	<i>The Lancet Planetary Health</i>	13	Note

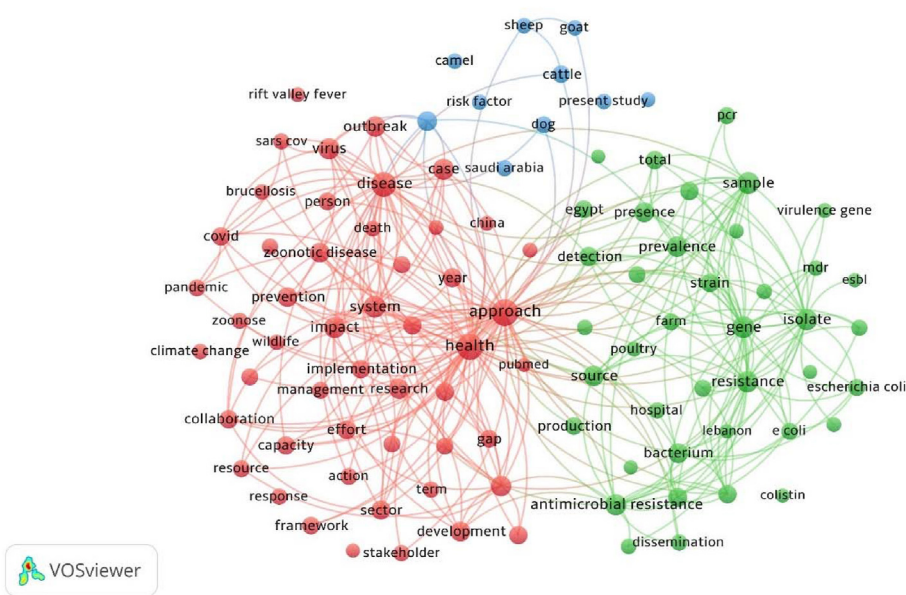


Fig. 8. Network visualization map of term co-occurrence within title and abstract of publications on One Health. The minimum occurrence for a term was fixed at 15, applying binary counting (which explores the existence or absence of a term in titles and abstracts of documents without considering the frequency of occurrence within a document). Out of 12,030 terms, 100 secured the set threshold, with a relevance score of 60 %, and were grouped into three distinct clusters: cluster 1 (red) having 50 terms; cluster 2 (green) with 40 terms; and cluster 3 (blue) with 10 terms. The map was created using VOSviewer software version 1.6.20.

recognized as a One Health concern, has provoked global interest in the One Health approach [58]. Scholars have significantly acknowledged the adoption of this approach to explicate and mitigate the transmission dynamics of zoonotic viruses, such as SARS-CoV-2 causing COVID-19 [59,60]. Although these successes represent just a modest addition to the global corpus of One Health and planetary health, Arab nations' progress in these fields on a global scale is significant. Their contributions—approximately 3.9 % of global yield in One Health and 3.0 % in planetary health—outperform the Arab nations' average contribution to worldwide research spanning all fields of science, which traditionally peaks at 2.2 % at its best rate [61].

4.2. Arab world research in step with global trends and major country-level contributors

Research practices in the Arab world coincide with global endeavors, backed up by the evidence that about 80.0 % of One Health studies (347 documents) and 96.8 % of planetary health studies (61 documents) emerged in the Arab world featured partnerships with non-Arab, mostly

developed countries. Egypt's significant performance in the field of One Health research, with respect to the Arab world, is driven by environmental health challenges. With the largest population and relying heavily on agriculture, Egypt has risks like Rift Valley fever (RVF) to foodborne diseases like campylobacteriosis, all exacerbated by poor levels of surveillance and control [29,62]. RVF remains an ongoing threat due to mosquito breeding in the Nile valley and climate change, which exacerbates these risks. Major public health effects and livestock losses are common in Egypt where humans, livestock, and vectors interact extensively and thus increase disease transmission rates [63]. In addition, AMR has been a critical concern in Egypt, which calls for the acceptance of the One Health concept in an effort to resolve the high prevalence of antibiotics abuse. The landscape in Egypt with regard to AMR involves poor awareness among the public, weak infection control practices, and inadequate implementation of antimicrobial stewardship (AMS) programs [64].

Saudi Arabia is another major contributor to the field of One Health in the Arab world, driven by unique ecological and cultural determinants. First, camels are playing an important role in the transmission of zoonotic diseases, and the extraordinary events of mass pilgrimage further

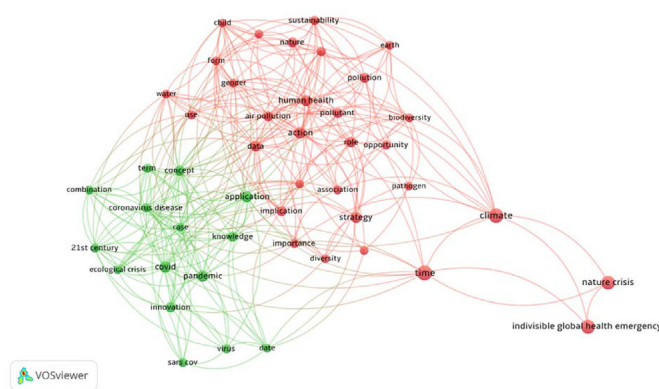


Fig. 9. Network visualization map of term co-occurrence within title and abstract of publications on planetary health. The minimum occurrences were set at three, applying binary counting (which explores the existence or absence of a term in titles and abstracts of documents without considering the frequency of occurrence within a document). Out of 1671 terms, 46 met the threshold, with a relevance score of 60 %, and were grouped into two distinct clusters: cluster 1 (red), featuring 31 terms; and cluster 2 (green), having 15 terms. The map was created using VOSviewer software version 1.6.20.

increase the risk of disease transmission because of proximity to humans [29,65]. Saudi Arabia has furthered the concept of One Health with state-of-the-art disease surveillance systems, intersectoral coordination between veterinary, medical, and environmental sectors, and even governmental contributions [65]. These efforts have been fundamental for the control of such zoonotic diseases as Middle East respiratory syndrome coronavirus (MERS-CoV) and rabies, underlining the importance of integrated approaches to infectious disease control [29,65,66].

The United Arab Emirates leads in planetary health and has an advanced position in One Health research in the Arab world, with a concentration on climate change, global health [67], and sustainable development through strong policies [68,69]. It boasts a resilient healthcare system, enables vaccine manufacturing, and works with WHO and other stakeholders to address diseases and expand health coverage. Hosting the COP28 UN Climate Change Conference and promoting renewable energy reflect its commitment to sustainability. The United Arab Emirates's economic and scientific progress propels its leadership in climate action, health challenges, and empowering low-resource countries. While there are some policy gaps, the United Arab Emirates' vision for global hubs and partnerships underlines a very proactive role in health-environment challenges [68].

4.3. Key focus areas of One Health and planetary health research in the Arab world

At the regional level, One Health research in the Arab world has placed a strong spotlight on the connectedness of human, animal, and environmental health as means to address zoonotic diseases and broader global health challenges [29]. One Health provides a strategic advantage in managing zoonotic diseases throughout the Arab world by utilizing unique environmental, cultural, and agricultural attributes found within the region [70]. The arid climate fosters the persistence of zoonotic pathogens, hence demanding robust early detection and monitoring systems—a strength of the One Health framework through its integrated surveillance mechanisms [70]. Besides, livestock farming—which is significant in many Arab countries—heightens this potential for zoonosis due to close interactions between people and animals, especially camels, cattle, and goats [71,72]. By promoting cross-sectoral collaboration within the sectors of human health, veterinary services, and agriculture, One Health responds appropriately to these risks, with particular attention to diseases such as brucellosis and tuberculosis [73]. In addition, cultural practices such as eating meat that is raw or undercooked,

particularly from camels, enhance the zoonotic risks [74], while the One Health approach helps lessen this risk by providing public education on food safety. The framework also allows for the formulation of culturally appropriate measures that can respect traditional ways of life while ensuring stronger positions in disease prevention [75].

Another central focus of the discourse was the spread and detection of AMR genes in bacteria across agricultural, clinical, and environmental settings [76–78]. This topic explores the prevalence and transmission of AMR genes, particularly in pathogens like *Escherichia coli* and *Salmonella*, within farms, hospitals, and food production systems [77,79]. It emphasizes the importance of understanding the mechanisms of gene resistance, the role of antibiotics, and the application of advanced detection techniques such as polymerase chain reaction, whole genome sequencing, and phylogenetic analysis to monitor and control the spread of resistant strains, ensuring both food safety and public health [80]. Generally, comprehensive surveillance for AMR is still markedly limited in low- and middle-income countries, including most Arab countries, because of weak laboratory capacity and governance, lack of resources, and fragmented data systems [81]. These challenges lead to the inability to adequately track AMR trends, delayed outbreak detection, and insufficient policy development, which can enhance resistance [81].

The role of domesticated animals in understanding and mitigating zoonotic disease risks was also a critical area of discussion in the Arab world. This subject focuses on identifying and managing the risk factors associated with zoonotic diseases transmitted through common domesticated animals, such as camels, cats, cattle, dogs, goats, and sheep [82]. It highlights the pivotal role these animals play within the One Health framework, emphasizing the need for coordinated efforts to monitor and control zoonotic risks, thereby protecting both human and animal health [82]. Of concern also was the One Health approach to enhanced food safety in the Arab world, in particular for those low- and middle-income countries where livestock is a prime economic sector. Given the dependence of the region on animal-based foods, coupled with inadequate food safety regulations and informal markets, developing a One Health framework is paramount in addressing foodborne diseases [83,84].

Research on planetary health within the Arab world stipulates how environmental stressors, such as air pollution and climate change, threaten biodiversity and public health in this region [85]. This is especially important, considering that many of the Arab countries face intensified challenges associated with rapid urbanization, industrialization, and climate-related factors like droughts and extreme heat that significantly impact human health and ecological stability [27]. Opportunities exist to harness innovation and knowledge to address related ecological and public health crises, so eloquently brought to the fore by COVID-19 [86].

4.4. Intersections and complementary aspects of One Health and planetary health concepts in the Arab world context

Climate change, environmental contexts, and public health all featured overlapping concerns in One Health and planetary health, with One Health dedicated more to infectious diseases and planetary health on climate change's implications on human health. Such overlaps confirm the need for communication between the two domains, which supplement each other regardless of their unique agendas. In the Arab region, the synergistic potential of One Health and planetary health presents a viable pathway for the realization of health and sustainability goals. One Health, though it stresses the resolution of localized challenges like zoonotic diseases, is particularly effective in the alleviation of urgent public health risks, focused interventions to safeguard communities, and improvement of environmental practices. On the other hand, planetary health stresses a more expanded and preventive approach, focusing on global ecosystem stability and increasing human well-being in order to shape sustainable development pathways. Such integration of approaches would harmonize localized efforts with broader ecological imperatives, fostering a healthier and more sustainable future for all.

4.5. One Health and planetary health governance in the Arab world

The Arab region, which covers mostly the Middle East and North Africa, has been actively making significant strides in adopting the One Health approach in many spheres. A WHO study conducted through the International Health Regulations-Joint External Evaluation (IHR JEE) missions on the performance of One Health assessed 14 countries in the Middle East and North Africa region found that over 90 % had developed some form of surveillance system. However, less than 50 % had the capacity to monitor one to four diseases of zoonotic origin [87]. In addition, more than 80 % of the countries had significant challenges in implementing functional national stewardship plans for the control of AMR [87]. The consequences of diseases in the political, economic, and social aspects of this region show the need to give priority to environmental and animal health [88]; using the One Health and planetary health approach will ensure a sustainable success in efforts to overcome these interlinked challenges [89].

As indicated by Baradaran-Seyed and Pishraft-Sabet [90], the establishment of a governing body that can oversee an integrated One Health surveillance system is critical in the region to facilitate early detection of threats at the human-animal-environment interface and enable a proactive health response. The overarching challenge is how to establish the political will to develop the system and nurture the intersectoral collaborations that are crucial for long-term success [90]. Moreover, successful implementation of One Health calls for a real urgent need to focus on raising public awareness of the concept and its advantages. Programs aimed at this should increasingly be incorporated into public dialogue and institutional frameworks. Another major hindrance to the more widespread application of One Health is the lack of sufficient financial resources within the region [29,90]. Effective implementation of this approach also demands professionals with the ability to garner government support for initiating and sustaining related activities [29].

Similarly, as climate change in the region fuels both droughts and water scarcity, among other such challenges, that restrain economic and social development, so too does it fuel infectious diseases, heat-related illnesses, food insecurity, and child malnutrition [85]. Each of these interconnected issues calls for the need to engage international partners to achieve enhanced climate resilience, promote major economic transformation, and make health policy and management a strategic priority [27,91]. In fact, conducting extensive research on the systemic link between environmental hazards and health consequences, and developing risk-informed sustainable development strategies [92] that cater to peculiar vulnerabilities of the region, are two critical steps toward planetary health in the Arab world.

5. Limitations

This analysis applies performance analysis and visualization mapping to explore both One Health and planetary health research dynamics at the Arab world level. It acknowledges specific limitations, almost like those identified in different investigations. First, the analysis is restricted to just publications indexed in the Scopus database, which could end up in a loss of some relevant studies not covered by this database. Fortunately, given Scopus' substantial coverage, the implication of these omissions is expected to be not significant. Second, the study's devotion to examining the terms "One Health" and "planetary health" in the titles, abstracts, and keywords of publications could overlook significant studies that address related topics without explicitly referencing these terms. Third, focusing solely on journal articles may overlook vital insights from other sources. However, the journals assessed address the vast bulk of literature on this topic, eliminating the effect of excluding other sources. Lastly, the reliance on the Scopus database for recognizing major contributors may underestimate the outcomes of some countries and institutions owing to name forms or spelling discrepancies. Regardless of these limitations, this analysis delivers an insightful global

perspective and is an asset for steering future studies and investments towards evidence-based strategies on One Health and planetary health.

6. Conclusion

The insights of this investigation present the primary visual presentation of One Health and planetary health-related studies from the Arab world. The critical investigation of scholarly literature in these two fields has indeed derived useful lessons from their characteristic features, advances, main contributors, critical gaps, and interface relationships. It also brings out the complementary roles that these fields are playing for each other's advancement and their future research prospects. The results of this study have indicated a rising scientific interest in both areas, especially in One Health. Compared with other scientific sectors, the performance in these fields outweighs the average scientific output of the Arab world globally. The unique social, cultural, governance, and agricultural attributes, along with major environmental challenges, shape the focus of both One Health and planetary health research endeavors in the Arab region. Boosting regional partnerships between Arab countries is imperative, as is developing regional research communities, alliances, and funding opportunities. Likewise, it is crucial to advance One Health and planetary health perspectives in academia, curriculum, and policy. Having a regional integrated realization of these concepts can complement global endeavors and contribute to managing regional sustainability challenges.

CRedit authorship contribution statement

Shaher Zyoud: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Sa'ed H. Zyoud:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Ethics approval and consent to participate

This analysis is without human involvement. There was no need for ethical approval.

Consent for publication

Not applicable.

Data availability statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Not applicable.

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.

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