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Review Article

One Health Approach for Control of Neglected Tropical Diseases in India

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ABSTRACT

Neglected Tropical Diseases are a diverse group of health conditions found predominantly among neglected and impoverished communities, and have historically received less attention. Many of these conditions occur at the interface of human, animal and environmental interactions. One Health is an approach that recognises the interdependence of human, animal and environmental health, and is part of the implementation approaches recommended by the roadmap for Neglected Tropical Diseases suggested by WHO. This review attempts to discuss the strategies used for the control of Neglected Tropical Diseases in India through a One Health lens. Relevant literature, programme and policy documents were reviewed and narratively synthesised to identify the One Health linkages in the current approaches for control of the various Neglected Tropical Diseases, gaps and possible opportunities. Though One Health approach has been increasingly endorsed by India for the control of various diseases, there is scope for more integrated implementation, which would lead to better control of different diseases where animals and the environment play a major role, including Neglected Tropical Diseases.

Keywords: Tropical Diseases, Environmental interactions, WHO, One Health approach

1. INTRODUCTION

Twenty diseases are classified by the World Health Organisation (WHO) as Neglected Tropical Diseases (NTDs) (*Neglected Tropical Diseases -- GLOBAL*, n.d.). These are a diverse group of conditions that are found predominantly among impoverished populations in LMICs, many of which are located in tropical or subtropical climates, and have historically received less attention. The majority of these diseases are infectious in nature, caused by a variety of pathogens – bacterial, viral, parasitic and fungal.

The following diseases are classified as NTDs by the WHO (*Neglected Tropical Diseases -- GLOBAL*, n.d.):

- Buruli ulcer
- Chagas disease
- Dengue and chikungunya
- Dracunculiasis
- Echinococcosis
- Foodborne trematodiases
- Human African trypanosomiasis
- Leishmaniasis
- Leprosy
- Lymphatic filariasis
- Mycetoma, chromoblastomycosis and other

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deep mycoses
- Noma
- Onchocerciasis
- Rabies
- Scabies and other ectoparasitoses
- Schistosomiasis
- Soil-transmitted helminthiases
- Snakebite envenomation
- Taeniasis and cysticercosis
- Trachoma
- Yaws

Many of these diseases are endemic to India. These include:

- Dengue and chikungunya
- Echinococcosis
- Food-borne trematodiases
- Leishmaniasis
- Leprosy
- Lymphatic filariasis
- Mycetoma, chromoblastomycosis and other deep mycoses
- Rabies
- Scabies and other ectoparasitoses
- Soil-transmitted helminthiases
- Snakebite envenomation
- Taeniasis and cysticercosis

In recent years, Dracunculiasis and trachoma have been eliminated from India as public health problems (Hopkins et al., 2000) (Jesudason, 2024).

2. ONE HEALTH APPROACH

The One Health High Level Expert Panel (OHHLEP) defines One Health as - "an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) is closely linked and interdependent (Adisasmito et al., 2022)."

While integrative thinking for human and animal health has a long history that dates back to medicinal practices in ancient Egyptian, Indian, Arabic and Chinese civilisations; with increasing practices of specialisation, these categories started to work more and more in siloes (Zinsstag et al., 2011).

However, in recent years, multiple failure points have been noted in such isolated approaches. Many recent emerging and re-emerging diseases were found to be of zoonotic origin, thus highlighting the neglected link between human and animal health (Mackenzie & Jeggo, 2019).

Another neglected link between human, animal and environmental health was found in antimicrobial resistance. In 1976, Calvin Shwabe recognised that humans share major anatomical and physiological similarities with other animals leading to many common drugs including antibiotics that are used in both, and popularised the concept of "One Medicine" (Zinsstag et al., 2011). Irrespective of the specialisations and siloes that have been created in the study of sciences, antimicrobial resistance stems from a selection of pathogens that can withstand pressures arising not just from antimicrobials used in humans, but from complex interactions between humans, other animals and the environment, and chemicals used in any of these (Djordjevic et al., 2024). Thus resistant strains of pathogens selected from antimicrobial use in other animals may be transmitted to humans, and vice versa; while antimicrobial residues in sewage can lead to resistant strains being selected in the environment and then transmitted to humans and other animals (McEwen & Collignon, 2018).

Additionally, the effects of climate change on human, animal and environmental health in the form of disasters, increase in infectious diseases and food insecurity cannot be studied in siloes, and require a One Health approach to be tackled effectively (Zinsstag et al., 2018).

Following the 2002-2004 SARS pandemic, the interdependent nature of human and animal

health was recognised, and the WHO, World Organisation for Animal Health (WOAH), Food and Agricultural Organisation (FAO) of the United Nations came together in 2008 to form the Tripartite ("One Health Implementation," 2025). Later, the United Nations Environment Programme (UNEP) was formally included in this alliance to form the Quadripartite. The One Health Joint Plan of Action (OH JPA) 2022-2026 developed by the Quadripartite provides a framework for the actions to be taken for the implementation of the One Health approach (*One Health Joint Plan of Action, 2022–2026*, 2022). This framework is built around six interdependent action tracks; of which Action Track 3 is "Controlling and eliminating endemic zoonotic, neglected tropical and vector-borne diseases."

Many of the neglected tropical diseases are parasitic, requiring an animal host other than human, to complete their life cycle, or vector-borne, relying on the presence of insect vectors making a One Health approach necessary to tackle them. This is also in line with the Sustainable Development Goal (SDG) 3.3, which aims to "end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases" (*SDG Target 3.3 Communicable Diseases*, n.d.). Using a One Health approach for ending epidemics of neglected tropical diseases is also in line with SDG 1 (No poverty), SDG 6 (Clean water and sanitation), SDG 10 (Reduced inequalities), SDG 11 (Sustainable cities and communities), SDG 13 (Climate action), SDG 14 (Life below water), SDG 15 (Life on land) and SDG 17 (Partnerships for the goals).

3. INDIAN SCENARIO

3.1 Use of One Health approach implicitly in existing National Health Programmes

Of the Neglected Tropical Diseases, specific national health programmes and strategies are in place to address under dengue and chikungunya, leishmaniasis, filariasis National Vector Borne Disease Control Programme; leprosy under National Leprosy Eradication Programme, rabies under National Rabies Control Programme, snakebite under National Programme for Prevention and Control of Snakebite Envenoming and soil-transmitted helminthiases under National Deworming Day.

3.1.1 National vector borne disease control programme

The National Vector Borne Disease Control Programme (NVBDCP) is an integrated national health programme which works for the control of six vector-borne diseases endemic to India: malaria, dengue, chikungunya, leishmaniasis, Japanese encephalitis and lymphatic filariasis. The general strategies used by NVBDCP are (Kaur & Verma, 2023):

i. Integrated vector management

ii. Disease management

iii. Supportive interventions

iv. Vaccination

v. Annual mass drug administration

Under NVBDCP, environmental interventions are implemented through the strategy of integrated vector management, where source reduction, chemical treatment and biological control measures are used to reduce vectors for all the vector-borne diseases under the purview of NVBDCP. However, there are several other areas of concern in terms of environmental factors. Unplanned urbanisation leads to increase in vectors due to creation of vector breeding sites, as well as increased movement of human cases and carriers. Climate change too has an effect on vector density. Change in rainfall patterns, as well as a reduction of the external incubation period of the malarial parasite with

increasing temperature is an important factor (Kaur & Verma, 2023).

Integrated vector management is an important strength of the programme, particularly due to rising concerns over traditional reliance on insecticides for vector control as many insecticides lead to adverse effects in both humans and the environment. Moreover, development of insecticidal resistance is a growing concern (Kaur & Verma, 2023; Van Den Berg et al., 2021). *Aedes* mosquitos, the vector for dengue and chikungunya, have developed resistance to all major classes of insecticides commonly used (Moyes et al., n.d.).

Recent research indicates that animals such as bats, non-human primates and pigs might act as animal reservoirs for dengue (Gwee et al., 2021; Pang & Gwee, 2020). This indicates a need for integrated surveillance as we work towards eliminating these diseases.

3.1.2 National Leprosy Eradication Programme

The National Leprosy Eradication Programme (NLEP) focusses on awareness generation in the community, early detection and treatment of leprosy cases and disability prevention and management in diagnosed cases (*NLEP*, n.d.). Though armadillos have been seen to act as reservoirs in some countries, and there has been some evidence of environmental transmission, to date, the One Health dimensions related to leprosy still remain unclear (Spiliopoulos et al., 2024).

3.1.3 National Rabies Control Programme

Rabies is a classic example of a disease that occurs at the human-animal-environment interface, where the causative organism, the rabies virus, is transmitted by a variety of mammalian reservoirs, including dogs, cats, cattle, jackals, bats, etc. In India, the most common reservoir for rabies, are dogs (Sudarshan et al., 2007). Studies have also shown that environmental variables such as altitude, vegetation density, humidity, climate change, seasonal variations and waste management systems are strongly associated with the distribution of rabies (Subedi et al., 2022; Yu et al., 2020).

The National Rabies Control Programme in India, is focussed on ensuring the availability of Anti-Rabies Vaccine (ARV) and Anti-rabies serum (ARS) at all levels of healthcare, capacity building of professionals in animal bite management, strengthening surveillance of animal bites and human rabies cases, strengthening rabies diagnostic capacity and increasing awareness about rabies (*National Rabies Control Programme (NRCP)*, n.d.).

However, inspite of progress under the NAPRE (National Action Plan for Rabies Elimination), 9.1 million animal bites and 5726 human rabies deaths occur annually in India (*Rabies - India*, n.d.). Certain gaps contribute to it – including inconsistencies in veterinary surveillance for animal rabies, inadequate animal vaccination as well as disparities in post exposure prophylaxis accessibility (Phukan, 2026).

Approaches that are more strongly grounded in the principle of One Health have already shown encouraging results in some small states of India. For example, in Sikkim, there was a strong focus on animal welfare and animal focussed measures, including the establishment of a clinic for the surgical sterilisation, rabies vaccination and treatment of sick and injured street dogs with mobile units providing the services in rural areas (Byrnes et al., 2017). Local veterinarians and volunteers were involved for activities, and statewide canine rabies vaccination campaigns were held every year in the month of September. This has led to control of both human and canine rabies in Sikkim since 2006, though occasional imported cases are present from neighbouring states and countries. Similarly in Goa, human rabies was eliminated, and canine rabies was reduced by 92%, through a One

Health approach, in which the three pillars of the elimination programme were dog vaccination, rabies education and dog rabies surveillance (Gibson et al., 2022).

Even though post-exposure prophylaxis for rabies is crucial in reducing deaths from rabies, it does nothing to decrease the pool of reservoirs for rabies in all the other animals that humans continuously interact with (Gibson et al., 2022). Thus, while India has come far in the control of rabies, additional strategies are required for the final push for rabies elimination; such strategies should emphasise on methods to reduce the pool of animal reservoirs and view the disease through the One Health lens of human, animal and environmental interaction.

3.1.4 National Programme for Prevention and Control of Snakebite Envenoming

The National Programme for Prevention and Control of Snakebite Envenoming focuses on building health-professional capacity related to snakebite, improving access to snakebite management, strengthening surveillance, research, intersectoral coordination, and public-private partnerships, and addressing legislative issues related to anti-snake venom collection, monitoring, and community outreach activities (*NCDC | MOHFW*, n.d.-a).

Snake distribution, and snake-human conflicts are heavily influenced by human-animal-environmental interactions; including human disruptions in habitat through agricultural practices, deforestation, snake catching practices associated with cultural aspects, construction work; seasonal disruptions in natural habitat through natural disasters and risk factors due to distribution of other animals including livestock and other small wild animals that are prey for snakes (Allen et al., 2026). Similar to the NRCP, the current strategies of the National Programme for Prevention and Control of Snakebite Envenoming are mainly focussed on ensuring critical lifesaving measures for people affected by snakebite; however, for prevention of snakebites among the vulnerable population, strategies grounded in One Health are essential in order to minimise snake-human conflicts.

3.1.5 National Deworming Day

The National Deworming Day is conducted biannually in India for the prevention and control of soil-transmitted helminthiases, where albendazole tablets are administered to all preschool and school-aged children of age 1-19 years through schools and Anganwadis on 10th of February and 10th of August every year (*National Deworming Day :: National Health Mission*, n.d.). However, emerging resistance towards common anthelminthics that are also used in livestock is a major concern, and needs to be addressed through a One Health approach (Ng'etich et al., 2023).

3.1.6 National One Health Programme for Prevention and Control of Zoonoses

The National One Health Programme for the Prevention and Control of Zoonoses is a comprehensive programme approved by the Government of India in the 12th Five Year Plan in 2013 (*NCDC | MOHFW*, n.d.-b). It plans to function on the basis of 6 components; the institutionalisation of One Health at the national, state, district level and up to the grassroots level, integrated capacity building programmes on zoonoses through multidisciplinary network of regional coordinators including One Health Institutes and Partner Organizations, integrated surveillance of zoonoses, integrated community outreach, advocacy and risk communication and operational research (*Operational Guidelines for National One Health Programme for Prevention and Control of Zoonoses*, 2022). Two Neglected Tropical Disease categories – echinococcosis, and taeniasis and cysticercosis have been recognised by the NCDC (National Centre for Disease Control) as zoonotic diseases of public health

importance (*Manual of Zoonotic Diseases of Public Health Importance*, 2025).

3.1.7 Other Neglected Tropical Diseases

Although India has dedicated national health programmes for some neglected tropical diseases such as vector-borne diseases, leprosy, rabies, snakebite and soil-transmitted helminthiases, other neglected tropical diseases are covered by broader national health programmes at varying levels. For instance, scabies is one of the many diseases that children are screened for under the RBSK (Rashtriya Bal Swasthya Karyakram) (*Rashtriya Bal Swasthya Karyakram 2.0 :: National Health Mission*, n.d.). On the other hand, food-borne trematodiases and mycetoma, chromoblastomycosis and other deep mycoses are not covered by any targeted health programmes, but are treated through routine health services. Similarly, routine clean water supply and sanitation services have a role in reducing the prevalence of many neglected tropical diseases.

3.2 National One Health Mission

In India, human, animal and environmental health efforts were carried out mostly independent of each other till an effort in the direction of One Health was taken in the year1964, and the Division of Zoonoses was established under the National Institute of Communicable Diseases (now the NCDC), acknowledging the influence of animal health on human health (Hegde et al., 2024). Later in 1978, the National Committee on Zoonoses was formed, in collaboration with the health and agriculture ministries. In 2019, the Department of Biotechnology (DBT) organised a One Health conference, and drew a roadmap for identifying the needs and opportunities, and integrating knowledge from the different sectors involved. Following this, a joint meeting was held with the Bill and Melinda Gates Foundation. In late 2019, an expert group was constituted for identifying priority areas related to emerging and re-emerging infections, biosafety challenges and deciding policies as needing immediate or long-term interventions. Following this, the DBT launched the One Health Consortium consisting of 27 centres (now 28) across the country, where medical, veterinary and wildlife specialists would come together to study the nationwide prevalence of 10 prioritised zoonotic diseases and five transboundary animal diseases (TADs) of importance (Hegde et al., 2024). Furthermore, the National Institute of One Health was envisioned to be developed in Maharashtra, and a pilot project was started in Karnataka and Uttarakhand to start a One Health Support Unit.

India launched the National One Health Mission in 2022, integrating 16 Ministries and Departments (*View of National One Health Mission: An Integrated Ecosystem for Augmenting India's Pandemic Preparedness*, n.d.). It is anchored on six pillars: intersectoral R&D, integrated surveillance and multisectoral outbreak response, a network of 23 BSL-3 laboratories, rapid medical countermeasure development, integrated data systems, and capacity building. India also has the National Action Plan on Antimicrobial Resistance which functions on the basis of 6 strategic objectives: improving awareness and understanding of AMR through effective communication, education and training; strengthening laboratory capacity for AMR detection, surveillance and targeted surveillance of antibiotic residues; reducing the incidence of infection through effective infection prevention and control; optimising the use of antimicrobial agents in humans, animals and food through uninterrupted access and judicious use of antimicrobials; research and innovations by identifying priority areas for research; strengthening governance, intra- and inter-sectoral coordination and collaborations on AMR (*National Action Plan on Antimicrobial Resistance*, n.d.).

The One Health Theory of Change argues that effective implementation of the One Health approach is driven by 3 pathways – (1) Policy,

legislation, advocacy and financing, (2) Organisational development, implementation and sectoral integration and (3) Data, evidence and knowledge (*One Health Joint Plan of Action, 2022–2026*, 2022). While India, like many other countries, has recently created a national level policy for One Health as well as a national action plan for the control of zoonoses with emphasis on the One Health approach, the different components of the other two pathways are implemented to varying levels.

India's disease-control framework, like its overall health system, operates through a collaborative yet fragmented division of duties between the central government and the states; for instance, it has conventionally been structured around distinct programs and supported by the Centre for investigating outbreaks. (Raut et al., n.d.). Although various initiatives related to One Health have come to light, such as the formation of the Centre for One Health and the National Institute of One Health through partnerships among ICMR, ICAR, and additional organisations, execution is still fragmented across distinct sectors of human, animal, and environmental health. (Raut et al., n.d.).

This highlights the necessity of advancing from separate programs to enhanced institutional collaboration, unified surveillance, data exchange, and collective decision-making across various sectors. To explore how this can be put into practice, we can examine instances from other nations and the insights they provide for reinforcing One Health implementation in India.

4. ONE HEALTH IN ACTION: GLOBAL INITIATIVES AND LESSONS FOR INDIA

4.1 China: From One Health Policy to Integrated Public Health Action

China has integrated multiple elements of the One Health strategy into its national policies via targeted programs and monitoring systems that encompass human, animal, and environmental health. (Liu et al., 2023). It enhanced the management of zoonotic diseases via the *Infectious Diseases Prevention Law* and specialised initiatives for significant zoonotic infections, in addition to surveillance systems that encompass both livestock and wildlife. (Li et al., 2021). The *National Action Plan to Combat Antimicrobial Resistance (2014)* unified issues related to human health, agriculture, and the environment by advocating for responsible antibiotic use in both healthcare and farming, clarifying intersectoral roles, and tackling antimicrobial pollution. This initiative resulted in a significant decrease in antibiotic usage among hospitalised patients, dropping from 59.4% in 2011 to 36% in 2019. (*Antimicrobial Resistance - China*, n.d.). China has connected One Health initiatives with food safety and environmental health by implementing its *Food Safety Law*, agricultural sustainability strategies, and national air pollution and climate action plans; from 2013 to 2017. These efforts have led to a 33.3% decrease in the annual average PM2.5 levels. (Huang et al., 2018).

For India, these instances highlight the importance of integrating current human, veterinary, and environmental monitoring systems, with well-established roles and methods for regular data exchange, instead of creating One Health programs as separate, sector-specific endeavours.

4.2 Bangladesh: Institutionalising One Health Coordination

After the avian influenza outbreaks of 2007–08, Bangladesh created *One Health Bangladesh*, which unites the *Institute of Epidemiology, Disease Control and Research*, the *Directorate General of Health Services*, and the *Department of Livestock Services*. (Dahal et al., 2017; *One Health Network South East Asia*, n.d.). Subsequently, in 2012, a *Strategic Framework for the One Health Approach* was introduced, and in 2016, an *Inter-*

Ministerial Steering Committee for One Health was established, along with a specific One Health Secretariat at IEDCR, comprised of personnel from the health, fisheries, environment, and agriculture ministries. (Dahal et al., 2017). The Secretariat facilitates consultations with stakeholders, organises training sessions, and conducts collaborative outbreak investigations, thereby establishing a formal means for cross-sectoral cooperation. Bangladesh has developed a comprehensive strategy for implementing One Health, which includes an extensive situational assessment, the appointment of a governing body for One Health initiatives, and detailed action strategies. In addition to regular training and awareness-raising activities, Bangladesh engages in collaborative outbreak investigations and has launched the Field Epidemiology Training Programme Bangladesh for the public health domain and the Field Epidemiology Training Programme for Veterinarians in the Animal Health sector. (Chowdhury et al., 2026).

India has a tropical climate, a similar distribution of wildlife species, and a population density comparable to Bangladesh. This highlights the importance of creating a dedicated coordination system with representatives from relevant ministries, rather than relying on occasional intersectoral collaboration.

4.3 Rwanda: Linking One Health Governance with Surveillance and Communities

In 2015, Rwanda implemented a One Health Strategic Plan that clearly combines disease monitoring and response efforts among humans, animals, and agriculture, while also tackling underlying factors like land use, water availability, deforestation, and interactions between humans and wildlife. (Nyatanyi et al., 2017). A coordination mechanism spanning multiple sectors, based within the Prime Minister's Office, manages One Health governance, aided by a small Secretariat and technical working groups focused on topics such as zoonoses, antimicrobial resistance, and workforce development. (Igihozo et al., 2022). Rwanda has integrated electronic surveillance for human diseases with laboratory networks and a comprehensive community-based sentinel system that includes community health workers, animal health practitioners, farmers, park rangers, and border officials. (*One Health Approaches Require Community Engagement, Education, and International Collaborations—a Lesson from Rwanda | Nature Medicine*, n.d.). Rwanda has also incorporated One Health into university curricula (Igihozo et al., 2022).

For India, Rwanda presents a framework for broadening One Health beyond central authorities by incorporating it into grassroots surveillance, community networks, professional training, and local environmental strategies.

4.4 Kenya: A Dedicated One Health Unit for Zoonotic Disease Control

In 2012, Kenya set up a *Zoonotic Disease Unit (ZDU)* that is staffed collaboratively by medical and veterinary epidemiologists from the Ministries of Health and Agriculture, and later included an environmental ecologist (Mbabu et al., 2014). The ZDU serves as the secretariat for a technical working group that spans multiple sectors and has established One Health frameworks at both county and sub-county levels, employing trained One Health professionals throughout all 47 counties(Mbabu et al., 2014). Kenya used a structured, multisectoral process to prioritise zoonotic diseases, involving experts from public health, animal health, and wildlife health, and subsequently developed disease-specific tools, including a Rift Valley fever risk map, a contingency plan, and a national rabies elimination strategy (Munyua et al., 2016).

5. CONCLUSION

One Health is progressively being integrated into India's strategy for neglected tropical diseases; however, execution continues to be mostly

disjointed among the human, animal, and environmental health sectors. Although India has made important advances, particularly through the National One Health Mission and disease-specific programmes such as rabies control, evidence-based strategies for integrating One Health for other NTDs remain limited, largely because context-specific evidence for prevention strategies is scarce. International cases illustrate practical frameworks for institutional collaboration, comprehensive monitoring, and cross-sectoral execution that can be tailored to fit the Indian context. Funding for preclinical, translational, and context-relevant research is crucial and will significantly impact our understanding of NTD epidemiology, their relationships with climate and environmental shifts, and successful interventions at the intersection of humans, animals, and the environment.

STATEMENTS AND DECLARATIONS

Author contributions: CB and AB conceived of the study. CB and NS conducted literature search and drafted the manuscript. AB critically revised the manuscript. All authors read and approved the final manuscript.

DECLARATION RELATED TO AI USE

During the preparation of this manuscript, the authors used Grammarly for grammar correction. All content has been reviewed by the authors, and the authors take full responsibility for the final content of the manuscript.

CONFLICT OF INTEREST

None declared

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