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Protocol for Developing a Database of Zoonotic Disease Research in India (DoZooRI)

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Abstract

Introduction: Zoonotic and emerging infectious diseases represent a public health threat that has been acknowledged only recently although they have been on the rise for the past several decades. On an average, every year since the second world war, one pathogen has emerged or re-emerged on a global scale. Developing countries like India bear a significant burden of zoonotic and emerging infectious diseases. We propose that the creation of a database of published, peer-

reviewed research will open up avenues for evidence-based policymaking for targeted prevention and control of zoonoses.

Methods and Analysis: A large scale systematic mapping of the published peer-reviewed research conducted in India will be conducted. All published research will be included in the database, without any prejudice for quality screening, to broaden the scope of included studies. Structured search strategies will be developed for priority zoonotic diseases (leptospirosis, rabies, anthrax, brucellosis, cysticercosis, salmonellosis, bovine tuberculosis, Japanese encephalitis, and rickettsial infections), and multiple databases will be searched for studies conducted in India. The database will be managed and hosted on a cloud-based platform called Rayyan. Individual studies will be tagged based on key pre-identified parameters (disease, study design, study type, location, randomization status and interventions, as applicable)

Ethics and Dissemination: The database will incorporate already-published studies, obviating the need for special ethical clearances. The database will be made available online, and in collaboration with multisectoral teams, domains of enquiries will be identified, and subsequent research questions raised. The database will be queried for these and resulting evidence will be analysed and published in peer-reviewed journals.

Keywords: zoonoses, database, one health, emerging infections

STRENGTHS AND LIMITATIONS

- The strength of this approach is that in the absence of rigorous surveillance programs and methods to track zoonotic diseases, this approach provides an alternate method to develop a continuously updated database to query zoonotic diseases and their determinants.
- The main limitation of the approach is that it is largely dependent on published data, which may be of heterogenous quality, and could also result in duplicate entries.

INTRODUCTION

Zoonoses, diseases that are naturally transmitted between humans and other vertebrate animals have been recognised since the beginning of history, but their public health importance has gained increased visibility in the last few decades [1]. A global analyses of emerging infectious disease (EID) between 1940 to 2004 identified that 60.3% of them were zoonosis and they were increasing rapidly over time [2]. A substantial portion of the global burden of endemic zoonosis is from India and it is predicted to be one of the several 'EID hotspots' [3,4]. India is experiencing rapid urbanisation, industrialisation, increased incomes, changing food preferences raising demand for animal source proteins, leading to a larger section of the workforce being in close contact with livestock, including poultry, making a wider section of the population extremely susceptible to zoonotic diseases. Owing to the public health importance of zoonotic diseases in India a National Standing Committee on Zoonoses was formed in 2007 [5,6]. Lately a Centre for Zoonoses Research has been proposed to be set up to harness inter-sectoral collaborative research in line with the One Health approach which is required to tackle zoonotic diseases [7]. However not much is known about the status of zoonotic disease research and several key aspects related to it including several aspects of clinical presentation, diagnoses, management and epidemiology in the Indian context [8]. There is also a need to synthesise evidence about zoonoses in India to guide further research, set research and public health priorities and streamline disease control efforts in an evidence informed manner [9,10]. This paper reports the protocol for development of a Database of Zoonotic Disease Research in India (DoZooRI) which intends to address these gaps.

Rationale for Development of Database of Zoonotic Diseases Research in India:

We envision DoZooRI as a multidisciplinary research database which would embed all zoonoses related research in India. DoZooRI will be made accessible to clinicians, veterinarians, researchers, public health professionals, programme managers and policy makers on request. Citations within the research database would be tagged on several carefully chosen key parameters that would enable rapid retrieval of relevant research from a wide variety of sources to those who seek evidence. This would provide critical evidence support for clinical or public health practice, evidence syntheses or plan future research in line with research gaps. This is essential in the context of India, where access to electronic databases as well as trained health

information specialists with capability to develop search strategies is severely limited [11]. DoZooRI will also address concerns about wasteful research waste, owing to new research not being based on pre-existing research and without their need being vindicated by existing systematic reviews demonstrating critical knowledge gaps [12,13]. Mapping zoonotic disease research and conduct of further evidence syntheses through the DoZooRI will facilitate better understanding of knowledge gaps which is critical for disease control efforts, policy making, public health planning and inform public health and research priorities. Further, the database will enable us to undertake analyses to identify research capacity across institutions in India.

DoZooRI is being developed as a strategic tool to support various activities of India Research Initiative on Peri-Urban Human-Animal-Environment Interface, which is housed at the Public Health Foundation of India, and aims to conduct and support multidisciplinary research, build workforce capacity across sectors, and conduct evidence syntheses and policy advocacy.

Implications and Possible Collaborations

The creation of a database of zoonotic disease research in India presents an innovative approach to systematic evidence synthesis. It should encourage researchers to collaborate, help to identify and dissolve the compartments which have restricted research efforts to sectoral silos, and encourage truly transdisciplinary collaborations to flourish [14–16]. Using the database, researchers can map zoonotic diseases research; describe the characteristics of interventional research on zoonotic diseases in India; describe the epidemiology of zoonotic diseases, including differences by location, geographic terrain, or other determinants; identify the research-policy disconnect and inform on realignment of research priorities in zoonotic disease prevention and control in India; understand institutional capacity to conduct zoonotic research in India; and address any other issues based on the extended tagging system. The database could potentially be developed into a dynamic repository of the body of work being done in India with respect to zoonotic diseases. Further, if collaborations with techno-medical entrepreneurs can be leveraged, this can be developed into a platform which is updated in real time and allows auto-tagging of published research for the purpose of evidence syntheses.

The database is going to provide a step towards closing the evidence-policy gap in zoonotic disease prevention and control programmes by providing the policy makers, programme managers or any other stakeholders access to a searchable, tagged database of existing evidence. This opens avenues for data mining and conducting multiple rapid reviews or systematic reviews to assess the state of the published evidence. The process will bring together the tenets of open science and evidence based policymaking to strengthen the clinical, veterinarian and public health response to zoonotic disease prevention and control.

Objective

To develop a database of zoonotic diseases research in India which is appropriately tagged to facilitate the further conduct of evidence syntheses and landscaping of zoonotic disease research in India.

METHODS AND ANALYSES

A large scale systematic mapping of important zoonotic disease research in India will be conducted. Systematic mapping covers a broad body of literature without a narrowly defined research question as is done in a systematic review and is ideal for the research objective[17–21]. No quality assessment is done unlike a systematic review but all research on zoonotic diseases is described based on pre-set characteristics as well as other characteristics identified iteratively as the mapping progresses. The database can however serve as a tool for conducting systematic reviews and rapid reviews on focussed research questions on zoonotic disease in India.

Criteria for inclusion of studies in the database

Definition of zoonotic diseases for the database

We will include research on the following nine priority zoonotic diseases from India, as defined by the study authors [22]:

1. Leptospirosis
2. Rabies
3. Anthrax

4. Brucellosis
5. Cysticercosis
6. Salmonellosis
7. Bovine tuberculosis
8. Japanese Encephalitis
9. Rickettsia Infections

We will not include research which has been conducted on participants of Indian origin living abroad or on those who have travelled from India to foreign countries.

Multi-centric studies containing Indian participants or samples and systematic reviews including at least one study which meets the population criteria will be included in the database. For studies conducted before 1947 and where it is not possible to differentiate it with results from post-1947 boundaries by reading the full text of the articles, the boundaries of undivided British India will be considered.

Study Design

We will include research using any kind of study design except commentaries, editorials, news item, historical articles, meeting notes and narrative reviews. This includes, but is not limited to animal studies, observational studies, experimental studies, case reports or case series, outbreak investigation, systematic reviews, practice guidelines and qualitative research.

Time limits

We will include research articles irrespective of their year of publication.

Language Restriction

We will include only articles published in English in the database. Exclusion of non-English studies introduces a very small risk of publication bias since English is the dominant language for health research in India.

Publication Status

We will include all articles irrespective of publication status **Search strategy for electronic databases**

Since the database intends to identify all zoonotic disease research in India, a sensitive search strategy was designed in PubMed using relevant free text key words and MeSH heading (Appendix 1). The search strategy was designed iteratively with the intention to achieve maximal sensitivity. This implies that we added additional free-text key words and MeSH headings when the search did not yield enough results. Additional free-text key words were developed by adding synonyms or alternative terms. We then adapted the search strategy for use in other electronic databases, namely CINAHL (EBSCO Host) (Appendix 2) and Global Health (EBSCO Host) (Appendix 3). Future versions of DoZooRI might include studies for more electronic databases and additional sources for grey literature. We envision that DoZooRI collaborators who conduct evidence syntheses by using the database, will add grey literature citations within the database through expert contact, reference checking of articles from the database, searching clinical trial registries and register of observational studies and registers for systematic reviews.

Screening of articles

We will screen all citations retrieved independently by at least two researchers based on titles and abstracts (if available) and mark them as retrieve (eligible or unclear eligibility) or do not retrieve (not eligible). For all citations marked retrieve full texts will be acquired and final decision on eligibility will be taken independently by two researchers. In case of any discrepancies that are not resolved through discussion between the two reviewers (SB and PC), consensus will be achieved by consultation with a third expert researcher (MK). Reasons for exclusion at full-text phase will be documented.

Data management

We will manage data and host the database in a cloud based platform called Rayyan (http://rayyan.qcri.org/). The platform allows simultaneous screening as well as tagging of citations in a blind fashion by multiple researchers. Rayyan also allows multiple tagging of each

citation. We chose Rayyan over other options because of its two-fold advantage – it is free to use and it has an inbuilt artificial platform where it provides prediction for includes and excludes based on the choices marked by researchers manually through a colour coded five-star system through text mining of the records. An independent evaluation of Rayyan found that after screening of three-quarters of included citations 98% of articles included were correctly predicted [23]. This would be an essential tool to rapidly allow the DoZooRI administrators to screen and mark includes and excludes when new studies are added as and when the database is updated from time to time. Rayyan also detects duplicates automatically.

Database tagging

We will develop a tagging system iteratively for several key parameters which would enable users to rapidly identify and retrieve articles to answer research, policy or clinical questions of their interest. Tagging will be done independently by at least two researchers (SB and PC) and discrepancies will be solved through consensus decision within the research team. We have predetermined tags for the following key parameters:

- Name(s) of zoonotic disease – from amongst the nine priority zoonotic disease
- Study Design – classification as per standard terminologies (example: case report or case-series, case-control, cohort, cross-sectional, retrospective study, ecologic study, clinical trial, systematic review, qualitative research, in-vitro studies)
- Special study type tags- example, GENE for genetic or genomic studies, EPIDEM for a study on any aspect of epidemiology, OUTBREAK for a study on any aspect of disease outbreak, DIAG for a study on diagnostic modality for a zoonotic disease, ECONOM on health economics related studies.
- For epidemiological studies- Name of state(s) from India where the study was conducted
- For clinical trials- randomisation status, name of intervention.

ETHICS AND DISSEMINATION

We prepared DoZooRI from already conducted research publications and did not involve any animal or human subjects. As such there are no ethical issues involved in the creation of the database or its subsequent use for evidence syntheses.

Findings from any research done by using DoZooRI will be published in peer-reviewed journals. The results of any such research on the database will also be shared with key stakeholders, including health professionals, researchers and policy makers in the form of policy briefs.

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Foot notes

- **Contributors** MK and PC conceptualized the article; SB and ASC were responsible for developing the initial methods; PC and SB refined the methodology and pilot tested it using a limited exercise; PC and SB drew up the first draft of the manuscript. PC and SB contributed equally to the manuscript. All the authors contributed in the development and drafting of the manuscript, including reviews and intellectual inputs in the process. All the authors have reviewed and approved the final version of the manuscript, which has been submitted to the journal.

Competing interests The authors declare that they have no conflicts of interest.

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Appendix 1: Search Strategy for PubMed

Anthrax

#	Searches	
#1	"Anthrax"[Mesh] OR "Anthrax Vaccines"[Mesh] OR anthrax OR (bacillus anthracis)	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Brucellosis

#	Searches	

#1	brucell* OR (Malta Fever) OR (undulant fever) or brucellosis[mesh]	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Bovine TB

#	Searches	
#1	(((bovine or zoono*) AND (tuberculosis OR "tuberculosis"[MeSH])) OR "mycobacterium bovis")	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Rabies

#	Searches	
#1	Rabies [MeSH] OR Rabies Vaccines [Mesh] OR rabies OR rabid	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Cysticercosis

#	Searches	
#1	cysticercosis[MeSH] OR cysticerc* OR neurocysticer* OR taeni* OR tapeworm	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Leptospirosis

#	Searches	
#1	Leptospirosis[Mesh] OR Leptospira[Mesh] OR leptospir* OR (weil* disease) OR infectious icterus OR canicola OR mud fever OR field fever OR (rat catcher* adj yellow*) OR pretibial fever OR grippotyphosa or icteroh* OR (spirochaet* jaundice) OR (spirochete* jaundice)	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Salmonellosis

#	Searches	
#1	"Salmonella Infections"[Mesh] OR "Salmonella Food Poisoning"[Mesh] OR "Salmonella Vaccines"[Mesh] OR "Salmonella typhi"[Mesh] OR typhoid OR "typhoid fever" OR "enteric fever" OR "Salmonella typhi" OR "Salmonella enterica" OR paratyphoid OR paratyphi	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Japanese Encephalitis

#	Searches	
#1	"Encephalitis, Japanese"[Mesh] OR " Japanese encephalitis" OR JBE	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Rickettsia Infections

#	Searches	

#1	"Rickettsia Infections"[Mesh] OR "Typhus, Epidemic Louse-Borne"[Mesh] OR "Typhus, Epidemic Louse-Borne"[Mesh] OR "Rocky Mountain Spotted Fever"[Mesh] OR "Boutonneuse Fever"[Mesh] OR typhus OR "rickettsial pox" OR "trench fever" OR "Q fever" OR "rocky mountain spotted fever"	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Appendix 2: Search Strategy for CINAHL

Leptosiprosis

#	Searches	
#1	(MM "Leptospirosis") OR leptospir* OR (weil* disease) OR infectious icterus OR canicola OR mud fever OR field fever OR (rat catcher* adj yellow*) OR pretibial fever OR grippotyphosa or icteroh* OR (spirochaet* jaundice) OR (spirochete* jaundice)	
#2	(MH "India") OR India	
#3	#1 AND #2	

Rabies

#	Searches	
#1	(MM "Rabies Vaccine") OR (MM "Rabies") OR rabies OR rabid	
#2	(MH "India") OR India	
#3	#1 AND #2	

Anthrax

#	Searches	

#1	(MM "Anthrax+") OR (MM "Anthrax Vaccines") OR anthrax OR (bacillus anthracis)	
#2	(MH "India") OR India	
#3	#1 AND #2	

Brucellosis

#	Searches	
#1	(MM "Brucellosis") OR brucell* OR (Malta Fever) OR (undulant fever)	
#2	(MH "India") OR India	
#3	#1 AND #2	

Cysticercosis

#	Searches	
#1	(MM "Cysticercosis") OR cysticerc* OR neurocysticer* OR taeni* OR tapeworm	
#2	(MH "India") OR India	
#3	#1 AND #2	

Salmonellosis

#	Searches	
#1	(MM "Salmonella") OR (MM "Salmonella Vaccines+") OR (MM "Salmonella Infections+") OR (MM "Paratyphoid Fever") OR typhoid OR "typhoid fever" OR "enteric fever" OR "Salmonella typhi" OR "Salmonella enterica" OR paratyphoid OR paratyphi	
#2	(MH "India") OR India	
#3	#1 AND #2	

Bovine TB

#	Searches	
#1	(((bovine or zoono*) AND (tuberculosis OR MH "tuberculosis")) OR	

	"mycobacterium bovis")	
#2	(MH "India") OR India	
#3	#1 AND #2	

Japanese Encephalitis

#	Searches	
#1	(MM "Encephalitis Viruses, Japanese+") OR (MM "Japanese Encephalitis Vaccines") OR " Japanese encephalitis" OR JBE	
#2	(MH "India") OR India	
#3	#1 AND #2	

Ricketssial Infections

#	Searches	
#1	(MM "Rickettsial Infections+") OR (MM "Rocky Mountain Spotted Fever") OR (MM "Typhus") OR typhus OR "rickettsial pox" OR "trench fever" OR "Q fever" OR "rocky mountain spotted fever"	
#2	(MH "India") OR India	
#3	#1 AND #2	

Appendix 3: Search Strategy for Global Health

Leptosiprosis

#	Searches	
#1	(DE "leptospirosis" OR DE "Leptospira") OR leptospir* OR (weil* disease) OR infectious icterus OR canicola OR mud fever OR field fever OR (rat catcher* adj	

	yellow*) OR pretibial fever OR grippotyphosa or icteroh* OR (spirochaet* jaundice) OR (spirochete* jaundice)	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	

Rabies

#	Searches	
#1	DE "rabies" OR rabies OR rabid	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	

#3	#1 AND #2	

Anthrax

#	Searches	
#1	DE "anthrax" OR DE "cutaneous anthrax" OR DE "inhalational anthrax" OR anthrax OR “anthrax bacillus”	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	

Brucellosis

#	Searches	
#1	DE "brucellosis" OR DE "Brucella" OR brucell* OR (Malta Fever) OR (undulant fever)	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE	

	"Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	

Cysticercosis

#	Searches	
#1	DE "cysticercosis" OR DE "neurocysticercosis" OR cysticerc* OR neurocysticer* OR taeni* OR tapeworm	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	

Salmonellosis

#	Searches	
#1	DE "typhoid" OR DE "salmonellosis" OR DE "enteric fevers" OR DE "paratyphoid" OR typhoid OR "enteric fever" OR paratyphityphoid OR	

	paratyphoid	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	

Bovine TB

#	Searches	
#1	(((bovine or zoono*) AND (tuberculosis OR DE "tuberculosis")) OR "mycobacterium bovis")	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	

#3	#1 AND #2	

Japanese Encephalitis

#	Searches	
#1	DE "Japanese encephalitis" OR " Japanese encephalitis" OR JBE	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	

Ricketssial Infections

#	Searches	
#1	DE "rickettsial diseases" OR DE "ehrlichioses" OR DE "neorickettsioses" OR DE "African tick bite fever" OR DE "Q fever" OR DE "spotted fever" OR DE "anaplasmoses" OR DE "typhus fevers" OR DE "Q fever" OR DE "spotted fever" OR DE "Mediterranean spotted fever" OR DE "Rocky Mountain spotted fever" OR DE "typhus fevers" OR DE "louse-borne typhus" OR DE "murine typhus" OR DE "scrub typhus" OR typhus OR "rickettsial pox" OR "trench fever" OR "Q fever" OR "rocky mountain spotted fever	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR	

	DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	

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Protocol for Developing a Database of Zoonotic Disease Research in India (DoZooRI)

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Abstract

Introduction: Zoonotic and emerging infectious diseases represent a public health threat that has been acknowledged only recently although they have been on the rise for the past several decades. On an average, every year since the second world war, one pathogen has emerged or re-emerged on a global scale. Developing countries such as India bear a significant burden of

zoonotic and emerging infectious diseases. We propose that the creation of a database of published, peer-reviewed research will open up avenues for evidence-based policymaking for targeted prevention and control of zoonoses.

Methods and Analysis: A large scale systematic mapping of the published peer-reviewed research conducted in India will be conducted. All published research will be included in the database, without any prejudice for quality screening, to broaden the scope of included studies. Structured search strategies will be developed for priority zoonotic diseases (leptospirosis, rabies, anthrax, brucellosis, cysticercosis, salmonellosis, bovine tuberculosis, Japanese encephalitis, and rickettsial infections), and multiple databases will be searched for studies conducted in India. The database will be managed and hosted on a cloud-based platform called Rayyan. Individual studies will be tagged based on key pre-identified parameters (disease, study design, study type, location, randomization status and interventions, host involvement, and others as applicable)

Ethics and Dissemination: The database will incorporate already-published studies, obviating the need for special ethical clearances. The database will be made available online, and in collaboration with multisectoral teams, domains of enquiries will be identified, and subsequent research questions raised. The database will be queried for these and resulting evidence will be analysed and published in peer-reviewed journals.

Keywords: zoonoses, database, one health, emerging infections, evidence synthesis, protocol

STRENGTHS AND LIMITATIONS

- The strength of this approach is that in the absence of rigorous surveillance programs and methods to track zoonotic diseases, this approach provides an alternate method to develop a continuously updated database to query zoonotic diseases and their determinants.
- The main limitation of the approach is that it is largely dependent on published data, which may be of heterogenous quality, and could also result in duplicate entries. However, we envisage that the issue of publication bias might be resolved to a large extent in future iterations of the database as collaborators would contribute by adding

more citations from the literature to make it a more comprehensive repository of zoonotic disease research in India.

INTRODUCTION

Zoonoses, diseases and infections that are naturally transmitted between humans and other vertebrate animals have been recognised since the beginning of history, but their public health importance has gained increased visibility in the last few decades [1]. A global analyses of emerging infectious disease (EID) between 1940 to 2004 identified that 60.3% of them were zoonosis and they were increasing rapidly over time [2]. A substantial portion of the global burden of endemic zoonosis is from India and it is predicted to be one of the several 'EID hotspots' [3,4]. India is experiencing rapid urbanisation, industrialisation, increased incomes, changing food preferences raising demand for animal source proteins, leading to a larger section of the workforce being in close contact with livestock, including poultry, making a wider section of the population extremely susceptible to zoonotic diseases. Owing to the public health importance of zoonotic diseases in India a National Standing Committee on Zoonoses was formed in 2007 [5,6]. Lately a Centre for Zoonoses Research has been proposed to be set up to harness inter-sectoral collaborative research in line with the One Health approach which is required to tackle zoonotic diseases [7]. However not much is known about the status of zoonotic disease research and several key aspects related to it including several aspects of clinical presentation, diagnoses, management and epidemiology in the Indian context [8]. There is also a need to synthesise evidence about zoonoses in India to guide further research, set research and public health priorities, and streamline disease control efforts in an evidence informed manner [9,10]. Further, given the resource restrictions and multiple competing priorities that need to be addressed by policymakers and funders alike, the synthesised evidence could help in making evidence informed decisions to guide resource allocation. This paper reports the protocol for development of a Database of Zoonotic Disease Research in India (DoZooRI) which intends to address these gaps.

Rationale for Development of Database of Zoonotic Diseases Research in India:

We envision DoZooRI as a multidisciplinary research database which would embed all zoonoses related research in India. DoZooRI will be made accessible to clinicians, veterinarians, researchers, public health professionals, programme managers and policy makers on request. Citations within the research database would be tagged on several carefully chosen key parameters that would enable rapid retrieval of relevant research from a wide variety of sources to those who seek evidence. This would provide critical support for clinical or public health practice, including, but not limited to the fields of human, veterinary and environmental health, by facilitating evidence syntheses or planning of future research in line with research gaps.The multidisciplinary nature of the database in fact provides and impetus for this purpose. This is essential in the context of India, where access to electronic databases as well as trained health information specialists with capability to develop search strategies is severely limited [11]. DoZooRI will also address concerns about wasteful research, owing to new research not being based on pre-existing evidence and without their need being vindicated by existing systematic reviews demonstrating critical knowledge gaps [12,13]. Mapping zoonotic disease research and conduct of further evidence syntheses through the DoZooRI will facilitate better understanding of knowledge gaps which is critical for disease control efforts, policy making, public health planning and inform public health and research priorities. Further, the database will enable us to undertake analyses to identify research capacity across institutions in India.

DoZooRI is being developed as a strategic tool to support various activities of India Research Initiative on Peri-Urban Human-Animal-Environment Interface, which is housed at the Public Health Foundation of India, and aims to conduct and support multidisciplinary research, build workforce capacity across sectors, and conduct evidence syntheses and policy advocacy.

Implications and Possible Collaborations

The creation of a database of zoonotic disease research in India presents an innovative approach to systematic evidence synthesis. It should encourage researchers to collaborate, help to identify and dissolve the compartments which have restricted research efforts to sectoral silos, and encourage truly transdisciplinary collaborations to flourish [14–16]. Using the database, researchers can map zoonotic diseases research; describe the characteristics of interventional research on zoonotic diseases in India; describe the epidemiology of zoonotic diseases, including

differences by location, geographic terrain, or other determinants; identify the research-policy disconnect and inform on realignment of research priorities in zoonotic disease prevention and control in India; understand institutional capacity to conduct zoonotic research in India; and address any other issues based on the extended tagging system. The database could potentially be developed into a dynamic repository of the body of work being done in India with respect to zoonotic diseases. Further, if collaborations with techno-medical entrepreneurs can be leveraged, this can be developed into a platform which is updated in real time and allows auto-tagging of published research for the purpose of evidence syntheses. Additionally, this protocol for the development of the database should be of interest to professionals involved with human, animal and environmental health alike. This manuscript outlines the development of a database that proposes curating the first of its kind of evidence-base for zoonotic diseases in India. This is likely to be interest to Indian and international scholars alike given the global health security threat posed by zoonotic and emerging diseases.

The database is going to provide a step towards closing the evidence-policy gap in zoonotic disease prevention and control programmes by providing the policy makers, programme managers or any other stakeholders access to a searchable, tagged database of existing evidence. This opens avenues for data mining and conducting multiple rapid reviews or systematic reviews to assess the state of the published evidence. The process will bring together the tenets of open science and evidence based policymaking to strengthen the clinical, veterinarian and public health response to zoonotic disease prevention and control.

Objective

To develop a database of publications resulting from research conducted on a set of priority zoonotic diseases in India and tag them in a manner so as to facilitate further conduct of evidence syntheses and landscaping of zoonotic disease research in India.

METHODS AND ANALYSES

A large scale systematic mapping of important zoonotic disease research in India will be conducted. Systematic mapping covers a broad body of literature without a narrowly defined research question as is done in a systematic review and is ideal for the research objective[17–21]. No quality assessment is done unlike a systematic review but all research on zoonotic diseases is described based on pre-set characteristics as well as other characteristics identified iteratively as the mapping progresses. The database can however serve as a tool for conducting systematic reviews and rapid reviews on focussed research questions on zoonotic disease in India.

Criteria for inclusion of studies in the database

Definition of zoonotic diseases for the database

We will include research on the following nine priority zoonotic diseases from India, as defined by the study authors [22]:

1. Leptospirosis
2. Rabies
3. Anthrax
4. Brucellosis
5. Cysticercosis
6. Salmonellosis
7. Bovine tuberculosis
8. Japanese Encephalitis
9. Rickettsia Infections

We will not include research which has been conducted on participants of Indian origin living abroad or on those who have travelled from India to foreign countries.

Multi-centric studies containing Indian participants or samples and systematic reviews including at least one study which meets the population criteria will be included in the database. For studies conducted before 1947 and where it is not possible to differentiate it with results from post-1947 boundaries by reading the full text of the articles, the boundaries of undivided British India will be considered.

Study Design

We will include research using any kind of study design except commentaries, editorials, news item, historical articles, meeting notes and narrative reviews. This includes, but is not limited to animal studies, observational studies, experimental studies, case reports or case series, outbreak investigation, systematic reviews, practice guidelines and qualitative research.

Time limits

We will include research articles irrespective of their year of publication.

Language Restriction

We will include only articles published in English in the database. Exclusion of non-English studies introduces a very small risk of publication bias since English is the dominant language for health research in India.

Publication Status

We will include all articles irrespective of publication status **Search strategy for electronic databases**

Since the database intends to identify all zoonotic disease research in India, a sensitive search strategy was designed in PubMed using relevant free text key words and MeSH heading (Appendix 1). The search strategy was designed iteratively with the intention to achieve maximal sensitivity. This implies that we added additional free-text key words and MeSH headings when the search did not yield enough results. Additional free-text key words were developed by adding synonyms or alternative terms. We then adapted the search strategy for use in other electronic databases, namely CINAHL (EBSCO Host) (Appendix 2) and Global Health (EBSCO Host) (Appendix 3). Future versions of DoZooRI might include studies for more electronic databases and additional sources for grey literature. We envision that DoZooRI collaborators who conduct evidence syntheses by using the database, will add grey literature citations within the database through expert contact, reference checking of articles from the database, searching clinical trial registries and register of observational studies and registers for systematic reviews.

Screening of articles

We will screen all citations retrieved independently by at least two researchers based on titles and abstracts (if available) and mark them as retrieve (eligible or unclear eligibility) or do not retrieve (not eligible). For all citations marked retrieve full texts will be acquired and final decision on eligibility will be taken independently by two researchers. In case of any discrepancies that are not resolved through discussion between the two reviewers (SB and PC), consensus will be achieved by consultation with a third expert researcher (MK). Reasons for exclusion at full-text phase will be documented.

Data management

We will manage data and host the database in a cloud based platform called Rayyan (http://rayyan.qcri.org/). The platform allows simultaneous screening as well as tagging of citations in a blind fashion by multiple researchers. Rayyan also allows multiple tagging of each citation. We chose Rayyan over other options because of its two-fold advantage – it is free to use and it has an inbuilt artificial platform where it provides prediction for includes and excludes based on the choices marked by researchers manually through a colour coded five-star system through text mining of the records. An independent evaluation of Rayyan found that after screening of three-quarters of included citations 98% of articles included were correctly predicted [23]. This would be an essential tool to rapidly allow the DoZooRI administrators to screen and mark includes and excludes when new studies are added as and when the database is updated from time to time. Rayyan also detects duplicates automatically.

Database tagging

We will develop a tagging system iteratively for several key parameters which would enable users to rapidly identify and retrieve articles to answer research, policy or clinical questions of their interest. Tagging will be done independently by at least two researchers (SB and PC) and

discrepancies will be solved through consensus decision within the research team. We have predetermined tags for the following key parameters:

- Name(s) of zoonotic disease – from amongst the nine priority zoonotic disease
- Study Design – classification as per standard terminologies (example: case report or case-series, case-control, cohort, cross-sectional, retrospective study, ecologic study, clinical trial, systematic review, qualitative research, in-vitro studies)
- Special study type tags- example, GENE for genetic or genomic studies, EPIDEM for a study on any aspect of epidemiology, OUTBREAK for a study on any aspect of disease outbreak, DIAG for a study on diagnostic modality for a zoonotic disease, ECONOM on health economics related studies.
- For epidemiological studies- Name of state(s) from India where the study was conducted
- For clinical trials- randomisation status, name of intervention.
- Based on host involved: human, cattle, wild animals, multi-host, invertebrate vectors, etc.

ETHICS AND DISSEMINATION

We prepared DoZooRI from already conducted research publications and did not involve any animal or human subjects. As such there are no ethical issues involved in the creation of the database or its subsequent use for evidence syntheses.

Findings from any research done by using DoZooRI will be published in peer-reviewed journals. The results of any such research on the database will also be shared with key stakeholders, including health professionals, researchers and policy makers in the form of policy briefs.

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Foot notes

• **Contributors** MK and PC conceptualized the article; SB and ASC were responsible for developing the initial methods; PC and SB refined the methodology and pilot tested it using a limited exercise; PC and SB drew up the first draft of

the manuscript. PC and SB contributed equally to the manuscript. All the authors contributed in the development and drafting of the manuscript, including reviews and intellectual inputs in the process. All the authors have reviewed and approved the final version of the manuscript, which has been submitted to the journal.

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Appendix 1: Search Strategy for PubMed

Anthrax

#	Searches	
#1	"Anthrax"[Mesh] OR "Anthrax Vaccines"[Mesh] OR anthrax OR (bacillus anthracis)	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Brucellosis

#	Searches	
#1	brucell* OR (Malta Fever) OR (undulant fever) or brucellosis[mesh]	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Bovine TB

#	Searches	
#1	(((bovine or zoono*) AND (tuberculosis OR "tuberculosis"[MeSH])) OR "mycobacterium bovis")	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Rabies

#	Searches	
#1	Rabies [MeSH] OR Rabies Vaccines [Mesh] OR rabies OR rabid	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Cysticercosis

#	Searches	
#1	cysticercosis[MeSH] OR cysticerc* OR neurocysticer* OR taeni* OR tapeworm	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Leptospirosis

#	Searches	
#1	Leptospirosis[Mesh] OR Leptospira[Mesh] OR leptospir* OR (weil* disease) OR infectious icterus OR canicola OR mud fever OR field fever OR (rat catcher* adj yellow*) OR pretibial fever OR grippotyphosa or icteroh* OR (spirochaet* jaundice) OR (spirochete* jaundice)	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Salmonellosis

#	Searches	
#1	"Salmonella Infections"[Mesh] OR "Salmonella Food Poisoning"[Mesh] OR "Salmonella Vaccines"[Mesh] OR "Salmonella typhi"[Mesh] OR typhoid OR "typhoid fever" OR "enteric fever" OR "Salmonella typhi" OR "Salmonella enterica" OR paratyphoid OR paratyphi	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Japanese Encephalitis

#	Searches	
#1	"Encephalitis, Japanese"[Mesh] OR " Japanese encephalitis" OR JBE	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Rickettsia Infections

#	Searches	
#1	"Rickettsia Infections"[Mesh] OR "Typhus, Epidemic Louse-Borne"[Mesh] OR "Typhus, Epidemic Louse-Borne"[Mesh] OR "Rocky Mountain Spotted Fever"[Mesh] OR "Boutonneuse Fever"[Mesh] OR typhus OR "rickettsial pox" OR "trench fever" OR "Q fever" OR "rocky mountain spotted fever"	
#2	India[Mesh] OR India	
#3	#1 AND #2	

Appendix 2: Search Strategy for CINAHL

Leptosiprosis

#	Searches	
#1	(MM "Leptospirosis") OR leptospir* OR (weil* disease) OR infectious icterus OR canicola OR mud fever OR field fever OR (rat catcher* adj yellow*) OR pretibial fever OR grippotyphosa or icteroh* OR (spirochaet* jaundice) OR (spirochete* jaundice)	
#2	(MH "India") OR India	
#3	#1 AND #2	

Rabies

#	Searches	
#1	(MM "Rabies Vaccine") OR (MM "Rabies") OR rabies OR rabid	
#2	(MH "India") OR India	
#3	#1 AND #2	

Anthrax

#	Searches	
#1	(MM "Anthrax+") OR (MM "Anthrax Vaccines") OR anthrax OR (bacillus anthracis)	
#2	(MH "India") OR India	
#3	#1 AND #2	

Brucellosis

#	Searches	
#1	(MM "Brucellosis") OR brucell* OR (Malta Fever) OR (undulant fever)	
#2	(MH "India") OR India	
#3	#1 AND #2	

Cysticercosis

#	Searches	
#1	(MM "Cysticercosis") OR cysticerc* OR neurocysticer* OR taeni* OR tapeworm	
#2	(MH "India") OR India	
#3	#1 AND #2	

Salmonellosis

#	Searches	
#1	(MM "Salmonella") OR (MM "Salmonella Vaccines+") OR (MM "Salmonella	

	Infections+") OR (MM "Paratyphoid Fever") OR typhoid OR "typhoid fever" OR "enteric fever" OR "Salmonella typhi" OR "Salmonella enterica" OR paratyphoid OR paratyphi	
#2	(MH "India") OR India	
#3	#1 AND #2	

Bovine TB

#	Searches	
#1	(((bovine or zoono*) AND (tuberculosis OR MH "tuberculosis")) OR "mycobacterium bovis")	
#2	(MH "India") OR India	
#3	#1 AND #2	

Japanese Encephalitis

#	Searches	
#1	(MM "Encephalitis Viruses, Japanese+") OR (MM "Japanese Encephalitis Vaccines") OR " Japanese encephalitis" OR JBE	
#2	(MH "India") OR India	
#3	#1 AND #2	

Ricketssial Infections

#	Searches	
#1	(MM "Rickettsial Infections+") OR (MM "Rocky Mountain Spotted Fever") OR (MM "Typhus") OR typhus OR "rickettsial pox" OR "trench fever" OR "Q fever" OR "rocky mountain spotted fever"	
#2	(MH "India") OR India	
#3	#1 AND #2	

Appendix 3: Search Strategy for Global Health

Leptosiprosis

#	Searches	
#1	(DE "leptospirosis" OR DE "Leptospira") OR leptospir* OR (weil* disease) OR infectious icterus OR canicola OR mud fever OR field fever OR (rat catcher* adj yellow*) OR pretibial fever OR grippotyphosa or icteroh* OR (spirochaet* jaundice) OR (spirochete* jaundice)	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	

Rabies

#	Searches	
#1	DE "rabies" OR rabies OR rabid	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE	

	"Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	

Anthrax

#	Searches	
#1	DE "anthrax" OR DE "cutaneous anthrax" OR DE "inhalational anthrax" OR anthrax OR “anthrax bacillus”	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	

Brucellosis

#	Searches	

#1	DE "brucellosis" OR DE "Brucella" OR brucell* OR (Malta Fever) OR (undulant fever)	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	

Cysticercosis

#	Searches	
#1	DE "cysticercosis" OR DE "neurocysticercosis" OR cysticerc* OR neurocysticer* OR taeni* OR tapeworm	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR	

	DE "West Bengal" OR India	
#3	#1 AND #2	

Salmonellosis

#	Searches	
#1	DE "typhoid" OR DE "salmonellosis" OR DE "enteric fevers" OR DE "paratyphoid" OR typhoid OR "enteric fever" OR paratyphityphoid OR paratyphoid	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	

Bovine TB

#	Searches	
#1	(((bovine or zoono*) AND (tuberculosis OR DE "tuberculosis")) OR "mycobacterium bovis")	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE	

	"Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	

Japanese Encephalitis

#	Searches	
#1	DE "Japanese encephalitis" OR " Japanese encephalitis" OR JBE	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	

Ricketssial Infections

#	Searches	

#1	DE "rickettsial diseases" OR DE "ehrlichioses" OR DE "neorickettsioses" OR DE "African tick bite fever" OR DE "Q fever" OR DE "spotted fever" OR DE "anaplasmoses" OR DE "typhus fevers" OR DE "Q fever" OR DE "spotted fever" OR DE "Mediterranean spotted fever" OR DE "Rocky Mountain spotted fever" OR DE "typhus fevers" OR DE "louse-borne typhus" OR DE "murine typhus" OR DE "scrub typhus" OR typhus OR "rickettsial pox" OR "trench fever" OR "Q fever" OR "rocky mountain spotted fever	
#2	DE "India" OR DE "Arunachal Pradesh" OR DE "Assam" OR DE "Bihar" OR DE "Chandigarh" OR DE "Chhattisgarh" OR DE "Dadra and Nagar Haveli" OR DE "Daman and Diu" OR DE "Delhi" OR DE "Goa" OR DE "Gujarat" OR DE "Haryana" OR DE "Himachal Pradesh" OR DE "Jammu and Kashmir" OR DE "Jharkhand" OR DE "Karnataka" OR DE "Kerala" OR DE "Lakshadweep" OR DE "Madhya Pradesh" OR DE "Maharashtra" OR DE "Manipur" OR DE "Meghalaya" OR DE "Mizoram" OR DE "Nagaland" OR DE "Orissa" OR DE "Puducherry" OR DE "Punjab (India)" OR DE "Rajasthan" OR DE "Sikkim" OR DE "Tamil Nadu" OR DE "Andaman and Nicobar Islands" OR DE "Andhra Pradesh" OR DE "Tripura" OR DE "Uttar Pradesh" OR DE "Uttarakhand" OR DE "West Bengal" OR India	
#3	#1 AND #2	