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Evidence mapping of current status, impact, prevention and control measures from rabies research in Bangladesh (2010–2021): a scoping review protocol

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ABSTRACT

Introduction Rabies is one of the priority zoonotic diseases in Bangladesh. Though the rabies cases have been reduced over the years due to the mass dog vaccination programme since 2011 throughout the country, it is still a major health problem in Bangladesh with an annual estimated 200 000 animal bite cases and over 2000 human deaths. This article presented a scoping review protocol for published literature on rabies in Bangladesh and believes to create impact in Bangladesh by identifying the research gap and guiding the evidence-informed policy adaptation from its findings in the future which will strongly underscore the elimination of Rabies and reduce preventable mortalities. We will attempt to synthesise evidence descriptively on burden and impact of rabies in human population as well as the awareness level and effective control and preventive measures from the available studies on rabies from 2010 to 2021 in Bangladesh.

Methods The scoping review is planned following the Joanna Briggs Institute methodology and the major guiding steps are: defining the research questions, determining the eligibility criteria with population, concept and context strategy, stating the plan for evidence searching, selection and data collection, searching for evidence and selection of literature by the inclusion criteria, data collection, descriptive analysis and presentation of the data and reporting of the findings. Search will be conducted for both published and grey literature in English language. Blinded screening processes will be adapted to prevent bias among reviewers.

Ethics and dissemination A scoping review synthesises existing knowledge and does not necessitate ethical approval. Results of this scoping review will be submitted to a journal for publication, presented in relevant conferences and disseminated on social media platforms (eg, Twitter) among the global health stakeholders.

Strengths and limitations of this study

► This will be the first scoping review to map the wide evidence base of rabies research in Bangladesh in the last 10 years.
► The search strategy includes both peer-reviewed literature (seven academic databases) as well as grey literature from government and other organisations' websites.
► Literature only written in English will be deemed eligible for inclusion.
► Articles included in the scoping review will not go through quality assessment and grading as these are not requisite for a scoping review.

INTRODUCTION

Rabies is a fatal encephalitic disease caused by the *Lyssavirus*, while 99% of the human fatalities are caused by the canine rabies virus variant.[1] A study reported that rabies attributes to 59000 deaths worldwide, whereas cases in Africa and Asia comprise 95% of the burden.[2] While Asia counts for more than 58% of the death from rabies, seven South Asian countries, including Bangladesh, bear 45% global burden of the human rabies. Under-reporting of human rabies death is evident in this region and an estimation in Bangladesh indicated that more than 60% of the human rabies death occurred at home.[3] Apart from the life loss, rabies costs more than 3.7 million disability-adjusted life years and US$8.6 billion per year, estimated by a 2015 study.[4] Rabies is recognised as one of the priority neglected zoonotic diseases by WHO and brucellosis, cysticercosis, echinococcosis, foodborne trematodiasis, human African trypanosomiasis and leishmaniasis are to name a few others. Of these diseases, the 'neglected' tagging indicates the diseases to be disproportionately affecting the population in low-source settings.[5 6] Elimination of neglected tropical diseases by 2030 is one of the indicators for achieving Sustainable Development Goals.[7] Furthermore, rabies is one of the prioritised zoonotic diseases in Bangladesh.[8]

In Bangladesh, rabies circulates in both urban cycle (maintaining infection in dog

populations) and sylvatic cycle (in wildlife) with the possibility of spillover between dogs and wildlife. While dogs remained as the most important rabies reservoir, in wildlife, mongooses (*Herpestes* spp.), jackals (*Canis aureus*), foxes (*Vulpes bengalensis*) and wolves (*Canis lupus*) have recorded as reservoirs of rabies in Bangladesh, India and Nepal.[9] Though advances have been made in wildlife rabies control measures, cost-effective techniques are needed to be identified and enforced to achieve the realistic goal.[10] Rabies is acknowledged as transboundary disease, although there are lack of data in Bangladesh to describe the interborder transmission and cycle. In 2018, Asian Rabies Control Network was established and it started to support the South Asian countries including Bangladesh with efforts to acknowledge rabies as a transboundary animal disease which is hoped in future to expediate data sharing among the neighbouring countries.[11]

Bangladesh has reported to be ranked third highest among the countries where human rabies death is endemic. As of 2012, the country reported an estimated 200 000 animal bite cases and over 2000 human deaths from rabies annually, given that there is lack of robust surveillance to get a comprehensive picture.[12 13] A previous review reported that almost 90.7% of the patients had dog bite contact in Bangladesh and only 24.4% (N=794) of rabies cases received postexposure vaccination.[14] A significant amount of health and economic losses both in the human and livestock sector can be attributed to rabies. A prior study estimated that the average direct medical cost, direct non-medical cost and income losses due to rabies were US$29.82, 25.32 and 18.38 per case, respectively, in humans.[15] Apart from humans, rabies affects the domestic animals such as cattle, buffalo and goat in the country and during 2010–2012, 3425 fatalities (24.32%) were reported out of 14 085 dog bites/rabies in livestock which adds to the economic burden by livestock losses for the livestock-dependent communities.[4 16]

Year 2010 was a significant year for Bangladesh in terms of response against rabies as the country launched the National Rabies Elimination Strategic Plan, and the strategy included the urge for operational research.[17] Government strategies have taken multipronged focus on advocacy, communication and social mobilisation level, animal bites management with tissue culture vaccine for postexposure prophylaxis (PEP), countrywide mass dog vaccination (MDV) programme as well as dog population control. The government of Bangladesh is providing free PEP through Infectious Disease Hospital (IDH), Dhaka, and through 66 public district rabies prevention and control centres (DRPCCs) around 64 districts to prevent rabies in humans all over the country. Approximately 500 patients receive treatment in IDH daily and Communicable Disease Control along with Directorate General of Health Services tries to meet 100% demand of PEP in IDH and 50%–80% demand at DRPCCs; still unmet need is evident in these centres.[18] Even with the presence of countrywide facilities, rabies deceased often reported to lack financial support for PEP or access to those facilities.[19] Further to that researchers ascertain that MDV was found to be more cost-effective for rabies control in comparison of doing human treatment alone.[20] An MDV programme has been implemented in Bangladesh since 2011 and total 705 839 dogs were vaccinated, reaching >70% coverage in majority areas where MDVs have scaled up. MDV, along with other interventions such as mass awareness and PEP, has played substantial role in reducing human rabies cases.[21] It is now important to document the impact of such interventions to evaluate the progress and also to look for other cost-effective and sustainable means of reducing rabies burden, especially in the underserved community. Cost-effective control and elimination measures should be the key under integrated strategies in low-income countries like Bangladesh.[22] To sustain the progress, synthesising evidence on current efficacious response as well as identification of better measures can underscore and connect the actions of researchers and policymakers on control and elimination of rabies.[23]

Initial search conducted in PubMed and Hinari by the current reviewers within the period of 2010–2021 has shown a growing amount of evidence on rabies research in Bangladesh since the 2010. With the objective to inform evidence-based practices, a scoping review offers appropriate methodology to develop an overview of research undertaken in this area as well as to understand the width and concepts of the published literatures and identify knowledge gaps.[24] The heterogeneous nature of the large evidence base limits the scope of other systematic reviews, which tend to answer more specific questions.[25] For the current study, systematic reviews will not be able to meet the broader scope and objectives; in such scenarios scoping review is indicated.[26]

To prevent duplication effort, a preliminary search using the keywords 'rabies' and 'Bangladesh' was made in Open Science Framework, PROSPERO, PubMed, the Cochrane Database of Systematic Reviews and Joanna Briggs Institute (JBI) Evidence Synthesis. We identified no published systematic reviews and scoping reviews or protocols on the topic. Therefore, a synthesis of the emerging evidence base is now overdue. This study promises nobility and comprehensiveness in terms of the methodological approach taken to synthesise evidence as such. Thus, the objective of this scoping review is to review the literature on observational and intervention studies to provide the descriptive overview of current status of rabies, and its health and economic impact in the human population reported knowledge, attitude and practices (KAP) among humans, findings from proposed interventions for prevention and control measures as well as gaps in current research for rabies elimination over the period of 2010–2021 in Bangladesh.

METHODS

The scoping review will be conducted based on the enhanced guideline of methodology provided by JBI

which is built on the initial Arksey and O'Malley framework. For reporting, we will use the extension of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement for Scoping Review (PRISMA-ScR) and fill out the checklist to check whether the intended scoping review confirms fidelity to the reporting standard.[27] As per the recommendation from the framework, the review will structure around the following stages:

1. Identifying the research question.
2. Identifying relevant studies that align with the inclusion criteria and research objectives.
3. Planning of evidence searching, selection and data collection.
4. Searching of the relevant literatures.
5. Selecting the evidence.
6. Extracting the data.
7. Data collating and analysis.
8. Presentation of the results.
9. Reporting of the findings.

Identifying the research question

To fulfil the objective of this scoping review, the following research questions were identified by consultation among the reviewers and an expert on the topic:

1. What type of frequency measures are used to express the current status of rabies in humans?
2. What is the summary of reported frequency measures?
3. What kinds of impacts are explored for rabies in terms of human health and economy in Bangladesh?
4. What are the findings on health and economic impact from those literature?
5. In the research conducted to identify KAP or awareness among human population, what is the level of awareness identified and what practices are recorded towards rabies prevention?
6. In the KAP studies, what kinds of variation are observed in terms of different study settings?
7. What types of interventions (both experimental and non-experimental including, public heath intervention, pharmacological and non-pharmacological interventions, etc) are examined in the literature to prevent and control rabies?
8. What are the settings where the prevention and/or control interventions are provided or proposed?
9. Which interventions are reported as effective for prevention and control of rabies?
10. What kinds of knowledge gaps in research are identified in the literature?

Determining eligibility criteria

Based on the recommendation from JBI for Scoping Review, we will select the studies which are underpinned by the following population, concept and context (PCC) elements and study design criteria.

Participants

We will include literature with both human and animal focus including studies underpinned with zoonotic and one health point of view, irrespective of sex, age and outcome.

Concept

We want to systematically identify the published literature on rabies in Bangladesh in between the timeframe of 2010 and 2021 and map them for summarising the kind and extent of the evidence base on this area.

Context

Our study will take account of all the identified literature on rabies in Bangladesh. Any literature on multiple countries and multiple diseases with primary focus including Bangladesh and rabies will be included in the review. We will include study from different settings in Bangladesh.

Types of sources/studies

We will include literature based on the inclusion criteria as mentioned in PCC and will add both primary and secondary research in our study.

These include but are not limited to experimental and quasi-experimental study designs, both descriptive and analytical observational study designs, outbreak investigations, reviews and meta-analysis will be examined for incorporation. Commentary papers, correspondence, editorials, letters, news items, perspectives, historical articles, practice guidelines, hospital data and laboratory surveillance will also be considered for inclusion in this scoping review. Any workshop, seminar and conference summary or report, strategy document, standard operating procedure and policy paper will be excluded.

Search strategy

The search strategy will include both peer-reviewed and grey literature. A preliminary sample search attempted in PubMed, Hinari and Google Scholar identified articles on the aforementioned topic and identified literature on epidemiological studies, KAP studies, economic burden analysis, prevention and control and treatment. The final search strategy for PubMed is presented in online supplemental appendix 1.

The scoping review will exert the search strategy to identify published literature in the following electronic databases: PubMed, Excerpta Medica Database (EMBASE), Web of Science, PLOS, Science Direct, Hinari, Scopus and Google Scholar. The reference lists of eligible full texts from initial screening will be checked manually for potential literature identification. The search strategy will be customised for each included database and/or information source, pilot adapted search strategy is included in online supplemental appendix 2. For grey literature search in Google Scholar, we will use keywords and time range (2010–2021) and will depend on the relevancy ranking within Google search engines for most relevant results to the top of the list and page limit will be set for

the number of pages to be screened considering the time constraint.[28]

For developing the search terms, the research team will consult among themselves and the search strategy will be developed with the support from experienced coauthor. To increase the sensitivity of the search, search terms will be kept broad. Studies published in English from January 2010 to June 2021 will be incorporated as the authors would like to analyse the contemporary studies.

Study/source of evidence selection

Selected citations will be imported and accumulated in Rayyan review platform (Rayyan.ai) to organise the deduplication and screening process by the reviewers. A piloting of title and abstract screening for 20 random articles identified by using the similar search will be done to understand the consensus level among all reviewers. The team will proceed to the next stage once we have reached 75% or more agreement.

The main selection stage is divided into two phases where each phase consists of title and abstract screening followed by full-text review. In the first phase, the reviewers will screen the titles and abstracts which are identified by searching the electronic databases using the selected search terms. Next, review of the full texts will be conducted. The second phase will include literature identified by hand-search from included full text obtained during the first phase which will follow the similar procedure of title and abstract screening, followed by full-text screening. Both titles and abstracts screening along with full-text screening will be done by four reviewers in pairs where each article will be screened at least twice and any discordance during each stage will be reassessed and ruled out by discussion. The scoping review will record and report the causes for exclusion of articles.

The complete results of the search and the study inclusion process will be outlined in the final scoping review and illustrated in a flow diagram of PRISMA-ScR. Critical appraisal of the included literature is not required to meet the purpose of the study and will not be performed.[29] All the searches will be conducted in August 2021; table 1 shows major steps for all phases of the screening and evidence selection.

Data extraction

A predefined data-charting tool was developed and piloted during the protocol development phase where two reviewers independently charted data from 10 literature which were identified during the preliminary search. Discrepancies between the reviewers were further discussed for unified understanding and a draft data extraction framework has been developed by using the tested precharting tool (see table 2). This framework will be adapted to create the final data extraction form and adjusted as per requirement during data extraction from all of the included evidence sources. Any alterations of the framework will be informed in the final scoping review. To collect the data, Microsoft Excel will be used

Table 1 Key steps in the screening and evidence selection process

Trial	1. Initial search in PubMed and Google Scholar with the search terms 2. Importing 20 references in Rayyan.ai for pilot title and abstract screening 3. All reviewers screen the same articles with the 'Blinds on' by using the inclusion criteria 4. Consistency attained by 75% or more for approaching next stage
Phase I (Searching and screening of electronic search results)	1. Searching in the academic electronic databases: PubMed, EMBASE, Web of Science, PLOS, ScienceDirect, Scopus and Hinari 2. Grey literature search in Google Scholar 3. Deduplication; title and abstract screening by four reviewers in pairs 4. Resolving conflict of decision through discussion among the team 5. Full-text screening of the selected literature 6. Discussion for agreement on any discordant in full-text review
Phase II (Searching and screening of hand search)	1. Manual searching of the literature with potential from reference list of the included full-text literature 2. Deduplication; title and abstract screening, followed by full-text screening for eligibility by four reviewers in pairs 3. Discussion for agreement on inclusion

and each of the included evidence will be abstracted in a duplicate manner by two reviewers independently. Charted data from included full texts will be compared between the reviewers to check for discrepancies and completeness; consistency will be reached by discussion among the reviewers.

Data collation, summary and reporting

Final extracted data will be collated in a single spreadsheet in Microsoft Excel for validation and coding. After exclusion, we will report the final totals in the resulting study publication in a PRISMA flow diagram. We are focusing on a broad knowledge base and will offer a numerical overview of our findings around the PCC concept and share descriptive narratives of extracted data on thematic categories by basic classification of concepts to identified domains. Data presentation will be made by using simple graphs and tables, such as graphical presentation of people, concept and contexts, plotting of KAP findings, tabulated summary of health and economic impact findings and displaying year-wise recommended research gap in a summary table. We will address the research questions from the identified literature and report additional findings. We presume to identify emerging themes during data charting, so the data analysis plan is not complete yet.

IMPLICATION OF THE REVIEW

Earlier review in similar endemic settings has generated evidence on the status of the rabies and identified the gaps and challenges in prevention and control measures,

Table 2 Data extraction framework

Category	Description
1. Title	
2. Summary of objective/aim	Describe the research objectives/aims of the study
3. Year of the study	Mention the publication year
4. Location of the study	Mention the location ad verbatim will all mentioned administrative level
5. Area/Domain of the study/literature	Specify the area of study (eg, epidemiological studies, economic burden studies, KAP studies, prevention and control, treatment, etc)
6. Study population	Human, animal or both
7. If a study, what is the settings	Specify level if study conducted in community (rural/urban), family, facility, educational or advocacy
8. Any frequency measures reported in human	Specify if incidence and/or prevalence
9. Summary of disease impact	Chart the health and/or economic impact reported
10. Level of awareness identified	Summarise the awareness level from KAP studies
11. Practices recorded from the KAP	List the practices reported to prevent rabies
12. Any preventive and/or control measures reported in the study	Mass dog vaccination and pre-exposure or postexposure vaccination in humans and animals
13. Effective measures	Chart which measures are found/claimed effective
14. Vaccine utilisation findings	Input any pre or post vaccination findings with dose, frequency and percentage
15. Research gap recommended	Briefly note the recommendations from the authors
16. Summary of findings (not captured with other data points)	Briefly describe findings of the literature.

KAP, knowledge, attitude and practices.

summarised on the rabies measures which have shown promises and finally recommended adoptable innovations.[30] The current review aims to come up with such findings specific to Bangladesh which will in the future guide the country's strategy in eliminating rabies. Reiterating the challenge to have basic information on rabies burden to comparative information related to efficiency of public health measures, control strategies and different vaccines and cost-effectiveness of pharmacological interventions, the review will establish an evidence base on rabies status in human, disease impact, knowledge and practice among people, effective prevention and control measures to support the national rabies action

strategies.[4 31] The authors wish to share glimpse of gap between rabies research and policy needs in final scoping review to support developing a strategic research agenda for policy translation.[32]

ETHICS AND DISSEMINATION
Due to the nature of evidence synthesis (secondary analysis of published studies) for scoping review, it does not warrant ethical approval. The study will follow 'Do no harm' policy, moreover, International Committee of Medical Journal Editors criteria will be maintained for authorship.[33] We presume that the findings from this scoping review will inform the global health practitioners and policymakers regarding major concepts, width of evidence and vignettes of gaps for future actions by highlighting the extent and types of research with key concepts available from recent time on rabies in Bangladesh. Results of this scoping review will be submitted to a peer-reviewed journal for publication, presented in relevant conferences, shared in social media-based community of practice and to global health practitioners within national and international organisations.

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Appendix 1- PubMed Search Strategy (Literature Search performed: June 12, 2021)

#	Query	Filters	Search Details	Results
1	Rabies		"rabies"[MeSH Terms] OR "rabies"[All Fields]	16,460
2	Rabies	from 2010 - 2021	("rabies"[MeSH Terms] OR "rabies"[All Fields]) AND (2010:2021[pdat])	5,345
3	Bangladesh		"bangladesh"[MeSH Terms] OR "bangladesh"[All Fields] OR "bangladesh s"[All Fields]	26,722
4	Bangladesh	from 2010 - 2021	("bangladesh"[MeSH Terms] OR "bangladesh"[All Fields] OR "bangladesh s"[All Fields]) AND (2010:2021[pdat])	19,005
5	Rabies[Title/Abstract]		"Rabies"[Title/Abstract]	14,753
6	Rabies[Title/Abstract]	from 2010 - 2021	("Rabies"[Title/Abstract]) AND (2010:2021[pdat])	4,921
7	Rabies[MeSH Terms]		"rabies"[MeSH Terms]	10,319
8	Rabies[MeSH Terms]	from 2010 - 2021	("rabies"[MeSH Terms]) AND (2010:2021[pdat])	2,626
9	Bangladesh[Title/Abstract]		"Bangladesh"[Title/Abstract]	15,140
10	Bangladesh[Title/Abstract]	from 2010 - 2021	("Bangladesh"[Title/Abstract]) AND (2010:2021[pdat])	9,960
11	(Rabies[Title/Abstract]) AND (Bangladesh[Title/Abstract])		"Rabies"[Title/Abstract] AND "Bangladesh"[Title/Abstract]	29
12	(Rabies[Title/Abstract]) AND (Bangladesh[Title/Abstract])	from 2010 - 2021	("Rabies"[Title/Abstract] AND "Bangladesh"[Title/Abstract]) AND (2010:2021[pdat])	25
13	(rabies) AND (Bangladesh)		("rabies"[MeSH Terms] OR "rabies"[All Fields]) AND ("bangladesh"[MeSH Terms] OR "bangladesh"[All Fields] OR "bangladesh s"[All Fields])	39

14	(rabies) AND (Bangladesh)	from 2010 - 2021	(("rabies"[MeSH Terms] OR "rabies"[All Fields]) AND ("bangladesh"[MeSH Terms] OR "bangladesh"[All Fields] OR "bangladesh s"[All Fields])) AND (2010:2021[pdat])	30
15	(rabies[Title/ Abstract]) AND (Bangladesh)		"rabies"[Title/Abstract] AND ("bangladesh"[MeSH Terms] OR "bangladesh"[All Fields] OR "bangladesh s"[All Fields])	36
16	(rabies[Title/ Abstract]) AND (Bangladesh)	from 2010 - 2021	("rabies"[Title/Abstract] AND ("bangladesh"[MeSH Terms] OR "bangladesh"[All Fields] OR "bangladesh s"[All Fields])) AND (2010:2021[pdat])	27
17	((rabies[MeSH Terms])) AND (Bangladesh)		"rabies"[MeSH Terms] AND ("bangladesh"[MeSH Terms] OR "bangladesh"[All Fields] OR "bangladesh s"[All Fields])	22
18	((rabies[MeSH Terms])) AND (Bangladesh)	from 2010 - 2021	("rabies"[MeSH Terms] AND ("bangladesh"[MeSH Terms] OR "bangladesh"[All Fields] OR "bangladesh s"[All Fields])) AND (2010:2021[pdat])	16
19	(rabies[MeSH Terms]) AND (Bangladesh[Title/Abstract])		"rabies"[MeSH Terms] AND "Bangladesh"[Title/Abstract]	18
20	(rabies[MeSH Terms]) AND (Bangladesh[Title/Abstract])	from 2010 - 2021	("rabies"[MeSH Terms] AND "Bangladesh"[Title/Abstract]) AND (2010:2021[pdat])	15

Appendix 2- Pilot adapted search strategy for ScienceDirect, Hinari, PLOS, EMBASE, Web of Science, Scopus, Google Scholar and resulted number of literature (Literature Search performed: August 08, 2021)

Source	Search strategy	Resulted literature
ScienceDirect	• General: Rabies Bangladesh • Title/Abstract/Keywords: rabies AND Bangladesh • Year: 2010-21	9
Hinari	• Title/Abstract: rabies Bangladesh - ((TitleCombined:("rabies")) OR (Abstract:(rabies))) AND ((TitleCombined:(Bangladesh)) OR (Abstract:(Bangladesh))) • Year: 2010-21	162
PLOS	• Title/Abstract: rabies Bangladesh - ((title:Rabies) OR (abstract:rabies)) AND ((title:bangladesh) OR (abstract:bangladesh)) • Year: 2010-21	2
EMBASE	rabies:ti,ab,kw AND bangladesh:ti,ab,kw AND [2010-2021]/py	27
Web of Science	(TS=(rabies)) AND TS=(bangladesh)	49
Scopus	(ABS (rabies) OR TITLE (rabies) OR KEY (rabies)) AND (ABS (bangladesh) OR TITLE (bangladesh) OR KEY (bangladesh)) AND PUBYEAR > 2009 AND PUBYEAR < 2022	49
Google Scholar	Keywords: Rabies AND Bangladesh Custom range: 2010-2021 Page: 1-30, 20 results per page	600