Preventing the next pandemic

The role of an effective
One Health programme in India

Executive Summary

Investing in One Health – cross-sectoral, multidisciplinary coordination and collaboration across the human health, animal health, and environmental health sectors – is crucial for protecting human, animal, and ecosystem health while maintaining economic, political, and environmental stability. Concerted and sustained actions can reduce the threat of future epidemics through preventive measures, early detection, and rapid response to outbreaks.

For this policy brief, Health Systems Transformation Platform (HSTP) interviewed 35 experts to assess the status of management regarding animal, wildlife, and human health, and the ability to respond to threats from infectious diseases. It provides broad recommendations on priority activities that need to be undertaken by policymakers, programme managers, and development partners.

Introduction

Infectious diseases have come back to the spotlight after COVID-19. While non-communicable diseases dominate morbidity and death globally, infectious diseases still account for around 40% of all deaths. About 70% of all infectious diseases are zoonotic in origin.

At least 1 million deaths occur from zoonotic diseases annually in India. India's rich biodiversity and varied ecosystems provide opportunities for pathogens to live within potential reservoirs, and thereby, get transmitted by hosts of vectors. India is also home to at least 536 million livestock, which contribute nearly 27 percent (US$91.66 billion, as of 2019) to the country's agricultural Gross Domestic Product (GDP). As a result, several communities depend on animal rearing for their livelihood. Several other factors create opportunities for the emergence of new and re-emergence of infectious diseases. From the perspective of prevention and early detection these factors include periodic migration of animals and humans together; habitat destruction; frequent human-animal interactions in diverse ecosystems and seasons; frequent mixing of livestock; and unhygienic living conditions of susceptible populations. With respect to early diagnosis and treatment in human and animals: low spending on healthcare; insufficient investment in animals and public health research; limited coordination between central and state health systems on disease reporting; lack of coordination between animal and human disease surveillance; and limited private sector involvement are drivers for persistence of infectious disease and ill health. Together these determinants make human and animal populations vulnerable to a variety of existing and new infectious diseases. Frequent seasonal outbreaks of infectious diseases such as malaria, Japanese Encephalitis (JE), chikungunya, Crimean Congo Haemorrhagic Fever (CCF), and dengue; sporadic outbreaks of Nipah, buffalopox, and novel influenzas (H5N8 and similar avian diseases); formidable fevers which are prevalent among our neighbours like Middle East Respiratory Syndrome (MERS) and rift valley fever along with growing and emergence of new types of antimicrobial resistance (AMR) remain prime concerns for India.

The COVID-19 pandemic and subsequent outbreaks like human monkey pox and lumpy skin disease in livestock have highlighted significant limitations in India's animal and public health systems. The persistence of zoonotic diseases like influenzas and JE, and human infectious diseases (measles in children and adults in 2022 for example) has revealed that the current measures to arrest outbreaks, contain epidemics, and mitigate spread across jurisdictions are limited, and need strengthening. Post-COVID-19, India has resolved to take significant measures in terms of investments and devising policies to prevent outbreaks and mitigate future pandemics. The COVID-19 pandemic has warned the global community that the threat of extant and novel infectious disease arising from animals poses a clear and present danger.

The State of Disease Surveillance in India

India has a diverse portfolio of surveillance programmes that gather information for human and animal infectious diseases.

The focal point for One Health remains the Department of Animal Husbandry & Dairying. DAHD's major initiative is the Livestock Health

and Disease Control Program (LHDCP) which aims to control animal diseases and prevent zoonosis. Launched in 2021, it has proposed an overarching Livestock Health and Disease Control Scheme (LHDCS). Under the DAHD is focussed programme, National Animal Disease Control Programme (NADCP) which aims to eradicate foot and mouth disease (FMD) and brucellosis by 2025 using vaccinations. The LHDCS provides assistance to States for control of animal diseases (ASCAD) and the establishment and strengthening of veterinary hospitals and dispensaries (ESVHD), both of which have programmes of these names.

Three other policy initiatives have marked the mainstreaming of One Health in India. First, in May 2020, the Department of Biotechnology constituted the National Expert Group on One Health. Second, the proposal to establish a National Institute of One Health (NIOH) at Nagpur, Maharashtra which will oversee operations of the Integrated Public Health Laboratories. NIOH is a joint initiative of Indian Council of Medical Research (ICMR) and Indian Council of Agricultural Research (ICAR) and will bring together several institutions under Ministries of Health & Family Welfare, Agriculture and Animal Health, S&T, Defence, Department of Biotechnology (DBT), Council of Scientific & Industrial Research (CSIR), among others which are involved in animal and human infectious disease research and control. There are several specialised institutions, universities, and veterinary and medical colleges that host advanced infrastructure for conducting basic research, clinical studies to policy analysis which will collaborate with NIOH. Third, India launched its National Action Plan on antimicrobial resistance (AMR), taking a OH approach involving human, animal and environmental sectors in 2017.

The flagship programme that covers animal health is the National Digital Livestock Mission (NDLM). NDLM was introduced in the Union Budget of 2014-15. It provides unique identification (pashu-aadhaar) for all livestock (cattle, buffaloes, sheep, goats, and pigs) in the country. NDLM will digital link livestock owners with the Information Network for Animal Productivity and Health

(INAPH) through an app. INAPH will be integrated to National Animal Disease Reporting System (NADRS) and link livestock owners to other services such as artificial insemination and insurance. Uttarakhand is the first state to roll out the NDLM in March 2023.[1]

National Livestock Mission, launched alongside NDLM, intends to achieve the objectives of employment generation through entrepreneurship development in small ruminant, poultry and piggery sector & Fodder sector, increase of per animal productivity through breed improvement, increase in production of meat, egg, goat milk, wool and fodder. NADRS is a computerized network established under the Department of Animal Husbandry, Dairy, and Fisheries, which collects and collates animal health information at the block, district, and state level and will blend into the NDLM. The National Institute of Veterinary Epidemiology & Disease Informatics (NIVEDI) has developed a software application, National Animal Disease Referral Expert System (NADRES). NADRES is a collaborative platform with DAHD that enhances the effectiveness of alert and response mechanisms for stakeholders. The National Institute of High Security Animal Diseases (NIHSAD) under Indian Council of Agricultural Research is a premier institute of India for research on exotic and emerging pathogens of animals. Set up in 2014, NIHSAD works closely with Indian Veterinary Research Institute (IVRI), Izatnagar. The NIVEDI/ NADRES platform is a comprehensive platform for livestock diseases. The system facilitates prediction, prevention, and control of animal disease threats, including zoonoses, by sharing information, conducting epidemiological analysis, and undertaking joint field missions to assess and manage outbreaks. However, currently it does not monitor or predict zoonotic diseases other than anthrax.

Under public health, the Ministry of Health & Family Welfare oversees disease surveillance. The flagship programme for infectious disease is Integrated Disease Surveillance Programme (IDSP) which is coordinated by the National Centre for Disease Control (NCDC).[2] IDSP maintains decentralized laboratory-based IT-enabled disease

[1] National Dairy Development Board. National Digital Livestock Mission. Ministry of Fisheries, Animal Husbandry and Dairying. New Delhi, India. Available from: https://dahd.nic.in/sites/default/filess/National%20Digital%20Livestock%20Mission-Blueprint-Draft%20%2802%29.pdf.

[2] National Centre for Disease Control. Program for strengthening inter- sectoral co-ordination for prevention and control of zoonotic diseases: Operational guidelines for regional coordinators. Ministry of Health and Family Welfare. New Delhi, India. Available from: https://ncdc.mohfw.gov.in/showfile.php?lid=421.

surveillance system for epidemic-prone diseases and monitors disease trends and responds to outbreaks through trained Rapid Response Team (RRTs). The IDSP has been upgraded as Integrated Health Information Platform (IHIP) under NCDC. There are several disease control programmes implemented by State governments through Directorate of Health Services under MoH&FW. The National Vector Borne Disease Control Programme (NVBDCP) is an umbrella programme for prevention and control of six vector borne diseases in humans, of which one is zoonotic disease (Japanese Encephalitis). There are also specialised institutions like the Vector Control and Research Centre, Puducherry and ICMR centres that studies different aspects of infectious disease. NCDC also leads an Intersectoral Coordination Programme for Prevention and Control of Zoonotic Diseases which was approved in the 12th Five-year plan (2012-17). The programme aims to co-ordinate between medical, veterinary, wildlife sectors and other stakeholders with the aim to prevent and control of zoonotic diseases. It monitors nine most common diseases and nine relatively less prevalent infections, as defined by IDSP. The experts we interviewed find that the allocations under this programme have been too limited to make a significant impact. There is also a standing committee on zoonosis chaired by Director-General Health Services (DGHS) which is facilitated by NCDC. In addition to central programmes, there are state-specific, human and animal infectious diseases control programmes as well.

According to the experts we interviewed, the various animal-human disease surveillance programmes established under different ministries and agencies operate independently and often data is gathered for the same disease using different metrics and standards. As a result, often duplicate, redundant and unverified data gets collected, resulting in a complex, uncoordinated, and ineffective disease-mapping mechanism and response systems.

The post-COVID landscape

Even before the onset of COVID-19, the Government of India had taken steps to prevent epidemics using the One Health (OH) concept. Post COVID-19, more measures have been put in place. These include: strengthening disease surveillance among animals; improving rapid response to stop outbreaks becoming epidemics; using better diagnostic tools and vaccines; and prioritising health of livestock.

An overarching mission titled the National One Health Mission under the office of the Principal Scientific Advisor to the Prime Minister has been constituted. The Mission will coordinate between ministries, agencies, and stakeholders to advance the One Health agenda in India. Two World Bank loans: first to the Department of Animal Husbandry & Dairying (DAHD) titled 'Animal Health System Support for Improved One Health (AHSSOH)' (P177671, loan amount $82 million, 2023-2028),[3] and second (titled, Transforming India's Public Health Systems for Pandemic Preparedness Program, PHSSP, loan amount $500 million, 2022-2027), is under MoH&FW.[4] There are critical areas of convergence in both these projects.

The AHSSOH project will cover five states (Assam, Karnataka, Maharashtra, Madhya Pradesh, and Odisha). The Bill & Melinda Gates Foundation (BMGF) provides support to the One Health Technical Support Unit (OHTSU) within the DAHD under the Ministry of Fisheries Animal Husbandry and Dairying (MoFAHD). OHTSU is developing technical capacity, strengthening centre-state coordination, and collaborating with international organisations. BMGF also supports state-level intervention programmes in Uttarakhand and Karnataka.[5] A few bilateral agencies (like GIZ, Shastri Indo-Canadian Institute, others) have also initiated One Health programmes.

[3]Sieglinde H, Katjiuongua B, Kumar A, Joshi A. Animal Health System Support for One Health Program (AHSSOH): Project Details, P177671, 31 March 2023. Available from: https://projects.worldbank.org/en/projects-operations/project-detail/P177671.

[4]Health, Nutrition & Population Global Practice: South Asia Region. PHSPP: Transforming India's Public Health Systems for Pandemic Preparedness (P175676). The World Bank, June, 2022. Available from: https://documents1.worldbank.org/curated/en/232991656371351229/pdf/India-Transforming-Indias-Public-Health-Systems-for-Pandemic-Preparedness-Program-for-Results-Project.pdf.

[5]Department of Animal Husbandry & Dairying (DAHD). One Health Pilot to be launched in Bengaluru tomorrow: Ministry of FAHD is implementing the One-Health Framework undertaking project in Karnataka and Uttarakhand. Ministry of Fisheries, Animal Husbandry & Dairying. Press Information Bureau. New Delhi, 27 June 2022. Available from: https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1837227

Centre-state coordination in infectious disease management

There were significant revisions to national and state legislations, which led to recalibration of powers of states and empowerment of institutions during the COVID-19 pandemic. These revisions have been made in public health laws and impact health systems. From the perspective of emergence of potential and new zoonotic infectious diseases (ZIDs), special provisions need to be adopted in both animal and public health laws. Most respondents emphasized on the need for a greater role of veterinary sciences and veterinarians. Veterinary science will play a critical role in preventing future epidemics by identifying and controlling diseases that originate in animals, which can also affect human health. The experts we interviewed suggest that more extensive survey of animals such as rodents, civets, bats, cows, buffaloes, among others is needed to pre-emptively identify potential pathogens. Wildlife and domesticated animals need to be carefully studied, separately and together in places where they interact.

There needs to be greater coordination to monitor and manage disease outbreaks through coordinated efforts across sectors. Most experts we interviewed opined that there is no comprehensive policy that links veterinary science practitioners with public health professionals. One Health lies at the intersection of animal, ecosystem and human health. There are also multiplicity of acts and legislations that govern public and animal health. Multiple ministries, agencies and government bodies currently advise, oversee, and monitor the implementation of regulations of diseases, these include Ministries of Agriculture and Farmers' Welfare; Animal Husbandry, Dairying, and Fisheries; Health & Family Welfare; Science & Technology; Environment, Forest, and Climate Change; Commerce and Industry, along with state and disease- specific surveillance agencies. Experts seek significant revisions to harmonize animal and public health laws to bridge gaps for effective and early response on outbreaks and epidemic management. The overall policy to govern epidemics and outbreaks needs to be relooked to cover all complex jurisdictional areas.

The coordination between managers of different sectors is most needed and yet most difficult to achieve as a mechanism to build an effective One Health programme. Empowering managers at the grassroots, starting with panchayats in villages and wards in urban settings to districts and states is needed. Building transparency and accountability into the system and ensuring incentives that reward responsiveness and proactive action, and rewards for innovation for managers is a way forward. This will be a major cultural shift in way governments work at all levels, but in order to stay one step ahead of outbreaks and epidemics, a coordinated and agile system is essential.

Building a governance structure for infectious disease control

In the event of an outbreak, the chief executive officer of the jurisdiction is empowered to take action. At the district level, all discussions are routed through the district collector's office. District collectors and allied officials especially the chief medical officer, animal and agricultural officers, and conservator of forest or divisional forest officer converge to mitigate an outbreak.

The experts we interviewed agree that the District Collector's office is best suited to coordinate with different departments and the District Disaster Management Agency, which has additional powers conferred by National Disaster Management Authority (NDMA). Such convergence is taken as close to the ground as possible. However, such matters often lead to delays since most district collectors have limited interaction with animal husbandry, forest department, and even public health officials. District collectors and other officials must develop stronger relationships with each other, triggered by clearly defined red flags. There is a clear absence of protocols and defined roles deters timely response when outbreaks or epidemic occur.

Even within veterinarians there is a little coordination. Wildlife, livestock and municipal vets seldom interact. There are only a few vets who specialise on wildlife diseases. There are also few defined standard operating procedures on how potential pathogens from living and carcasses of wildlife needs to be taken. Several sanctuaries, national parks, and even zoos have limited capacity and infrastructure to handle emergence of new fevers. There is overdependence on wildlife

conservation groups (like Worldwide Fund for Nature, WWF) to support collection and diagnosis when wild animals die. Municipal veterinarians who certify abattoirs and oversee animal hospitals have no common platform to share their data or reports.

To establish a robust reporting mechanism for disease outbreaks, it is crucial to empower districts to report to their respective state agencies, which should then alert the central agency. The central government has powers to take measures to prevent spread of infection between states and at ports of entry. The central agency's role in local response should be to provide financial and technical support to states, make available real-time surveillance data and the use of early warning systems to alert state officials. A group of state and national experts should then work collaboratively to decide the level to which the response needs to be escalated. Overall, a participatory policy should support proactive efforts at the grassroots to detect early signs of outbreaks and foster collaborations between various departments.

Clear operating procedures – from monitoring pathogens, reporting outbreaks, responding and mitigating – for agencies and officials at district, state and national-level are needed.

There are several agencies, departments, scientific and research organizations, and laboratories that need to coordinate with one another. Other than capacity and institutional limitations, India will need to overcome a shortage of veterinary and public health workers, provide training for epidemiologists, coverage of diagnostics and treatment services and infrastructure gap, reduce delays in reporting disease outbreaks, and intensify surveillance within and across districts and states.

Experts agree that a central authority that oversees both animal and public health should respond to any biological emergency such as threats of laboratory accidents and leaks. Currently, India lacks a formal policy for biological disasters, other than provisions and measures highlighted in the NDMA's Guidelines for Biological Disasters. Although India already has a National Crisis Management Committee that convenes as soon as there is a threat to national security, it is only mandated to coordinate responses once a disaster has occurred. It does not pre-emptively focus on preventing outbreaks. It also lacks specific focus on biological emergencies. This nodal agency should oversee the functions across domestic,

wildlife, human, and ecosystem health, and bring together experts from different ministries, research groups, representatives from the private sector, and other experts to ensure a comprehensive and collaborative approach. An independent committee comprising experts from animal and human health should provide oversight and strategic guidance to the agency. In summary, despite the significant investment in new programmes and policies, most experts believe multiplicity of roles and duplication of efforts between different actors must be mapped first and eliminated.

Given that infectious diseases are constantly evolving; it is crucial for India to invest in an agency that can effectively coordinate policy responses for any future emergency. Future infectious disease research and interventions must embrace an interdisciplinary, multidisciplinary and cross-disciplinary approach. They need to foster partnerships with smaller regional and local institutions to decentralize operations while building capacities especially for local institutional based and community-led early warning systems. To enable this there must be a centralized national-level heat maps and dashboards linked with real-time databases. Local level heat maps, diagnostic facilities, and localised rapid response teams (RRTs) will relay action taken from the ground to the centre. Real time data can keep district, state, and the centre in-sync.

Failures to detect the disease early means that transmission gets firmly established before local administration can begin to respond. To ensure effective disease monitoring, reporting, and control, it is crucial to incentivize and not punish vigilant local veterinarians, health workers, and other frontline workers, and stakeholders like farmers, herders, and pastoralists. Frontline workers and managers must receive adequate training to detect anomalies and be empowered to raise red flags. Creating a culture of openness and transparency in disease control is vital to encourage workers to report potential issues or concerns without fear of retaliation or negative consequences. Incentives should be provided to frontline workers who report red flags, rather than reprimand them for false alarms or mistakes. Given the potential risks associated with outbreaks, it is better to err on the side of caution and take swift action to prevent an outbreak from spiralling out of control. Providing assurance to frontline workers that reporting issues will not lead to any negative consequences is critical. By incentivizing and recognizing the

efforts of frontline workers to report red flags and fostering a culture of transparency and learning, disease control efforts can improve their overall effectiveness and reduce the risk of errors in the long run.

Most experts we interviewed endorsed that even post-COVID the funding scenario has not changed, despite more funding being made available. Some experts point that India may not be making adequate use of its existing infrastructure and whether it is optimally used. They cite that intramural and extramural funding within ministries and departments is quite strait-jacketed. This leaves very little scope for cross-department and transdisciplinary research. International funding and drawing collaborations with industry is cumbersome. Publishing data on new pathogens and further research on them is seldom encouraged. Documentation in India's scientific institutions remain limited as there are no real incentives for publications and filing for patents.

Leveraging data and digital technologies to counter diseases

To effectively identify and respond to infectious disease risks, traditional event-based surveillance needs to be complemented with data integration and advanced analytics. However, incomplete and inaccurate data has impeded outbreak response. Such problems occur in part because disease surveillance is based on traditional and obsolete practices. Frontline health workers report data through paper-based analogue channel. Transforming analogue systems to digital will help better coordination and reduce response time. At present there are multiple sources of data and yet there is limited synthesis and analysis.

India requires strong detection and response capabilities at both local and national levels, as well as a network of first responders to prevent the spread of disease. Timely entry and analysis of data is crucial, as is rapid validation of the data and on-ground verification. However, India's public and animal health are mired with under-reporting and misdiagnosis when outbreaks and fevers occur. This is largely due to the perception

among frontline workers and health official in-charge that it will reflect poorly on them, and the administration as a whole. This can partially be overcome through incentivization of grassroots workers to report suspected outbreaks. It is better to err towards being overcautious than regret error of omission. Even as we begin to set up a single database, it is important we begin first by harmonizing data obtained from different disease surveillance programmes. Private stakeholders (eg: dairy and poultry cooperatives, animal insurance companies) should be involved in disease surveillance programmes and outreach. A single mobile technology platform that can link all animal and public health workers to databases should be used, and regular validation from grassroots workers is necessary. There is one mobile app of note (e-Gopala) which has been optimally rolled out in some states. Such apps need to have a line-list of zoonotic diseases and record symptoms of unknown or undiagnosed fevers. Experts cited the example of the Thailand's Participatory One Health Digital Disease Detection (PODD) which was launched in 2014. PODD detects emerging animal and environmental health threats in the Chiang Mai region of Thailand but has been adopted by the entire country, as well as neighbouring countries such as Vietnam. The list of notifiable diseases needs to be backed by regular sero-surveillance and vaccine effectiveness monitoring. Involvement of stakeholders at the grassroots level, especially pastoralists, animal herders and farmers, animal insurance agents, animal and livestock cooperatives, animal welfare boards and specialised NGOs that work with animal care, and auxiliary health workers, is vital. The use of versatile AI/ML-backed technologies need to be harnessed to improve disease prediction systems which presents real-time scenarios and building more robust models of risk assessments of disease outbreaks. Different levels of simulation exercises should be conducted to train epidemiologists, managers and policymakers and assess India's and disease forecasting, emergency plans, procedures, and policies at the district-state and national levels. There are some interesting initiatives from India that need to be highlighted and replicated. Tata Institute for Genetics and Society in collaboration with Bangalore Water Supply and Sewerage Board

[6] M Dunowska. Cross-species transmission of coronaviruses with a focus on severe acute respiratory syndrome coronavirus 2 infection in animals: a review for the veterinary practitioner. New Zealand Veterinary Journal, 2023. DOI: 10.1080/00480169.2023.2191349

(BWSSB) and Bruhat Bengaluru Mahanagara Palike (BBMP) to conduct environmental surveillance of the wastewaters and has built a real time monitoring system to understand disease dynamics and tracking of SARS-CoV-2. The wide application of environmental surveillance using novel metagenomics can be important step forward to anticipate and predict disease outbreaks.

Another interesting observation shared by an expert was in the unequal relationship within and between departments. There is need to bridge current gaps between animal and public health departments at central and state level. Only after the two departments are accorded equal importance can greater coordination of frontline animal and health workers be possible. There are also several frontline workers and stakeholders who see the first signs of sickness and disease. There is no mechanism to involve these 'first responders.'

What India needs to do to prevent the next pandemic?

In summary, the experts we interviewed made the following broad recommendations:

1: Empower a dedicated agency to monitor epidemics: Most experts we interviewed emphasized the need for setting up a new specialized agency with special powers to coordinate across Centre and State, and their institutions. The most suitable agency to advance One Health will be under the guidance of the Office of the Principal Scientific Advisor. The Office of the PSA will coordinate with key ministries and agencies to develop comprehensive guidelines for disease control which link panchayat, municipal, district levels to state and national agencies. In addition, a unified reporting structure, backed by decision support systems is vital.

2: Improve coordination between Centre-State and animal-public health institutions: For better coordination, the One Health programme requires stronger networking, clear demarcation of roles and responsibilities, and regular and open channel of communication.

3: Leverage the use of technology: The use of advanced technologies such as Artificial Intelligence (AI), Machine Learning (ML), and metagenomics can play a crucial role in enhancing One Health initiatives. It can provide accurate, real-time monitoring, and support predictive analytics and present trends for decision makers. AI/ML can analyse large datasets from diverse sources (eg: clinical, environmental, and social media data) and identify patterns to predict disease outbreaks. It can help develop early warning systems and track disease spread, allowing for timely interventions.

4: Building trust through transparency and information sharing: To advance One Health, from grassroots to policymakers, requires framework built on trust and transparency. One Health programmes need to be inclusive, participatory and one which provide voice to local stakeholders. In order to adopt new scientific methods, myths, misconceptions and rumours need to be weaned out of the system. Evidence-based policies and practices need to be translated and conveyed in simple terms and in local languages for dissemination. Understanding local audience and contexts at the grassroots will be vital. Containing and managing infodemic onsite should be integral to control of the disease itself. This is best handled as close to the ground as possible, rather than at the centre.

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