

A SCOPING REVIEW ON THE ORIGIN, STATUS AND PROGRESS OF POLICY ORIENTED ONE HEALTH RESEARCH IN INDIA AND THE WAY FORWARD

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ABSTRACT

Zoonotic infectious diseases like Zika, Ebola, Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS) and the very recent Coronavirus Disease (COVID-19) can leap from one species to another and within the same species by constantly mutating to defy therapeutics and vaccines. The SARS-CoV-2 is emerging to be closely related to bat coronaviruses, highlighting the need of One Health approach to combat new disease threats that affects both animals and human beings. One Health is a collaborative, multi-sectoral and trans-disciplinary approach - working at the local, regional, national, and global levels, with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants and their shared environment. Therefore, One Health can be considered as a global approach to maintain health of human beings, animals and ecosystem. The present study plots the One Health publications available in Web of Science (WoS) database from 1997 to 2021. WoS provides access to databases that supplies reference and citation data from research publications. Globally, a total of 4397 publications were published. In Indian context, about 230 scientific literatures were published and only 94 publications were found relevant to policy makers. Relevance to policy-makers was judged by the presence of policy implications in the research publication. Further, data were analysed using bibliometrix R-package to evaluate research publications of authors, the annual growth of research publications and citation analysis to understand the status of One Health research in India. The annual growth rate of publications in India was 47.48 per cent with collaboration index 6.58, which is greater than global collaboration index. Three-fields plot exhibited that in Guru Angad Dev Veterinary and Animal Science University (GADVASU), Ludhiana, dedicated research on One Health is being carried out with 13 publications on One Health. The collaboration network analysis found that Indian authors are highly collaborative with researchers from Australia, USA and Germany. In addition to these formal collaborations, there is opportunity to strengthen informal collaboration through digital platforms like Google Scholar, ResearchGate, LinkedIn, Facebook, Google+, Twitter etc. With judicious use, they could be used to sprout fruitful collaborations. Thus, the trend of policy oriented One Health research in India was analysed to illuminate on the possible researchable themes and future line of works.

Keywords: One Health, multidisciplinary, zoonosis, collaboration, health policy, India

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INTRODUCTION

Infectious agents with a pandemic potential have evolved to breach barriers. They can leap from one species to another and within the same species by constantly mutating to defy therapeutics and vaccines. So is the strategy of One Health. It breaches barriers and constantly evolve with a collaborative, multisectoral and transdisciplinary approach to build a resilient approach for disease control which evolve constantly responding to newer challenges. Various diseases in the past like Zika, Ebola, SARS, MERS, flu and most importantly the COVID-19 pandemic have reinstated the interdependence

of human, animal and ecosystem health (Destoumieux-Garzon *et al.*, 2018).

One Health is a collaborative, multisectoral, and transdisciplinary approach - working at the local, regional, national, and global levels - with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants and their shared environment (Centre for Disease Control and Prevention, 2020). Therefore, One Health can be considered as a global strategy which underlines the need for holistic and transdisciplinary approach when dealing with the health of human beings, animals and ecosystem (One Health Initiative Task Force, 2008). This idea about One Health is still evolving conceptually under the

influence of health threats, scientific advances, political priorities and economy (Zinsstag *et al.*, 2015).

The intersectoral collaborations are gaining pace globally (Lubroth., 2013), however, designing of a holistic One Health model requires fair share of weightage to every component of the One Health triad. It has been observed that One Health programs are generally focussed on collaboration between health and veterinary sector whereas ecosystem sector is side-lined (Mackenzie J. S., 2014). This is a cause for concern as healthy ecosystem plays a key role in maintaining human and animal health and it is often overlooked (Rizzo *et al.*, 2021).

In India, the One Health concept is in an embryonic stage and increasingly gaining importance from all stakeholders such as policy makers, veterinarians, healthcare providers and medical professionals (Aggarwal & Ramachandran., 2020). The country is facing severe threats from several zoonotic diseases because of population explosion, rapid urbanisation, climate change, deforestation, changes in farming systems, globalization, etc. (Nambiar, 2020). Many scientists agree on the need for an effective One Health policy in India for timely action (Varma, 2014). Among the 8 sub-indicators (public participation, rule of law, transparency, responsiveness, consensus orientation, fairness and inclusiveness, effectiveness and efficiency and policy support) of the One Health Governance Index (OHGI), India is performing on par with other BRICS nations in the sub-indicators - rule of law, consensus orientation and responsiveness whereas it has lowest score in the sub-indicators – public participation and policy support (Li *et al.*, 2023). India began its focus on One Health in the year 2005 when the action plan for preparedness, control and containment of H5N1 was developed by the Ministry of Agriculture Department of Animal husbandry, Dairying and Fisheries (Ministry of Agriculture, 2005). The National Centre for Disease Control (NCDC) under Ministry of Health and Family Welfare has also started a program named Intersectoral collaboration for prevention and control of zoonotic diseases which was approved in the 12th five-year plan from 2012 to 2017 (National Centre for Disease Control, 2020). The strategies of this program include sensitisation of professionals, capacity building, awareness generation and strengthening of intersectoral collaboration between medical, veterinary and ecosystem sectors. When the global trends of emerging infectious diseases were analysed, northern and eastern India are among the areas where new diseases are most likely to occur in the coming years (Jones *et al.*, 2008). In this backdrop, “One Health India conference 2019” was organised to integrate knowledge and identify needs and opportunities to coordinate activities related to One Health for combating health threats to human and animals. A “National Expert Group on One Health” was constituted in May, 2020 to

promote multi-sectoral, transdisciplinary collaboration and cooperation. The Indian Council of Agricultural Research (ICAR) and Indian Council of Medical Research (ICMR) had jointly planned to establish a National Institute of One Health at Nagpur, Maharashtra which is another milestone in the progress of One Health (Chaudhari *et al.*, 2021). By taking all these initiatives, India is moving forward in its One Health approach in this post-COVID-19 era.

The generation of a baseline data on the previous and ongoing research based on One Health can serve as a foundation to build better One Health models. It can identify loop holes and bridge gaps between multiple sectors including researchers, public health workers and policy makers. ‘Scientometrics’ attempts to measure the evolution of a scientific domain by analysing the scientific productivity of authors, the annual growth rate of publications and citation analysis. We utilized this technique to identify the scientific publications from India, that in future will serve as the scientific raw materials for developing One Health policies in India. For this study, due to its high reliability, Web of Science (WoS) database was used as the source of metadata with keywords to filter relevant published literature (Ramanan., *et al.*, 2020; Zyoud *et al.*, 2017; Fratesi & Vacher., 2008; Lonchamp, 2012; Reinhold *et al.*, 2015). WoS was first used in scientometric study by Derek J. de Solla in his study on “Networks of Scientific Papers” (Price, 1965). Since then and with the introduction of the journal ‘Scientometrics’, WoS has become synonymous with scientometric studies worldwide.

A focused search in the Web of Science database on December 31, 2021 using the keyword ‘One Health’ revealed that from 1997 to 2021, total 4397 pieces of literature were published. When filtered for One Health literature from India, a total of 230 records were shown from 2011-2021. All these 230 literatures were manually verified by the authors for their relevance to policy makers and only 94 publications were found to be relevant. These 94 publications are chosen for its significant inputs to public policy-making. The objectives of the study were (i) to characterise the research efforts taken all over the Indian subcontinent on One Health concept in the last decade; (ii) to understand the dynamic growth of One Health research in the field of public health; (iii) to study the variations in authorship characteristics and author affiliations over the years; (iv) to identify the research journals in which higher number of One Health research articles were published in India; (v) to map the keywords used in One Health publications and chart out the future line of works.

MATERIALS AND METHODS

Ethical approval was not required for this study as no live subjects were used and the data were obtained

from public databases. The scientific domain of concern in this paper is One Health. The metadata on published literature was collected from the Web of Science (WoS) database. Many authors had carried out similar bibliometric studies in Web of Science database for different topics of interest (Zyoud *et al.*, 2017; Ramanan, *et al.*, 2020). Apart from providing comprehensive information on the topic, the database also helps in analysing the obtained data.

Keywords are good indicators of a paper's content and are often used in scientometric studies (Fratesi & Vacher, 2008; Lonchamp, 2012; Reinhold *et al.*, 2015). The search for published literature on 'One health' was done in Web of Science database during December 2021 deploying the keywords, "One Health" AND ("Well Being" OR "Multidisciplinary" OR "Disease Incidence" OR "Vulnerable" OR "One Health*") OR ("Public Health" AND "Epidemics" AND "Contagious Diseases" AND "One Health*") OR ("Agriculture Crisis" AND "Environmental Sustainability" AND "Food Safety and Security" AND "Natural Resources" AND "Zoonoses" AND "One Health*") AND ("Plant Health" AND "Animal Health" AND "Eco-System" AND "Health Threats" AND "One Health*"). All these keywords are extracted from the keywords section of highly cited One Health publications around the world by adopting Delphi technique (Dalkey & Helmer, 1963). A total of 71 keywords were chosen by the authors as a result of extensive reading. These 71 keywords were sent for expert opinion to a panel of 20 selected experts. After several rounds of deliberation, 17 keywords with highest consensus among the experts were selected as appropriate keywords for search. The search generated a total of 6402 records across the world from 1997 to 2021. The generated metadata was downloaded in BibTeX format for further analysis. In the next stage, certain types of literature like news items, book chapter reviews, notes, meeting abstracts, editorial materials etc. were excluded from analysis. A manual check was done before analysis and the 6402 records collected were reduced to 4397 records. In the next stage, the publications from India or by any one author affiliated to India were screened out which came to be 230 records. R version 4.0.1 was employed to analyse the generated metadata along with Rstudio Version 1.3.959 using a special package known as bibliometrix R-package (Aria and Cuccurullo, 2017). For duplicate searching and rectification, JabRef software version 5.0 was utilized. Also, the biblioshiny tool was employed to have web-interface for bibliometrix.

RESULTS AND DISCUSSION

Global One Health research: The global research output on One Health over the years from 1997 to 2021 is summarized in Table 1. Majority of the documents on

One Health were published after 2011 (91.47%) and the numbers were in ever-increasing trend after COVID-19 pandemic. In the year 2021 alone, 1072 documents were published on One Health indicating the increased attention gained by this scientific domain. A total of 4397 literature were published by 21807 authors with an average of 0.202 documents per author and 4.96 authors per document as shown in Table 2. Of the total 21807 authors, only 228 authors had single authored documents and the remaining 21579 authors had collaboration with others. This scientific domain One Health possesses one of the highest levels of collaboration indicated by the collaboration index of 5.20.

The global progress of One Health research from 1997 to 2021 is depicted in Figure 1 along with citation per article. Annual growth rate in the number of published research is 11.44 per cent which indicates the huge rise in One Health research over time. The maximum number of research output was in 2021 i.e., 1072 publications (24.38%) followed by 2020 i.e., 770 publications (17.51%). This data highlights the inherent scope in One Health research in coming years.

One health research in India: To better understand the status of One Health research in India, the publications from this country of interest (either the author is affiliated to India or the publication is related to India or both) was considered for further analysis. Table 3 summarizes the research output on One Health in India from 2011 to 2021. The search for scientific literature on One Health yielded a total of 230 records. After manual check, these 230 records were reduced to 94 records based on its relevance for policy makers i.e., One Health publications with policy implications. Literature on One Health is increasing immensely in India with an annual growth rate of 47.48 per cent. Moreover, Collaboration Index in India is greater than the global collaboration index of 5.20 at 6.58 and there were only 4 authors who published single-authored documents. The data on authors per document is greater in India (6.34) than the world (4.96) which implies that a greater number of authors are converging for One Health research in India.

In Figure 2, the entire list of published articles in India along with the average citation per article is shown. Similar to the global scenario of 24.38 per cent of total One Health publications in 2021, One Health research is also growing steadily in India from 2011 with 35.10 per cent of total publications in 2021 alone.

In Table 4, the researchers who has been contributing productively to One Health research is listed. Dr M Kakkar of Public Health Foundation of India, New Delhi has published seven One Health publications which is the highest number by any other author in India from the year 2014. The first article on One Health in India was "Rabies control initiative in Tamil Nadu, India: A test case for the One Health approach" authored by

Abbas S S *et al.* of Public Health Foundation of India, New Delhi in 2011. Among government universities, Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana tops the list with a fair number of publications (5 research articles) on One Health. Dr B B Singh of School of Public health and zoonosis, GADVASU, Ludhiana holds highest h-index value of 5 from five One Health articles. This h-index or Hirsch index is a measure to assess the productivity and impact of an author by analysing the citations gained by his publications.

All One Health publications were ranked on the basis of its total citations and shown in Table 5. The research article titled “Access to effective antimicrobials: a worldwide challenge” published by Laxminarayan R *et al.* of Public Health Foundation of India, New Delhi in LANCET journal was the highest cited publication (492 citations) on One Health. This article published in 2016 is distantly followed by the research article “Antibiotic resistance: What is so special about multidrug-resistant Gram-negative bacteria? (2017)” of Exner M *et al.* of Institute of Hygiene and Public Health, Bonn University, Germany published in GMS Hygiene and Infection Control with 131 citations. This research article was published in collaboration with Tata Medical Center, Kolkata and many other international medical organisations.

Figure 3 gives an overview of published articles from 2011 to 2021. It reveals that Guru Angad Dev Veterinary and Animal Science University (GADVASU), Ludhiana, The University of Sydney and RD Gardi Medical College, Ujjain are the research institutes, where dedicated research on One Health is being carried out in India. The right side indicates the top journals where research on One Health is being published by the authors from these research institutes. *Revue scientifique et technique* - Office international des epizooties journal of France published highest number of articles from India. In the centre part of the figure, the major keywords used by authors were shown. The predominant keywords were ‘One Health’, ‘India’, ‘zoonosis’ and ‘antibiotic resistance’.

The University of Sydney has published 18 articles with authors who are affiliated to India as shown in Figure 4. Among Indian institutes, Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana tops the list with 13 publications on One Health followed by RD Gardi Medical College, Ujjain with 12 publications.

When the journals with highest number of One Health publications were ranked (Table 6), Indian Journal of Medical Research by Medknow Publications topped the chart with a total of 7 publications out of 94 One Health publications in India. The journal *Revue scientifique et technique* of Office International des Epizooties (OIE) has published 4 articles out of 94 publications. Impact factor of top 10 journals varied from

0.56 to 60.39 as per the Journal Citation Report 2019-2020 by Clarivate Analytics (Sayed., 2020). However, except the journal *Revue scientifique et technique*, all other journals are with an impact factor of more than 1.50. The h-index of journals were also compared as per SCImago Journal & Country Rank portal and it varied from 22 to 762. Average h-index of top 10 journals is 178.90 which denotes that the journals are covering wider disciplines and has published large number of papers.

Keyword analysis: Keyword analysis in this study portrayed that majority of the One Health research in India is on zoonotic diseases like Rabies, Brucellosis, Anthrax and SARS COV-2. According to World Health Organisation (WHO) report (2018), rabies is endemic in India contributing to 36 per cent of total world rabies deaths. Majority of the research publications on rabies focused on “collaborative, multisectoral and transdisciplinary approach” called One Health to control rabies transmission. There are several bottlenecks in control of rabies in India and the predominant one is research-policy disconnect in rabies control (Abbas & Kakkar, 2015). Apart from the existing zoonotic diseases, there are several risk factors contributing to the emergence of new diseases. The risk factors include development projects, population explosion, climate change, tourism, disasters and pathogen adaptation (Dhiman & Tiwari, 2018).

Another significant research area in One Health research is antimicrobial resistance (AMR). AMR has been identified as a global threat with severe health, political and economic implications. Currently, India has some of the highest Antibacterial Resistance (ABR) rates posing serious health threat (Gandra *et al.*, 2017). There is a total of 2,152 publications on AMR in India as reported by Scoping Report on Antimicrobial Resistance in India, 2017. Of these, majority of the publications were on human beings (48 per cent) with the Christian Medical College, Vellore (46 publications) leading the chart. When it comes to AMR publications in animals, there were a total of 70 studies (3 per cent) and Anand Agricultural University (AAU), Anand (4 publications) tops the list. A total of 90 AMR studies (4 per cent) were on environment with Indian Institute of Technology (IIT), Delhi topping the chart. AMR can be effectively contained by intersectoral collaboration among medical, veterinary and environmental professionals.

Research collaborations are very important in combining expertise and resources for solving more complicated research questions (Nabarro., 2012). The collaboration network among scientists was studied to understand their nature of networking. It was found that there is strong collaboration among authors within India and also abroad.

Future line of works: With the constant threat of new zoonotic infectious diseases looming over the planet, the

research communities are extensively studying the potential threats and coming up with novel solutions. However, such solutions are rarely translated into public policy, making the translation deficit an important issue to be addressed (Martin *et al.*, 2019). The World Health Organization (WHO) identifies One Health as an approach to design and implement programmes, policies, legislation and research in which multiple sectors communicate and work together to achieve better public health outcomes (World Health Organisation, 2017). The research conducted in the disciplines under One Health such as Zoonoses, Food Safety, Antimicrobial resistance etc. serve as the foundation for development of policies on One Health. During the curation of data for this, it was observed that even though extensive research is ongoing on specific zoonotic diseases, AMR and foodborne pathogens, most research publications are pathogen or host specific. There are limited publications which cover the One Health topics with respect to the impact on the 'traid' that can draw the attention of One Health policy makers. In India, the health policies for humans are formulated by the Ministry of Health and Family Welfare. The Ministry of Animal Husbandry, Dairying and Fisheries designs the health policies of animals and the Ministry of Environment, Forest and Climate Change looks after environmental policies and now India is in dire need of establishing a One Health policy (Varma, 2014; Chatterjee *et al.*, 2016). The formulation of One Health policy will obligatorily rely on inter disciplinary collaboration. However, lack of supportive policies, conflicting departmental priorities and limited institutional capacities have been identified by key informant interviews of national and state level policymakers, disease managers and zoonoses experts as major barriers that hamper effective cross-sectoral collaboration on zoonotic disease control in India (Asaaga *et al.*, 2021). Researchers working on related areas of One Health can establish formal research collaboration between individuals or institutions where particular areas of research can be earmarked, with responsible fulfilment of agreed deliverables (Shaikh, 2019). Since foundation of inter disciplinary research is still being laid it will be worthwhile for researchers working in the area of zoonoses, public health and epidemiology to highlight the open ends for collaboration in their scientific publications. An example of a recent effort of formal collaboration is the formulation of 'One Health Consortium' consisting of 27 organisations led by DBT-National Institute of Animal Biotechnology, Hyderabad with an aim to conduct surveillance of bacterial, viral and parasitic infections of zoonotic and transboundary pathogens. Other than formal collaborations, strengthening informal inter-personal relationships and collaboration platforms have also been suggested as the way forward (Asaaga *et al.*, 2021). Giant academic social networks like Google Scholar,

ResearchGate, LinkedIn, Facebook, Google+, Twitter etc. have been found to be popular among researchers (Van Noorden, 2014). With judicious use they could be used to sprout fruitful collaborations.

Table 1 Summary of global literature (metadata) on One Health between 1997 – 2021.

Description	Total	
	Number	Per cent
Total publications	4397	100
Research articles	4209	95.72
Proceedings papers	123	2.79
Articles in proceedings papers	59	1.34
Book chapters	4	0.09
Data papers	2	0.04
Decadal growth of publications		
1997 – 2000	48	1.09
Decade I (2001 – 2010)	327	7.43
Decade II (2011 – 2021)	4022	91.47

Table 2 Details of global research publications on One Health during 1997 – 2021

Description	Value
Annual growth rate (%)	11.44
Average citations per document	12.33
Total authors	21807
Authors of single-authored documents	228
Authors of multi-authored documents	21579
Documents per author	0.202
Authors per document	4.96
Co-authors per documents	6.29
Collaboration Index (CI)	5.20

Table 3 Summary of Indian literature (metadata) on One Health between 1997 – 2021

Description	Value
Total publications	94
Research articles	91
Proceedings papers	3
Annual growth rate (%)	47.48
Average citations per document	13.90
Total authors	596
Authors of single-authored documents	4
Authors of multi-authored documents	592
Documents per author	0.15
Authors per document	6.34
Co-authors per documents	7.20
Collaboration Index (CI)	6.58

Limitations: Web of Science (WoS) is the only database utilized in this study which hinders the accessibility of all research papers on One Health. However, WoS has a larger coverage (Birkle *et al.*, 2020) compared to other database and reliable indexing technology minimizes the "indexer effect" which is well accepted among scientific communities (Ekundayo & Okoh, 2018). Non-inclusion of publications other than English is also a major

drawback. Furthermore, the topic of study is a broad concept and hence in-depth publications which may be under One Health domain but fell short of the word One Health are also screened out.

Table 4 Top 15 productive authors based on the total number of One Health publications in India

Author	Affiliation	Total no. of articles	h-index	Publishing year - start
Kakkar M	Public Health Foundation of India, New Delhi	7	4	2014
Singh B B	Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana	5	5	2013
Chatterjee P	Public Health Foundation of India, New Delhi	4	3	2016
Gill JPS	Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana	4	3	2018
Kumar A	Indian Veterinary Research Institute, Izatnagar	4	3	2017
Abbas SS	Public Health Foundation of India, New Delhi	3	3	2011
Bruchhausen W	University of Bonn, Germany	3	-	2019
Ghatak S	ICAR Research Complex for Northeastern Hill Region, Meghalaya	3	2	2013
Lundborg CS	Karolinska Institutet, Sweden	3	3	2015
Rahi M	Indian Council of Medical Research	3	2	2019
Robertson LJ	Norwegian University of Life Sciences	3	2	2015
Walsh MG	The University of Sydney	3	2	2020
Yasobant S	University of Bonn, Germany	3	2	2019
Ahmed N	The Royal London Hospital, UK	2	2	2014
Aulakh RS	Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana	2	2	2019

Table 5 Top 10 research articles on One Health in India.

S. No.	Title of the article	Author	Year of publication	Name of the journal	Total citations	Total citations per year
1	Access to effective antimicrobials: a worldwide challenge	Laxminarayan R <i>et al.</i>	2016	LANCET	492	82
2	Antibiotic resistance: What is so special about multidrug-resistant Gram-negative bacteria?	Exner M <i>et al.</i>	2017	GMS Hygiene and Infection Control	131	26.20
3	Exploring the evidence base for national and regional policy interventions to combat resistance	Dar OA <i>et al.</i>	2016	LANCET	85	14.17
4	Disrupted seasonal biology impacts health, food security and ecosystems	Stevenson TJ <i>et al.</i>	2015	Proceedings of the Royal Society B	79	11.29
5	Clonal spread and interspecies transmission of clinically relevant ESBL-producing <i>Escherichia coli</i> of ST410-another successful pandemic clone?	Schaufler K <i>et al.</i>	2016	FEMS Microbiology Ecology	64	10.67
6	Extraintestinal pathogenic <i>Escherichia coli</i> (ExPEC) of human and avian origin belonging to sequence type complex 95 (STC95) portray indistinguishable virulence features	Nandanwar N <i>et al.</i>	2014	International Journal of Medical Microbiology	39	4.88
7	One Health approach to cost-effective rabies control in India	Fitzpatrick MC <i>et al.</i>	2016	Proceedings of National Academy of Sciences of the USA	38	6.33
8	Antibiotic Resistance in an Indian Rural Community: A 'One-Health' Observational Study on Commensal Coliform from Humans, Animals, and Water	Purohit MR <i>et al.</i>	2017	International Journal of Environmental Research and Public Health	31	6.20
9	Antimicrobial resistance in South East Asia: time to ask the right questions	Kakkar M <i>et al.</i>	2018	Global Health Action	28	7
10	Integrating One Health in national health policies of developing countries: India's lost opportunities	Chatterjee P <i>et al.</i>	2016	Infectious Diseases of Poverty	25	4.17

Table 6 Top 10 journals with highest number of publications on One Health during 2011-2021

S. No.	Name of the journal	Total publications	Discipline	h-index (2020)	Impact factor (2020)	Publisher
1	Indian Journal of Medical Research	7	Medicine	87	1.50	Medknow Publications
2	Revue scientifique et technique	4	Animal science and medicine	88	0.56	Office International des Epizooties
3	One Health	3	Infectious Diseases, Public Health, Environmental and Occupational Health	22	4.69	Elsevier
4	PLOS ONE	3	Interdisciplinary	332	2.74	Public Library of Science (PLOS)
5	Antimicrobial Resistance and Infection Control	2	Medical and Public health	37	3.59	BioMed Central Ltd.
6	BMC Public Health	2	Public Health, Environmental and Occupational Health	143	2.52	BioMed Central Ltd.
7	International Journal of Environmental Research and Public Health	2	Public health	113	2.84	Multidisciplinary Digital Publishing Institute (MDPI)
8	Preventive Veterinary Medicine	2	Animal Science and Zoology	95	2.30	Elsevier
9	LANCET	2	Medicine	762	60.39	Elsevier
10	Letters in Applied Microbiology	2	Applied Microbiology and Biotechnology	110	2.17	Wiley-Blackwell Publishing Ltd.

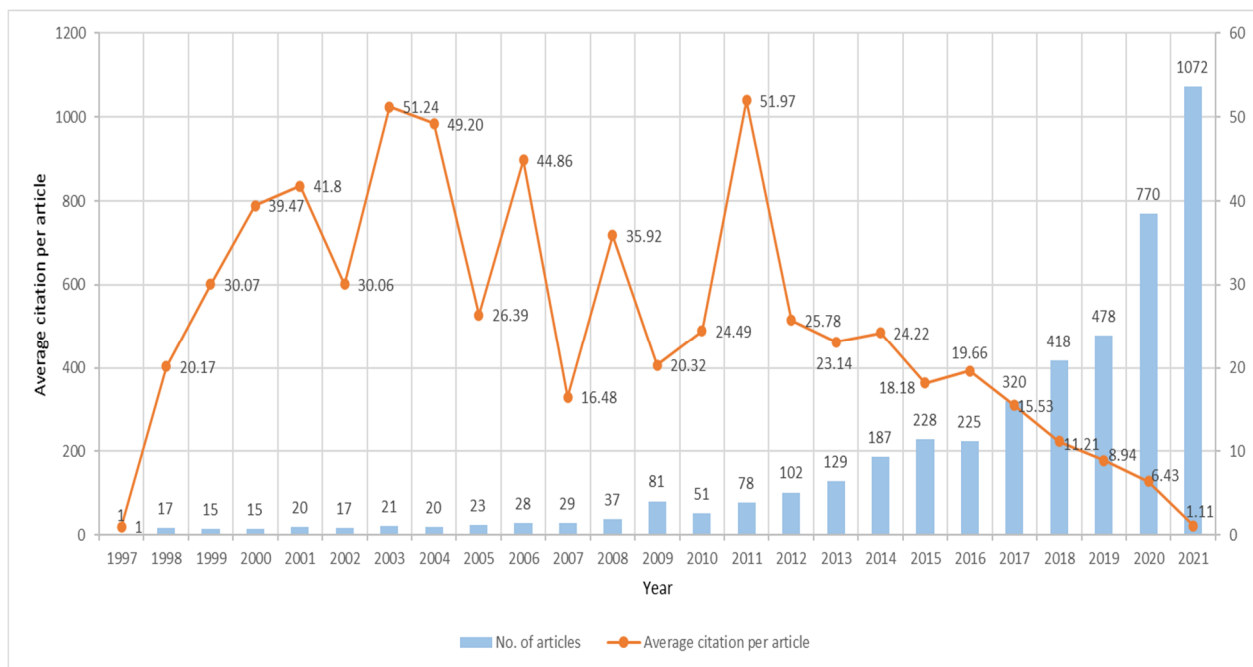


Figure 1 Published studies on One Health across the world from 1997 to 2021

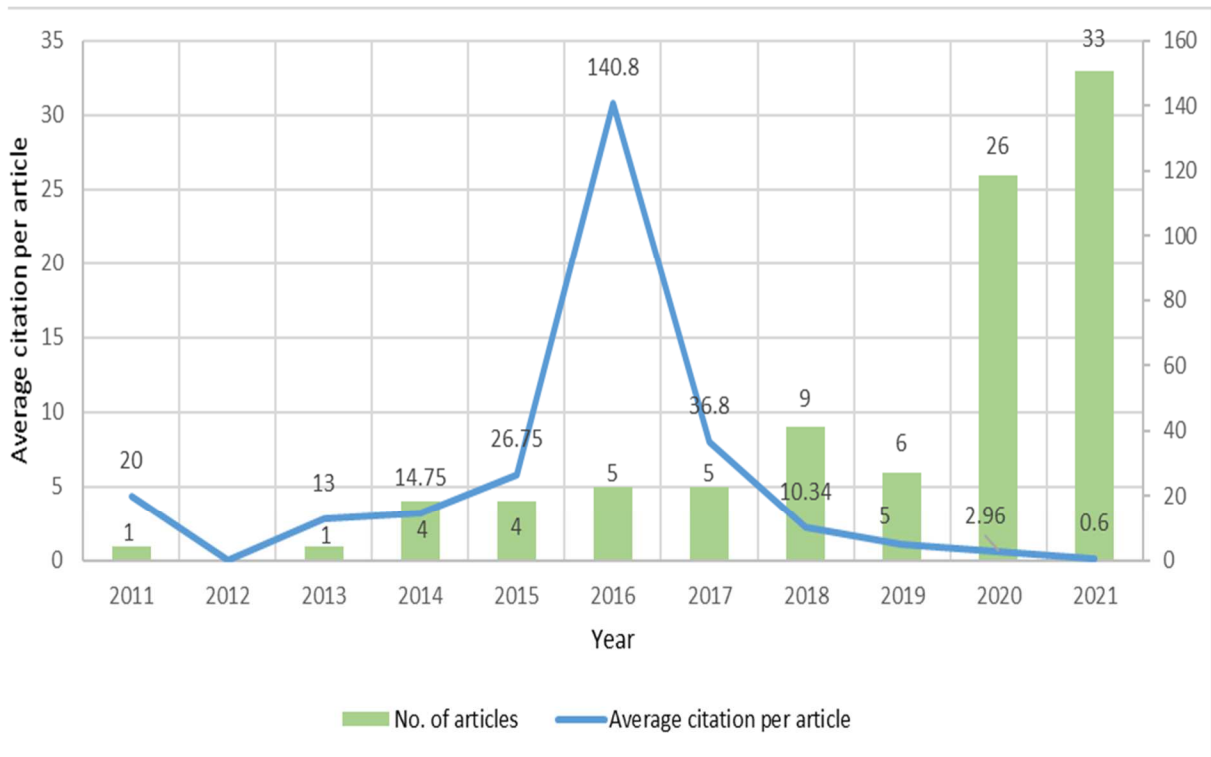


Figure 2 Published studies on One Health in India from 2011 to 2021

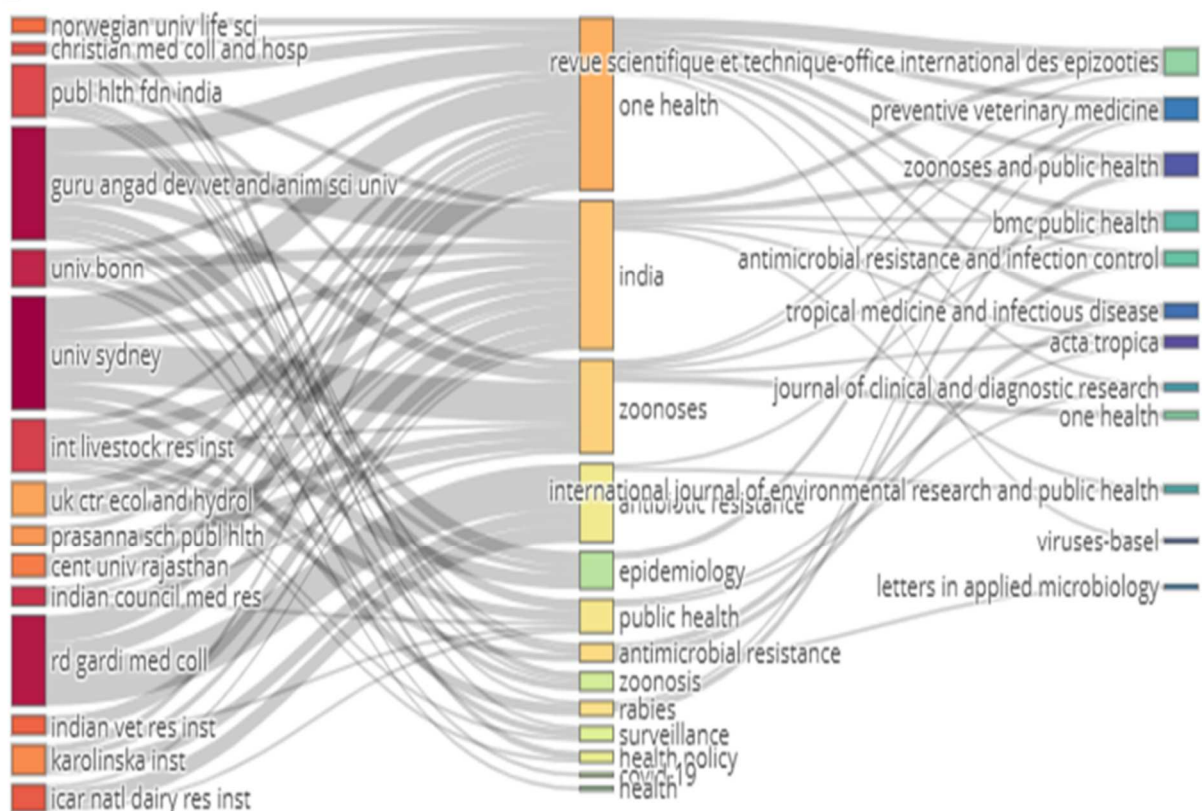


Figure 3 Three-fields plot depicting the top 15 research institutes, keywords and journals for One Health from 2011 to 2021

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