CII

Confederation of Indian Industry

The One Health Paradigm

Unifying Health for a Sustainable Future

October 2023

PRIMUS PARTNERS

Foreword

Dr. Naresh Trehan

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I am pleased to introduce this pivotal report, titled **"The One Health Paradigm: Unifying Health for a Sustainable Future."** This report underscores the indisputable interconnected-ness of human, animal, and environmental health, reaffirming that our well-being transcends boundaries between these domains. The understanding conveyed within these pages highlights the vital need for embracing a holistic and interdisciplinary approach to health.

India's "One Earth, One Family, One Future" initiative, as highlighted in this report, signifies our nation's steadfast commitment to safeguarding the health of our citizens, our environment, and the well-being of generations to come. It serves as a clarion call for collective action, unwavering collaboration, and visionary leadership in the realm of health.

In our unwavering pursuit of health for all, we must confront the challenges posed by zoonotic diseases, antimicrobial resistance, food safety risks, and the far-reaching implications of environmental factors. This report confronts these multifaceted issues with a clear-eyed determination to unearth solutions that traverse boundaries and, in doing so, transform countless lives.

I extend my heartfelt appreciation to all the dedicated individuals, experts, and stakeholders whose unwavering commitment and unrelenting efforts have contributed to the shaping of this report. Your tireless endeavours are guiding us toward a future where health is not a privilege but an inviolable human right.

I invite you to immerse yourself in the insights contained within these pages. Together, let us embark on an extra-ordinary journey to transform the vision into a tangible reality.

Foreword

It is a privilege to introduce this report**, "The One Health Paradigm: Unifying Health for a Sustainable Future."** This document represents our collective commitment to the transformation of health in India.

At the heart of this report, we find the One Health paradigm, representing a fundamental change in our approach to health challenges. It underscores the intricate interconnection of humans, animals, plants, and the environment, emphasizing that the well-being of one domain is inextricably linked to the health of all.

This report encapsulates the very essence of "Health for all" and articulates a compelling vision for the future of health in India. It underscores the indispensable role of collaborative, multi-sectoral efforts in realizing comprehensive health for all. By fostering a holistic perspective on health, addressing zoonotic diseases, combating antimicrobial resistance, enhancing food safety, and embracing digital interventions, we are establishing the groundwork for a healthier and more resilient India.

Notably, the relevance of this report extends beyond national borders. In a world characterized by interconnectivity and shared vulnerabilities, India's leadership in advocating the One Health approach within the G20 exemplifies our unwavering commitment to global health.

I wish to express my profound gratitude to all the contributors who have shared their expertise to craft this report.

I encourage you to delve into the contents of this report, assimilate its valuable insights, and join us in our shared mission to shape a healthier, fairer, and more sustainable future for everyone.

Mr. Hari Menon

Chairman,
CII Public Health Council
&
Director, India Country Office,
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Foreword

Mr. Dilip Jose

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The focal point of this report is the **"One Health paradigm"**, which emphasizes the interconnected-ness of human health, animal health, and environ-mental well-being. It lays out a transformative vision
for a sustainable future, where these components are holistically integrated to preserve the health of our planet and all its inhabitants.

Within the report, you will discover insights and recommendations that showcase the potential of One Health to revolutionize healthcare. It calls for the policy recommendations that often segregate human medicine, veterinary science, and environ-mental studies, emphasizing that the well-being of humans, animals, and our ecosystems is profoundly interrelated.

I extend my sincere thanks to all those who have contributed to this report and to the broader One Health movement. As we launch this report, let us also launch a renewed commitment to One Health, with the well-being of all life on Earth as our guiding principle.

This report underscores our commitment to a sustainable future where human health, animal health, and the environment are holistically considered and safeguarded.

I eagerly anticipate the positive changes we will collectively usher into our world through the principles of One Health.

Foreword

The One Health Paradigm: Unifying Health for a Sustainable Future report embodies the important principles, offering a comprehensive roadmap for addressing the intricate health challenges facing our nation.

The One Health approach has emerged as a strategic necessity in our pursuit of a healthier India.Recognizing the intricate connections between human health, animal health, and the environment, we embark on a transformative journey that surpasses traditional boundaries and divisions.

This report is a combined expertise of a diverse array of experts and policymakers who have united in their pursuit of a future where health is not a luxury but a necessity for every individual. It underscores the vital need for integrated healthcare systems that are resilient, responsive, and adaptable to the ever-evolving health landscape.

India's global leadership, notably within the G20, positions us uniquely to advocate for the "One Health" approach as a global imperative. This approach aligns seamlessly with the Sustainable Development Goals, recognizing the intricate links between health, well-being, and environmental sustainability.

I extend my accolades to all those who dedicated their efforts to shaping this report.

I cordially invite stakeholders, policymakers, industry leaders, and health professionals to engage deeply with the insights and recommendations within this report.

Mr. Chandrajit Banerjee

Director General,
Confederation of Indian
Industry (CII)

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Abbreviations

AMR	Anti-microbial Resistance
ABDM	Ayushmann Bharat Digital Mission
BSL	Biosafety Level
CDC	Centre for Disease Control
CSS	Central Sponsored Schemes
FAO	Food and Agricultural Organisation
GHSA	Global Health Security Agenda
GMP	Global Manufacturing Practices
HIE	Health Information Exchange
ICT	Information & Communication Technology
IDSP	Integrated Disease Surveillance Programme
MOOC	Massive Open Online Courses
NAPCC	National Action Plan on Climate Change
NHM	National Health Mission
OH JPA	One Health Joint Plan of Action
PPR	Pandemic Preparedness and Response
SARS	Severe Acute Respiratory Syndrome
SDG	Sustainable Development Goal
NGS	Next Generation Sequencing
SBCC	Social and Behavioural Change Communication Strategies
UHC	Universal Health Coverage
UNEP	United Nations Environment Programme
WOAH	World Organisation for Animal Health
WHO	World Health Organisation

Preface

In a world marked by profound transformations, the conventional boundaries that once confined our understanding of health are rapidly dissolving. The emergence of the One Health paradigm represents a transformative shift in how we perceive and address health challenges on a global scale. This visionary approach underscores the intricate interplay between human, animal health, and environmental, recognizing that the well-being of all these domains is profoundly interconnected.

Confederation of Indian Industry (CII) is poised to present a pioneering report that charts a path toward "Health for All" through the profound principles of One Health. Our contemporary world is marked by unprecedented interconnectivity, where diseases can traverse borders with ease. This reality underscores the necessity of collab-orative efforts to monitor, detect, and respond to these threats, forming the cornerstone of global health security.

The report takes cognizance of the Sustainable Development Goals (SDGs), a comprehensive framework for global progress, and aligns One Health seamlessly with these objectives. It acknowledges the intricate interplay of social, economic, and environmental factors in shaping well-being and underscores the importance of an integrated approach that encompasses these dimensions.

Within the pages of this report, a diverse array of objectives is explored, ranging from fostering multi-sectoral collaboration and strengthening disease surveillance systems to advancing climate change adaptations, integrated immun-ization strategies, and nurturing a culture of quality within the health ecosystem. Together, these objectives pave the way for holistic and comprehensive solutions that encompass food safety, livelihood improvement, and zoonotic disease prevention.

As we set forth on this transformative path towards achieving "Health for All", we will delve into the profound impact of the One Health paradigm. Together, let us envision a healthier, more resilient future where the well-being of humanity, animals, and the environment is intertwined and secure.

Executive Summary

The recent pandemic has made us realise that the health of human beings cannot be seen in isolation.

There is an undeniable interconnection between humans, animals, and the environment which is being recognized as **One Health.**

The human population's continuous growth, rapid industrialization, and complex geopolitical challenges have fuelled significant global transformations.

Unfortunately, these changes have resulted in profound consequences for biodiversity, leading to extensive damage to ecosystems and triggering substantial migratory patterns among both human populations and various species. The health of humans, animals, and the environment should be seen as interconnected elements that form an integral continuum. If one aspect is compromised, it can have cascading effects on the others.

One Health originated as a concept that shed light upon the domino effect that one lifeform's activities can have on the entire ecosystem. This integrated perspective recognized that the health of humans, animals, and ecosystems are interconnected and that collaboration across disciplines is essential for effective disease prevention, control, and surveillance.

Over the years, One Health has evolved into an approach towards identifying ways to modify practices in order to have a sustainably healthy future for all lifeforms and lately, it has emerged as a movement in light of the Covid-19 pandemic. The idea of a unified approach to health emerged as early as the 19th century, with pioneers like Rudolf Virchow, a German physician, who emphasized the links between human and animal health. He is credited with originating the term "zoonosis" to define illnesses that have the potential to pass from animals to humans. In the 1980s, epidemiologist Calvin Schwabe called for a unified approach, encompassing human and veterinary medicine, to effectively combat zoonotic diseases.

This laid the modern foundation for the principles of One Health wherein the ultimate objective is to achieve optimal health outcomes while recognising the inter-connectedness of all elements within the One Health framework. The emergence of zoonotic diseases like SARS, Ebola virus infection, and the COVID-19 pandemic in recent times has underlined the critical need for implementing a global One Health and ecosystem-centered approach.

The concept of One Health has gained significant recognition as a holistic approach to addressing complex health challenges at the intersection of human, animal, and environmental health.

The report highlights key actions and strategies for advancing One Health in India. First, it emphasizes the importance of policy and governance, calling for investment in the National One Health Mission and expanding its scope to achieve long-term goals. The report highlights key actions and strategies for advancing One Health in India.

First, it emphasizes the importance of policy and governance, calling for investment in the National One Health Mission and expanding its scope to achieve long-term goals. This will provide a solid foundation for coordinated efforts in the future. The report emphasizes the need to strengthen surveillance and early warning systems for infectious diseases, particularly zoonotic diseases, through improved data collection, sharing, and analysis capabilities. Collaboration and information sharing between the human and animal health sectors are essential for effective disease detection and response. Research and development play a crucial role in One Health.

Encouraging interdisciplinary collaboration and innovation in areas such as zoonotic disease transmission, antimicrobial resistance, and ecosystem health will drive progress and facilitate evidence-based interventions.

Moreover, to enhance the efficiency of information dissemination, facilitate data sharing, and promote collaborative decision-making across essential departments such as those focused on animals, humans, and wildlife/forestry, there is a recognized necessity to establish an institutional framework that includes representatives from the relevant departments.

Capacity building is identified as a critical step in enhancing knowledge and skills among healthcare professionals, veterinarians, and other stakeholders. Training programs and initiatives should be implemented to ensure a well-equipped and interdisciplinary workforce capable of addressing One Health challenges.

The report underscores the importance of collaboration and partnerships, both within sectors and with international organizations and research institutions. Leveraging expertise, resources, and best practices will enhance the effectiveness of One Health initiatives.

Public awareness and community engagement are vital to promoting the interconnectedness of human, animal, and environmental health. Public awareness campaigns should be launched to educate communities and encourage their participation in disease surveillance, prevention, and control efforts.

Adequate **infrastructure and resources,** including laboratory facilities, diagnostic capabilities, and research infrastructure, are necessary for the effective implementation of One Health approaches. Investment in these areas is crucial to support the required infrastructure and skilled personnel.

Furthermore, it is imperative to conduct a gap analysis of laboratories, particularly those in the veterinary and wildlife/forest sectors, and subsequently allocate investments in infrastructure to bring them up to the same standard as those dedicated to human health.

The report highlights the need for **legislation and regulations** that align with One Health principles. Regulations on food safety, animal welfare, antimicrobial use, and environmental protection should be developed and enforced.

Collaboration between relevant regulatory bodies will ensure harmonized standards and effective implementation. International cooperation is emphasized as a key aspect of advancing One Health. Engaging in global initiatives, sharing information and best practices, and contributing to international efforts will help combat zoonotic diseases and promote ecosystem health.

Finally, **monitoring and evaluation** mechanisms are essential to assess the progress and impact of One Health initiatives. Regular assessment will identify areas for improvement and allow for the adjustment of strategies as needed.

By implementing these recommended actions, India can strengthen its One Health approach, ensuring a comprehensive and integrated ecosystem that addresses health challenges at the human-animal-environment interface.

Embracing these key areas of focus, including policy reforms, disaster management, surveillance systems, climate change, immunisation, workforce development, regulations and compliance, social and behaviour change, integrative medicine, digital interventions, public-private partnerships, and quality management, will contribute to the advancement of the One Health approach.

By adopting a comprehensive and collaborative approach, we can effectively address health challenges, promote resilience, and improve the well-being of humans, animals, and the environment.

Background

The initiative "One Health, One India, One Future" is a visionary approach that seeks to integrate the principles of One Health into India's healthcare framework. This concept recognizes the intricate connections between humans, animals, plants, and their shared environment, emphasizing that the well-being of all three domains is interconnected.

The One Health approach acknowledges that diseases can pass through animals to humans, often facilitated by environmental factors. This recognition becomes particularly crucial in a world where urbanization, globalization, and ecological changes are influencing disease emergence and transmission. Approximately 60% of existing human infectious diseases are zoonotic in nature, with 75% originating from animals, while the emergence of five new diseases annually includes three stemming from animal sources.

Due to its rich array of wildlife, substantial livestock numbers, and densely populated humancommunities, India faces elevated susceptibilities to the cross-boundary dissemination of diseases. The occurrence of the Covid pandemic, recent incidents of Lumpy Skin Disease affecting cattle, and the ever-present specter of Avian Influenza demonstrate that disease management transcends the confines of human health alone (zoonosis). It is imperative to encompass the perspectives of livestock and wildlife health. This context also creates avenues for harnessing the innate synergies and proficiencies within each sector, allowing the formulation of holistic, resilient, and adaptable response mechanisms. By adopting a One Health perspective, India aims to proactively address health challenges by understanding and managing these interdependencies.

The concept of a National One Health Mission is gaining momentum with numerous ongoing One Health initiatives across various Ministries of the Government of India and private organizations, alongside similar endeavors globally. This situation provides an opening to assess the underlying focal points of each initiative, recognize potential avenues for collaboration, and endeavor to address any remaining deficiencies.

The initiative's significance is further elevated by two key factors:

- **Holistic Health Care:**
  The ongoing global response to the COVID-19 pandemic underscores the importance of preparedness, collaboration, and a holistic view of health. India's response to the pandemic has showcased its capabilities. It highlighted the need for coordinated efforts between the healthcare, veterinary, and environmental sectors.

- **G20 Leadership:**
  India's leadership role within the G20 provides a platform to influence international health agendas. By championing the One Health approach, India can advocate for global cooperation in addressing health challenges that transcend borders.

The thematic underpinning of "One Earth, One Family, One Future" reflects India's growing global influence and its commitment to sustainable development.

This theme encapsulates the idea that the well-being of humanity, animals, and the environment are interconnected, and securing a healthy future requires a unified approach.

Rationale

The Confederation of Indian Industry (CII) is aiming to create a vision report to envisage a roadmap to achieve Health for All through One Health approach. The rationale behind the proposed initiative is:

Addressing health issues through a One Health lens allows for comprehensive and holistic solutions. For instance, improving animal health can enhance food safety, secure livelihoods for communities dependent on livestock, and prevent zoonotic diseases.

With the world becoming more interconnected, the rapid spread of diseases is a major concern. Collaborative efforts to monitor, detect, and respond to disease threats across borders are crucial for global health security.

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Achieving the Sustainable Development Goals (SDGs) requires an integrated approach that considers social, economic, and environmental factors. One Health aligns with this agenda by recognizing the complex interactions between different aspects of well-being. One of the goals emphasizes health, specifically SDG 3, which obliges governments to guarantee healthy lives and advance well-being for everyone, regardless of age. Nevertheless, the attainment of this this objective hinges on proactive measures across the domains addressed by various other SDGs. These encompass eradicating poverty (SDG 1), and addressing hunger (SDG 2), facilitating comprehensive and fair access to quality education (SDG 4), and ensuring the presence of water and sanitation services (SDG 6), among numerous additional targets. It also helps address mitigating the impact of climate change on human, animal, and environmental health by promoting sustainable land use practices, reducing greenhouse gas emissions, and preserving biodiversity (SDG 13: Climate Action). Furthermore, the One Health approach aligns with Sustainable Development Goal 15 (Life on Land) by averting the dissemination of animal diseases and diminishing the likelihood of zoonotic disease transmission.

A One Health approach can lead to synergies in policymaking. By integrating human health, animal health, and environmental concerns, governments can streamline efforts and resources, leading to more effective policies.

Environmental factors are contributing to the spread of diseases. Changes in ecosystems, climate, and biodiversity can alter disease vectors, making it imperative to consider the health of the environment alongside human and animal health.

Humans, animals, and the environment share resources such as water, food, and habitats. Pollution, contamination, and overexploitation of these resources can have direct health implications for all three domains.

The irrational use of antibiotics and other antimicrobial agents in both human and veterinary medicine has led to the emergence of drug-resistant pathogens. A One Health approach promotes responsible use of antibiotics, recognizing that the same drugs are often used in both human and animal health. The use of water contaminated with antibiotics, drug-resistance genes, or antibiotic-resistant bacteria results in further transmission of these micropollutants- emerging contaminants into the environment, thereby increasing the risk of spreading drug resistance and endangering public health.
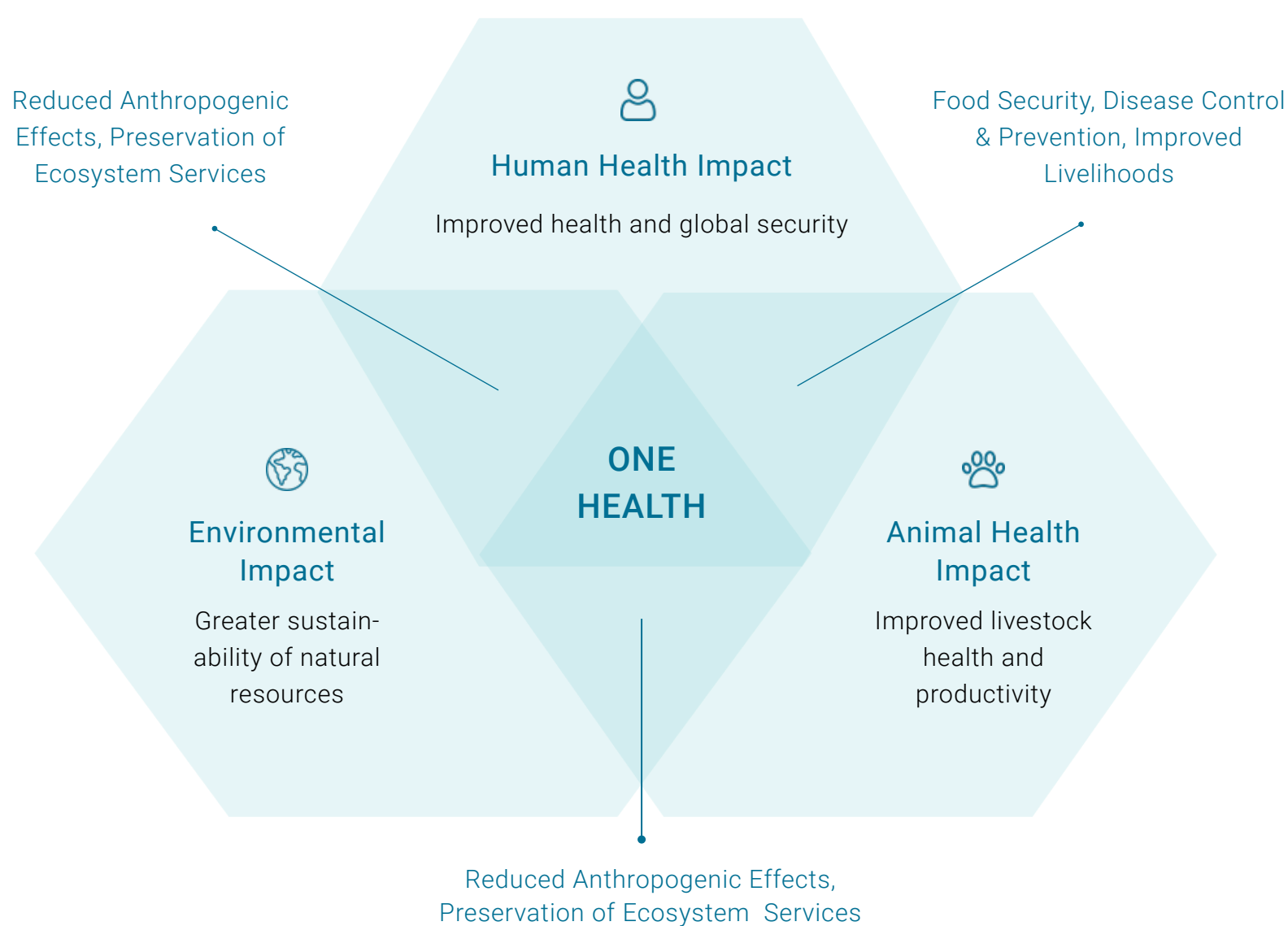
Key Objectives

To achieve "health for all" through various measures, i.e., (which has been discussed later in detail in the chapters of the document):

- Multi-sectoral collaboration
- Robust disease surveillance systems
- Climate Change Adaptations
- Integrated Immunization strategy
- One health approach in medical and veterinary education
- Regulations and compliances

- Promoting Healthy Behaviour and Preventing the Spread of Diseases
- Strengthening health infrastructure
- Inclusion of integrative medicine
- Digital Intervention
- Public-Private Partnerships
- Fostering a quality culture

The Vision report will focus on these points, keeping in mind the foundation of One Health - **Communication, Coordination, and Collaboration.**

Reduced Anthropogenic Effects, Preservation of Ecosystem Services

Human Health Impact
Improved health and global security

Food Security, Disease Control & Prevention, Improved Livelihoods

Environmental Impact
Greater sustain-ability of natural resources

ONE HEALTH

Animal Health Impact
Improved livestock health and productivity

Reduced Anthropogenic Effects, Preservation of Ecosystem Services

Key Significance of One Health Interventions

1. Interventions will help reduce financial losses for the country.

2. Eradication of the diseases is possible with planning and systematic interventions.

3. Interventions will bring focus on the overall economic health through its trans-disciplinary approach among various departments and at a global level.

4. Through the process of risk analysis and awareness campaigns, foodborne diseases can be prevented at a large scale.

5. Interventions help in establishing and developing centers of excellence for education and training in zoonotic diseases, awareness, and preventive measures.

Key Considerations

Chapter 1 · Integration of Efforts – Policy Reforms with multi-sectoral collaboration

No.	Challenges	Policy Recommendations
1a	Research and Development	Encourage interdisciplinary research in areas such as zoonotic disease transmission, antimicrobial resistance. Establish research grants and incentives for cross-sectoral research collaboration involving scientists, public health experts, veterinarians, medical professionals, and environmental experts, etc.
1b	Capacity Building	Invest in training programs for healthcare professionals, veterinarians, and relevant stakeholders to enhance their understanding of One Health principles and practices. Foster interdisciplinary education and collaboration to facilitate holistic health approaches.
1c	Collaboration and Partnerships	Foster collaboration among relevant sectors and ministries, both at the national and state levels. Strengthen partnerships with international organizations, research institutions, and other countries to leverage expertise, resources, and best practices.
1d	Public Awareness and Community Engagement	Launch of public awareness campaigns to educate communities about the interconnectedness of human, animal, and environmental health. Encourage community participation and engagement in disease surveillance, prevention, and control efforts.
1e	Infrastructure and Resources	Allocation of adequate resources for the development and maintenance of laboratory facilities, diagnostic capabilities, and research infrastructure. Ensure the availability of necessary equipment, supplies, and skilled personnel.
1f	Legislation and Regulations	Develop and enforce regulations that support One Health principles, including regulations related to food safety, animal welfare, antimicrobial use, and environmental protection. Enhance collaboration between relevant regulatory bodies to harmonize standards.
1g	International Cooperation	Engage in international cooperation and collaboration to address global health challenges. Participate in regional and global initiatives, exchange information and best practices, and contribute to international efforts in combating zoonotic diseases and promoting ecosystem health.
1h	Monitoring and Evaluation	Establish mechanisms to monitor and evaluate the progress and impact of One Health initiatives in India. Regularly assess the effectiveness of interventions, identify areas for improvement, and adjust strategies accordingly.

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Chapter 2 · Disaster Management with Robust Disease Surveillance Systems

No.	Challenges	Policy Recommendations
2a	Early Detection of Zoonotic Diseases	Implementation of a comprehensive One Health surveillance system that integrates human, animal, and environmental data. Establish a network of well-equipped laboratories for early detection of zoonotic diseases. Promote collaboration between health authorities and veterinary agencies to monitor and report potential threats. Encourage the use of advanced genomic tools for rapid pathogen identification.
2b	Interdisciplinary Collaboration	Development of policies that foster interdisciplinary collaboration among health professionals, veterinarians, environmental scientists, and relevant stakeholders. Establish clear communication channels and mechanisms for information sharing between sectors. Encourage joint training programs and capacity building initiatives to enhance collaboration.
2c	Data Transparency and Sharing	Enforcement of policies that ensure data transparency and sharing between local, regional, and national health authorities. Implement digital data platforms for real-time reporting and data sharing. Create incentives for organizations to share data with government agencies while protecting individual privacy.
2d	Financial Resources for Surveillance	Allocation of sufficient financial resources to support disease surveillance systems. Develop funding mechanisms to sustain ongoing surveillance efforts. Encourage public-private partnerships to enhance resource mobilization for surveillance infrastructure and technology.
2e	Population-Based Approaches	Promote population-based approaches to disease surveillance, including active monitoring of vulnerable communities and high-risk areas. Develop policies to prioritize surveillance in regions with a history of disease outbreaks. Implement community engagement programs to encourage reporting of unusual health events.
2f	Predictive Modeling for Intervention	Invest in epidemiological modeling and predictive analytics to guide intervention strategies. Support research and development of modeling tools that simulate disease transmission dynamics. Encourage the use of modeling data in policy decision-making.
2g	Preparedness and Rapid Response	Develop comprehensive disaster management plans that include strategies for rapid response to disease outbreaks. Establish communication protocols and coordination mechanisms among relevant agencies. Conduct regular drills and exercises to test response readiness.
2h	Digital Technologies for Surveillance	Embrace digital technologies such as data science, machine learning, and artificial intelligence for disease surveillance. Create policies that facilitate the adoption of digital tools for case tracking, outbreak prediction, and monitoring compliance. Ensure data security and privacy regulations are in place.

Chapter 3 · Climate Change: Impact and Adaptations

No.	Challenges	Policy Recommendations
3a	Increased Frequency of Extreme Weather Events	Develop and implement climate-resilient infrastructure and early warning systems to minimize the impact of extreme weather events. Enhance preparedness and response mechanisms for emergencies.
3b	Disruption of Food Systems	Promote sustainable agriculture and food security measures. Invest in climate-smart farming practices, crop diversification, and resilient supply chains. Support small-scale farmers and ensure access to nutritious food for vulnerable populations.
3c	Rise in Climate-Related Diseases	Strengthen disease surveillance and healthcare systems to respond to climate-related health risks. Implement vector control measures and public health campaigns to mitigate the spread of diseases.
3d	Vulnerability of Disadvantaged Groups	Development of targeted interventions and social safety nets for disadvantaged communities, including women, children, ethnic minorities, and impoverished populations. Ensure equitable access to healthcare and resources.
3e	Impacts on Mental Health	Establish mental health support programs and community-based interventions to address the psychological impacts of climate change. Promote mental health awareness and resilience-building.
3f	Health Risks to Livestock and Wildlife	Implement policies to reduce greenhouse gas emissions from the livestock sector. Promote sustainable land use, dietary choices, and wildlife conservation. Strengthen disease monitoring and management for animals.
3g	Ecosystem Disruption and Biodiversity Loss	Protect and restore ecosystems, including coastal wetlands, coral reefs, and mangroves, to safeguard biodiversity. Support habitat conservation and mitigate habitat loss due to climate change and human activities.

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Chapter 4 · Advancing Health through integrated Immunization Strategy

No.	Challenges	Policy Recommendations
4a	Multispecies Vaccination	Develop and prioritize research and development for vaccines that target zoonotic diseases and diseases affecting both humans and animals. Establish incentives for the development of such vaccines through public-private partnerships.
4b	Expanded Vaccine Coverage	Implement a comprehensive immunization program that ensures equitable access to vaccines for all, including underserved areas and marginalized populations. Strengthen outreach and vaccination campaigns to reach remote and vulnerable communities.
4c	Strengthening Domestic Vaccine Development	Invest in research and development for vaccine production, with a focus on domestic capabilities. Facilitate technology transfer from research institutions to the industrial sector for commercial vaccine production.
4d	Robust Surveillance Systems	Establish a nationwide surveillance system for early detection of diseases in both human and animal populations. Strengthen monitoring networks to track disease trends and enable prompt responses.
4e	R&D for Vaccines	Prioritize research and development for vaccines, especially for emerging infectious diseases. Foster collaboration between industry and academia to accelerate vaccine discovery and production. Embrace innovative approaches like mRNA technology.

Chapter 5 · Developing an inter-disciplinary workforce

No.	Challenges	Policy Recommendations
5a	Curriculum Reform	Integrate One Health principles into the medical and veterinary school curricula, including modules on zoonotic diseases, environmental health, and the impact of animal agriculture on public health. Establish clear learning objectives and competencies related to One Health.
5b	Access to Resources	Increase access to existing One Health guidance, tools, and information resources through online platforms, such as MOOCs (Massive Open Online Courses). Utilize school websites, course syllabi, and lectures to disseminate key One Health content. Create a centralized repository of One Health resources.
5c	One Health Training Program	Establish a national One Health training and education program open to professionals from all sectors. Develop standardized curricula and competencies for One Health education. Provide financial support for individuals from marginalized communities to participate in the program.

Chapter 6 · Regulations and Compliances: Key to Successful Execution

No.	Challenges	Policy Recommendations
6a	Human-Related Compliances for One Health	Establish clear regulations for food safety throughout the production chain, including animal feed, veterinary drug residues, hygiene, and labeling requirements. Mandate the prompt reporting of suspected zoonotic diseases to relevant health authorities
6b	Human-Related Compliances	Establish clear regulations for food safety throughout the production chain, including animal feed, veterinary drug residues, hygiene, and labeling requirements. Mandate the prompt reporting of suspected zoonotic diseases to relevant health authorities
6c	Animal-Related Compliances	Compliance measures should include guidelines for responsible antibiotic use, vaccination, and hygiene practices on farms.

Chapter 7 · Community-Inclusive approach for better health outcomes

No.	Challenges	Policy Recommendations
7a	Environmental compliances	Strict enforcement of regulations to promote wild life conservation, sustainable land use practices and habitat protection
7b	Education and Awareness	Incorporation of One Health principles into the curricula of medical, veterinary, and environmental sciences. Invest in interdisciplinary research to better understand the dynamics of disease transmission and the impacts of human activities on the environment.
7c	Social and Behavior Change Communication (SBCC)	SBCC initiatives are being implemented at various levels, ranging from mass media campaigns to community-level activities. Information and Communication Technologies (ICT), including mobile phones and the internet, are harnessed to deliver targeted health messages and promote healthy behaviours.

Chapter 8 · Strengthening infrastructure with a focus on diagnostics and research

No.	Challenges	Policy Recommendations
8a	Health infrastructure	Promotion and strengthen the Health Innovation Fund.

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Chapter 9 · Inclusion of Integrative Medicine

No.	Challenges	Policy Recommendations
9a	Supply Chain Management	Establish a robust supply chain system to ensure that traditional medicine molecules are efficiently available to every point of care.
9b	Trust Building through Evidence	Conduct rigorous research and clinical trials to demonstrate the effectiveness and safety of AYUSH treatments.
9c	Holistic Treatment Packages	Develop comprehensive healthcare packages that incorporate the right balance of traditional, complementary, and modern medicine.

Chapter 10 · Tech Fusion: For Robust & Interoperable System

No.	Challenges	Policy Recommendations
10a	E-Learning and Capacity Building	Strengthen E-learning platforms to provide opportunities for networking and collaboration among learners, fostering knowledge exchange and sharing of experiences across different sectors and geographic locations.
10b	Data Governance Framework	Establishment of a comprehensive data governance framework to define roles, responsibilities, and processes for data management, quality assurance, and integrity maintenance

Chapter 11 · Fostering a quality culture: A Core Component

No.	Challenges	Policy Recommendations
11a	Safety	Implementation of protocols to reduce Anti-Microbial Resistance, minimize risks.
11b	Effective quality management for animal health and food safety	Holistic approach to ensure that quality standards are upheld at every stage, from animal health and health on farms to food safety and public health considerations throughout the production process.

Integration of Efforts – Policy Reforms with multi-sectoral collaboration

1.1   Introduction

The significance of transdisciplinary approaches is exemplified by the COVID-19 pandemic. While epidemiologists and virologists possess scientific expertise in understanding the outbreak, the guidance on how society should respond extends beyond their purview. Addressing this challenge necessitates collective action, as neither governments nor scientists can resolve it in isolation. Each stakeholder group holds its own interests, making a social consensus most attainable through a participatory and transdisciplinary process that incorporates representatives from all interest groups.

However, discussions on the convergence of efforts are now taking place globally, involving participation from both developed and developing nations. The focus is on identifying the most vulnerable populations, sharing knowledge about best practices, and developing policies that promote positive changes. The world is becoming more aware and proactive in recognizing the reciprocal effects of human activities on the environment.

Key elements of effective multi-sectoral collaboration:

High-level commitment

Trust

Common objectives & priorities

Shared benefits

Strong governance structures, aligned legal frameworks and recognition of existing international standards

Identification and involvement of all relevant partners

Coordinated planning of activities

Capacity Development

Strong and effective health systems within the individual sectors

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1.2   The Global One Health Movement

The modern era marked a significant turning point in the conceptualization of One Health. In the mid-20th century, outbreaks of zoonotic diseases such as avian influenza, Ebola, and severe acute respiratory syndrome (SARS) prompted global attention to the interconnections between human and animal health.

In 2004, the "One World, One Health" initiative began, led by the Wildlife Conservation Society, CDC, and WHO. It aimed to address diseases at the human-animal-environment intersection. This effort produced the "Manhattan Principles," 12 recommendations guiding the One Health approach's adoption.

In 2019, the "Berlin Principles" emerged to update this approach for evolving global challenges, endorsed by the Climate and Environmental Foreign Policy Division and the Wildlife Conservation Society.

The subsequent years saw increased recognition of the One Health approach, leading to the establishment of various international collaborations and initiatives. Four key organizations - FAO, UNEP, WOAH (formerly OIE), and WHO - collaborate to address health challenges at the human-animal-plant-environment interface. They've developed the One Health Joint Plan of Action (OH JPA) from 2022 to 2026 in response to pandemic prevention and sustainable health demands. The OH JPA enhances global and regional One Health initiatives, focusing on capacity building to address complex health risks and strengthen health systems at various levels. It outlines six Action Tracks for practical implementation.

Action Tracks outlined in OH JPA

1. Enhancing One Health capacities to strengthen health systems.

2. Reducing the risks from emerging and re-emerging zoonotic epidemics & pandemics.

3. Controlling and eliminating endemic zoonotic, neglected tropical and vector-borne diseases.

4. Strengthening the assessment, management, and communication of food safety risks.

5. Curbing the silent pandemic of antimicrobial resistance.

6. Integrating the environment into One Health

These Action Tracks are guided by certain cross-cutting principles -

i. Adopting systems thinking

ii. Fostering advocacy and communication and public private partnership (PPP)

iii. Enhancing governance, institutional, and legal frameworks

iv. Using the traditional knowledge of Indigenous Peoples and local communities, as appropriate.

The OH JPA serves to converge the regional initiatives into a global standard of practice to detect, prevent, and mitigate the health threats caused by the interaction of Humans, Animals, and the Environment.

1.3   One Health and the Indian Perspective

India has demonstrated its commitment to the One Health approach through various initiatives and programs. By integrating efforts across sectors, strengthening surveillance systems, and promoting interdisciplinary collaboration, India is working towards a more comprehensive understanding of health and disease dynamics. These initiatives serve as a foundation for mitigating the impact of zoonotic diseases, addressing antimicrobial resistance, and promoting sustainable health systems for the well-being of both humans and animals.

Within the context of the G20 Leaders' Declaration, the Government of India expresses its anticipation for a fruitful conclusion of the ongoing negotiations at the Intergovernmental Negotiating Body (INB). These negotiations are directed towards establishing an ambitious, legally binding WHO convention, agreement, or other international instruments focusing on pandemic Preparedness and Response (PPR), known as WHO CA+, by May 2024. Furthermore, the Government of India highlights the need for amendments to enhance the effective implementation of the International Health Regulations (2005). This collective effort reflects India's commitment to fortifying global health governance and fostering collaboration across sectors to bolster pandemic readiness and response.

Taking a cue from the West and acknowledging the need for a unified implementation strategy, The Prime Minister's Science, Technology, and Innovation Advisory Council (PM-STIAC) approved to set up the multidisciplinary initiative called the National One Health Mission in February 2022.

India's National One Health Mission unites sectors, enhancing pandemic readiness, integrated disease control, and cutting-edge research for a healthier future.

The mission will involve the Ministry of Health and Family Welfare, Ministry of Animal Husbandry, Fisheries and Dairying, Ministry of Environment, Forest and Climate Change, as well as concerned departments of other ministries collaborating with the private sector.

The objective of the Mission is to effectively coordinate efforts in achieving comprehensive readiness for pandemics and integrated disease control in both the human and animal sectors. This entails establishing early warning systems based on an integrated surveillance system, as well as ensuring preparedness to respond to endemic diseases, emerging epidemics, and potential pandemics.

The Mission will work towards Implementing integrated disease surveillance and developing robust outbreak investigation mechanisms with initiatives like:

i.   Targeted R&D

ii. Data and Database Integration

iii. Streamline Regulatory and Approval Process

iv. Build a Governance Model

National One Health Mission serves as a strong foundation to build a larger framework for Capacity Building of Human Resources, Community Inclusive Initiatives, Joint ventures with Industry and Academia, and International Collaborations.

Government Stakeholders

National / International Partners
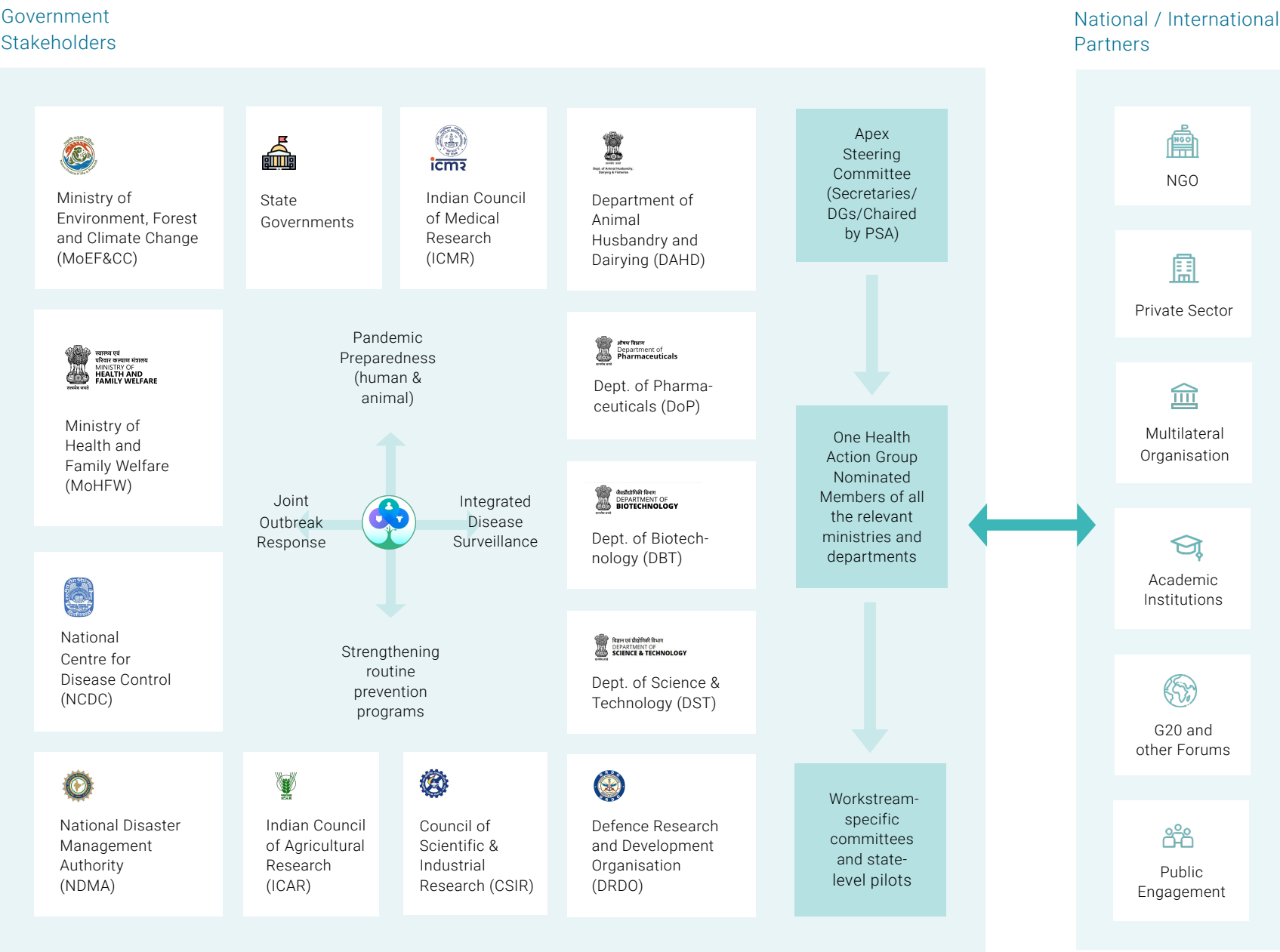
Source: Office of the Principal Scientific Advisor to the Government of India Website

1.4   The Road Ahead

Harmonize global policies for One Health, nationwide, and forge cohesive strategies to create a seamless ecosystem tackling:

- Zoonotic outbreaks

- Vector-borne diseases

- Climate-linked non-communicable illnesses

- Ensuring food security

- Combating Antimicrobial Resistance (AMR)

As we have seen Nationally and Internationally, we are at that point of the One Health journey where the paths have started to converge, and all the stakeholders have started moving towards a common destination. There is a need to keep this momentum going and focus on the following -

Policy and Governance:

Investing in the National One Health Mission and ensuring that the initial scope of work is achieved and expanded as the mission grows in the future.

Surveillance and Early Warning Systems:

Strengthen surveillance systems for infectious diseases in both humans and animals, including zoonotic diseases. Enhance data collection, sharing, and analysis capabilities to enable early detection and response to disease outbreaks. Foster collaboration and information sharing between human and animal health sectors.

Research and Development:

Promote research and innovation in areas relevant to One Health (includes zoonotic disease transmission, antimicrobial resistance, and ecosystem health). Encourage interdisciplinary research collaboration among scientists, veterinarians, medical professionals, and environmental experts.

Capacity Building:

Invest in training programs and capacity-building initiatives to enhance the knowledge and skills of healthcare professionals, veterinarians, and other relevant stakeholders in One Health principles and practices. Foster interdisciplinary education and collaboration to facilitate a holistic approach to health.

Collaboration and Partnerships:

Foster collaboration among relevant sectors, including health, agriculture, environment, wildlife, and fisheries. Strengthen partnerships with international organizations, research institutions, and other countries to leverage expertise, resources, and best practices in One Health.

Public Awareness and Community Engagement:

Launch public awareness campaigns to educate communities about the interconnectedness of human, animal, and environmental health. Encourage community participation and engagement in disease surveillance, prevention, and control efforts.

Infrastructure and Resources:

Allocate adequate resources for the development and maintenance of laboratory facilities, diagnostic capabilities, and research infrastructure. Ensure the availability of necessary equipment, supplies, and skilled personnel to support One Health activities.

Legislation and Regulation:

Develop and enforce regulations that support One Health principles, including regulations related to food safety, animal welfare, antimicrobial use, and environmental protection. Enhance collaboration between relevant regulatory bodies to harmonize standards and ensure effective implementation.

International Cooperation:

Engage in international cooperation and collaboration to address global health challenges. Participate in regional and global initiatives on One Health as being done in G20 Health Working Group Meetings, exchange information and best practices, and contribute to international efforts in combating zoonotic diseases and promoting ecosystem health.

Monitoring and Evaluation:

Establish mechanisms to monitor and evaluate the progress and impact of One Health initiatives in India. Regularly assess the effectiveness of interventions, identify areas for improvement, and adjust strategies accordingly.

1.5   Summary

The One Health approach, exemplified by the response to the COVID-19 pandemic, recognizes that addressing complex health challenges requires collective and transdisciplinary efforts. It involves stakeholders from various sectors, including government, science, and society, to build social consensus on how to manage health crises effectively.

Globally, discussions have intensified to identify vulnerable populations, share best practices, and formulate policies that promote positive changes, demonstrating increased awareness of the interconnectedness of human activities and environmental health.

India has embraced the One Health approach, integrating efforts across sectors to understand health dynamics comprehensively. Initiatives, including the National One Health Mission, demonstrate India's commitment to pandemic readiness, integrated disease control, and sustainable health systems.

This mission aligns with the G20 Leaders' Declaration's call for a legally binding WHO convention on pandemic Preparedness and Response (PPR) and amendments to the International Health Regulations (2005).

To maintain momentum, India aims to focus on policy and governance, surveillance and early warning systems, research and development, capacity building, collaboration and partnerships, public awareness, infrastructure, legislation and regulations, international cooperation, and monitoring and evaluation in the One Health journey.

02

Disaster Management Planning with Robust Disease Surveillance Systems

2.1   Introduction

Enhancing the disease surveillance system involves integrating human health, veterinary, and environmental data, and leveraging advanced analytics to proactively detect emerging threats.

The ongoing COVID-19 pandemic, classified as a potentially animal-originated emerging disease, has underscored the need for early response to emerging zoonotic diseases before they spill over into the human population. Understanding the pathways through which animal pathogens cross species barriers and cause epidemics or pandemics is crucial for effective prevention.

A One Health platform is a multidisciplinary framework aimed at addressing complex health challenges at the intersection of human, animal, and environmental health. It involves assembling a diverse team of experts, fostering collaboration among stakeholders, and establishing data-sharing systems. Key components include research, capacity building, policy development, community engagement, and public awareness campaigns. International collaboration and adaptability are crucial, as health challenges evolve. Effective communication, monitoring, and continuous improvement are essential, along with public and private sector engagement. Advocacy for One Health principles at the policy level ensures better health outcomes for all and emphasizes the importance of an interconnected approach to global health.

In today's globalised era, characterised by rapid population growth and increased trade mobility, infectious diseases have the potential to spread worldwide within a remarkably short span of 36 hrs.

The foundation of preparedness for public health threats relies on the robustness of surveillance and forecasting models, which play a crucial role in mobilizing resources and enabling timely responses.
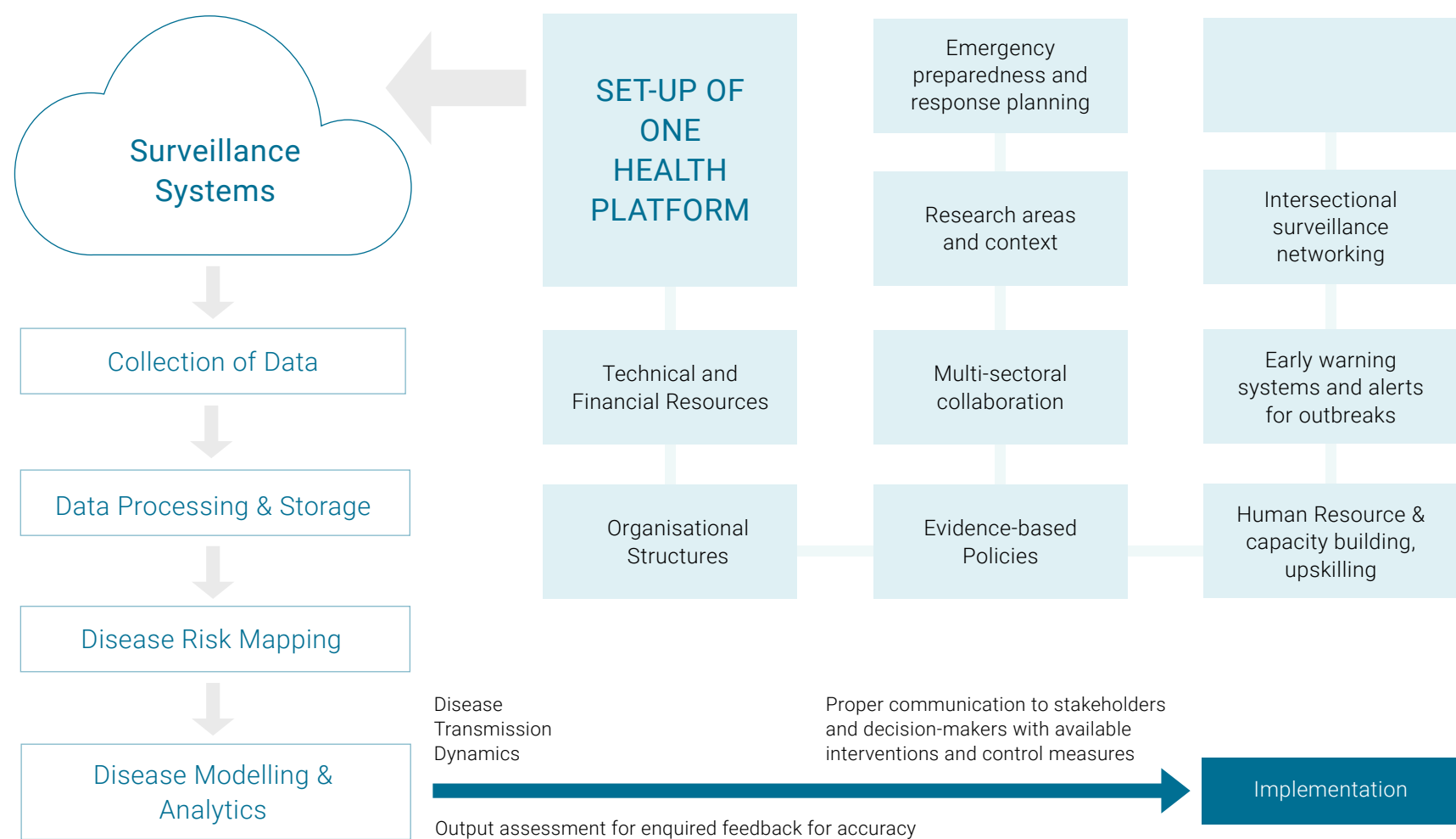
Surveillance in public health, animal health and wildlife are essential for promptly detecting new cases of emerging infections and assessing the current health status of populations. Epidemiological models support preparedness and decision-making by stakeholders through the simulation of likely scenarios, including transmission pathways, disease dynamics, and the evaluation of alternative intervention strategies. Information systems that incorporate routine surveillance, modelling, and forecasting provide predictive insights that influence organizational decisions and increase public awareness of health-related events. Advanced surveillance and disease models, coupled with environmental data, enable the temporal and spatial assessment of risks associated with infectious diseases, particularly vector-borne diseases. This integration of surveillance and modelling has significantly strengthened epidemic prevention and control capabilities.

Numerous countries have leveraged modern technologies like data science, computational biology, medical image processing, disease tracking, prediction models, machine learning, and artificial intelligence to contribute to the fight against COVID-19. Software-enabled smartphones, wristbands, and facial recognition cameras have played a significant role in swiftly identifying cases, tracking infection sources, forecasting outbreaks, and monitoring compliance with quarantine regulations.

In healthcare settings, robots have been employed for the delivery of food and medications to patients, while drones have been utilized for patrolling, broadcasting awareness messages, and conducting site disinfections.

2.2   Case Study

The outbreak of severe acute respiratory syndrome (SARS) serves as a global example, originating in Guangdong, China, it quickly escalated into a pandemic affecting "5 countries within 24 hours and to more than 30 countries on 6 continents within 6 months." The impact was significant, with 8,096 cases and 774 deaths. Additionally, other recent infectious disease outbreaks of global significance facilitated by air travel include the chikungunya epidemic in Europe in 2007, which was initiated by a single infectious traveller from India, pandemic influenza in Mexico, the spread of the New Delhi metallo-beta-lactamase-1 (NDM-1) gene from India to Sweden and multiple other countries, the Middle East Respiratory Syndrome (MERS) epidemic in South Korea, the largest outbreak outside Saudi Arabia, resulting from a single infectious traveller returning from Saudi Arabia. Furthermore, the West African Ebola virus outbreak from 2014 to 2016 claimed 11,325 lives and spread to seven countries, while the Zika outbreak from 2015-2016 originated in Brazil and spread to 87 countries and territories.

More recently, the COVID-19 pandemic has further demonstrated the risks of global spread. A study on the H1N1 pandemic influenza strain highlighted that, despite the presence of high-efficiency particulate air (HEPA) filters in aircraft, the attack rate on a 9-hour flight was estimated to be as high as 4.3 percent. Hence, in our interconnected world, public health preparedness is of paramount importance to mitigate the devastating consequences of emerging threats. [1]

The 2018 Nipah outbreak in Kerala, India serves as an example of the successful early detection of the pathogen within a remarkably short timeframe of 12 hours. This achievement was possible due to the presence of skilled personnel and the utilization of advanced genomic tools like next-generation sequencing (NGS). The rapid detection facilitated a swift response and the mobilization of a multi-disciplinary team to effectively contain the outbreak. Detecting novel pathogens of this nature necessitates the presence of well-equipped laboratory networks integrated with robust surveillance systems, community involvement, and an understanding of the socio-economic and environmental factors at play.

A strong surveillance system that can swiftly report newly identified threats, disseminate best practices to public health workers, utilize epidemiological disease modelling for intervention strategies, simulate transmission dynamics, and improve forecasting is vital in mitigating future emerging public health threats. It is crucial to foster multisectoral cooperation and coordination among all stakeholders, within the framework of One Health, to enable a rapid and efficient response to these public health challenges.

[1]   Bedi JS, Vijay D, Dhaka P, Singh Gill JP, Barbuddhe SB. Emergency preparedness for public health threats, surveillance, modelling & forecasting. Indian J Med Res. 2021 Mar;153(3):287-298. doi: 10.4103/ijmr.IJMR_653_21. PMID: 33906991; PMCID: PMC8204835.

2.3 The Road Ahead

Recognizing the urgent need for a global collaborative approach to tackle the significant challenges in the fields of One Health, climate change, and planetary health research, it is essential to focus efforts on enhancing One Health surveillance systems at local, regional, and national levels. This is in response to the existing challenges that require prompt detection, prediction, and effective decision-making tools to guide policies and actions. The core principles for an integrated disease surveillance system include population-based approaches, laboratory confirmation, utilization of digital data, ensuring data transparency, and securing adequate financial resources.

2.4   Summary

The ongoing pandemic, identified as a potentially animal-originated emerging disease, has accentuated the urgency of early responses to zoonotic diseases before they cross over to humans. Understanding how animal pathogens breach species barriers and lead to epidemics is crucial for prevention.

The One Health approach, involving coordinated interdisciplinary efforts across human, animal, and environmental domains, is essential for addressing public health challenges, including infectious diseases, antimicrobial resistance, and environmental issues.

In today's globalized world marked by rapid population growth and increased trade, infectious diseases can spread globally within just span of days.

Effective public health preparedness relies on robust surveillance and predictive models that help mobilize resources and enable timely responses. Advanced technologies, such as data science, machine learning, and artificial intelligence, have played crucial roles in tracking cases and enforcing compliance. Case studies, like the SARS outbreak and the Nipah outbreak, illustrate the significance of early detection and the need for well-equipped laboratory networks, community involvement, and multisectoral cooperation within the One Health framework to mitigate emerging public health threats.

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03

Climate Change: Impact and Adaptations

3.1   Introduction

Climate change has emerged to be a bigger evil than anyone could have imagined. It has caused an imbalance between humans, animals, and the environment creating an increasingly unsafe situation for lifeforms to survive and thrive.

There is a myriad of ways in which Climate Change has affected human health. This includes causing an increase in the frequency of extreme weather events like heatwaves, storms, and floods, which result in fatalities and illnesses. It also disrupts food systems, leading to a rise in diseases transmitted through food, water, and vectors. Climate change has additional effects on mental health.
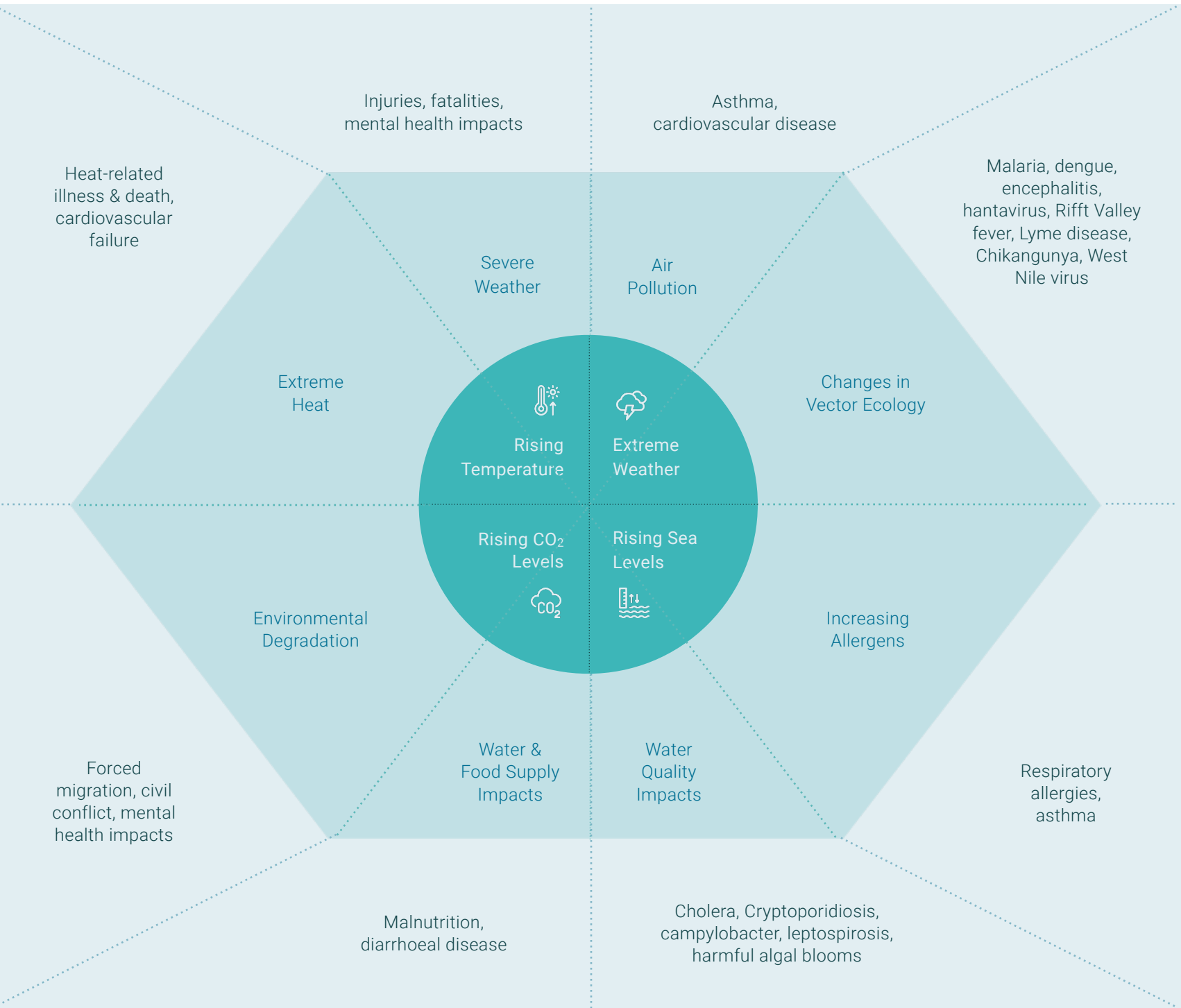
Tropical and Subtropical countries like India and other countries that constitute the *"Global South"* are more vulnerable to the heat stress caused by Climate Change. Moreover, it undermines the social determinants necessary for good health, such as livelihoods, equality, access to healthcare, and supportive social structures. These health risks related to climate change disproportionately affect disadvantaged groups, including women, children, ethnic minorities, impoverished communities, migrants or displaced individuals, the elderly, and those with pre-existing health conditions. One can say that the health impact of Climate Change is largely on the population that is least responsible for it.

‣ Keeping climate change in perspective measures should be taken to build sustainable green infrastructure with fewer carbon emissions.

‣ Push to renewable energy, which is key to a safer, cleaner, and sustainable world.

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3.2   How does Climate Change affect …
Human Health?

Climate change affects the environment by way of increased Air Pollutants, Rising Temperatures, Rising Sea Levels, and Increased Concentrations of CO2 in the Atmosphere. All these disturbances to the natural order will affect the system upon which human life depends for survival. Consumption of polluted water and air, excess or dearth of natural resources, extreme weather and increased allergens in the air contribute to several communicable and non-communicable diseases.

Injuries, fatalities, mental health impacts

Asthma, cardiovascular disease

Heat-related illness & death, cardiovascular failure

Malaria, dengue, encephalitis, hantavirus, Rifft Valley fever, Lyme disease, Chikangunya, West Nile virus

Severe Weather

Air Pollution

Extreme Heat

Changes in Vector Ecology

Rising Temperature

Extreme Weather

Rising CO$_2$ Levels

Rising Sea Levels

Environmental Degradation

Increasing Allergens

Forced migration, civil conflict, mental health impacts

Water & Food Supply Impacts

Water Quality Impacts

Respiratory allergies, asthma

Malnutrition, diarrhoeal disease

Cholera, Cryptoporidiosis, campylobacter, leptospirosis, harmful algal blooms

Source: Climate Effects on Health - CDC (US)

According to WHO, approximately 250,000 additional deaths per year will be reported due to malnutrition, diarrhoea, heat stress and malaria caused by Climate Change. [2]

The impacts of climate change on males and females differ due to various factors and are expected to exacerbate existing gender-based health disparities in the future. [3] Females are biologically more susceptible to climate change effects, particularly extreme heat. [4] Moreover, factors such as nutritional deficiencies during menstruation and pregnancy, as well as spending more time in kitchens with traditional stoves (chulhas), make women more vulnerable to heat stress. Climate change also has negative consequences for children's health. [5] Extreme climate events like floods and droughts have been found to have detrimental effects on children's mental health. [6] For example, previous research indicated that children exposed to drought during pregnancy had lower scores on math and reading tests. [7] These children were less likely to recognize numbers from 1 to 10 and less likely to perform simple subtraction problems compared to baseline scores. Furthermore, a study on child survivors of the 2014 floods in Kashmir revealed that both boys and girls exhibited moderate-to-severe psychological impacts across various domains. [8]

[2] WHO Climate Change Factsheets - https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health#:~:text=Climate%20change%20affects%20the%20social,malaria%2C%20diarrhoea%20and%20heat%20stress

[3] WHO (2021a) Climate change and health, World Health Organization. Available at: https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health

[4] PAHO (2021) Heatwaves: a guide for health-based actions, Pan American Health Organization. Available at: https://iris.paho.org/bitstream/handle/10665.2/54979/9789275124086_eng.pdf?sequence=1&isAllowed=y

[5] American Academy of Pediatrics (2021) How climate change affects children: AAP Policy explained. Available at: https://www.healthychildren.org/English/safety-prevention/all-around/Pages/Climate-Change-Policy-Explained.aspx

[6] UNICEF (2021) The climate crisis is a child rights crisis, United Nations Children's Fund. Available at: https://www.unicef.org/media/105376/file/UNICEF-climate-crisis-child-rights-crisis.pdf

[7] Shah M and Steinberg B M (2014) Drought of opportunities: contemporaneous and long term impacts of rainfall shocks on human capital. https://sites.bu.edu/neudc/files/2014/10/paper_31.pdf

[8] Hassan FU, Singh G, Sekar K (2018) Children's reactions to flood disaster in Kashmir. Indian J Psychol Med 40:414–419. https://doi.org/10.4103/IJPSYM.IJPSYM_571_17

3.2 How does Climate Change affect …
Animal Health?

Humans are heavily dependent on livestock for food and other consumable products and for that reason there is close interaction between these lifeforms. Livestock sector is a significant contributor to GHG emissions and, consequently, climate change. To achieve long-term sustainability, a multi-pronged approach that considers the One Health perspective is needed, focusing on reducing methane emissions, improving resource efficiency, and promoting more sustainable dietary choices and land-use practices.

Direct Effects

· Metabolic Disorders

· Oxidative Stress

· Immunosuppression

· Death

Indirect Effects

· Altered reproductive patterns

· Favourable conditions for infectious fungi and bacteria in the environment

Climate change can have direct and indirect effects on animals. [9]

If Covid-19 was any example, we must be conscious of the fact that physiological detriment in one species can spread to other species in a manner that keeps evolving through mutation and becomes challenging to contain, this is known as *Zoonoses*.

Climate change leads to a rise in disease occurrence, affecting healthcare systems. It also intensifies the frequency of extreme weather events, directly impacting the well-being of animals. Elevated temperatures, for example, have altered the spatial and temporal distribution of disease-carrying vectors like mosquitoes and ticks, which are responsible for spreading vector-borne illnesses.

The loss of habitats caused by climate change, as well as human activities like mining, farming, and deforestation, can force wildlife to migrate to new areas. This increased interaction between wildlife, human settlements, and livestock can facilitate the transmission of pathogens.

To safeguard both human and animal health, countries must enhance their disease monitoring capabilities and commit to improved management of wildlife health, ensuring the protection of wildlife and their ecosystems.

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[9] Nicola Lacetera, Impact of climate change on animal health and welfare, Animal Frontiers, Volume 9, Issue 1, January 2019, Pages 26–31, https://doi.org/10.1093/af/vfy030

3.2 How does Climate Change affect …
Environmental Health?

Based on data from the India Meteorological Department (IMD), the average temperatures in India have risen by 0.6 °C between 1901–1910 and 2009–2018 (IMD 2020). [10] It is projected that in a scenario of unrestricted climate change, the future average temperatures in India could increase from 25.1 °C to as high as 29.1 °C by 2100. This climate change will have adverse effects on living standards in India, particularly in areas already experiencing water stress, which are more vulnerable compared to the national average. [11]

Climate change disrupts ecosystems and threatens biodiversity. Rising temperatures, altered precipitation patterns, and changing habitats can result in shifts in species distribution and composition. Many plant and animal species face challenges in adapting to these changes, leading to reduced biodiversity and potential species extinctions.

Furthermore, increasing global temperatures cause the melting of glaciers and ice caps, leading to sea-level rise. This results in coastal erosion, loss of coastal wetlands, and increased vulnerability to storm surges. Coastal ecosystems, including coral reefs and mangroves, are particularly at risk, affecting the habitats and biodiversity they support.

[10] IMD (2020) Statement on Climate of India during 2019.
Available at: https://mausam.imd.gov.in/backend/assets/press_release_pdf/Statement_on_Climate_of_India_during_2019.pdf

[11] Krishnan R, Sanjay J, Gnanaseelan C, Mujumdar M, Kulkarni A, and Chakraborty S (2020)
Assessment of climate change over the indian region: a report of the Ministry of Earth Sciences (MoES), Government of India.
https://link.springer.com/book/10.1007/978-981-15-4327-2

3.3   The Road Ahead

For India to effectively tackle climate change and health, a comprehensive and multi-faceted approach is crucial. Here are some key aspects that can guide India's way forward:

Strengthening Policy Framework:

The Government of India launched National Action Plan on Climate Change (NAPCC) on 30th June, 2008 outlining eight National Missions on climate change. These include:

i.   National Solar Mission
ii.   National Mission for Enhanced Energy Efficiency
iii. National Mission on Sustainable Habitat
iv.   National Water Mission
v.   National Mission for Sustaining the Himalayan Eco-system.
vi.   National Mission for a Green India
vii. National Mission for Sustainable Agriculture
viii. National Mission on Strategic Knowledge for Climate Change

This policy must be reviewed and revised to be more inclusive of the relevant stakeholders and updated as per the requirements of the current times. Subsequently, the implementation of this policy must happen at a State level in order to reach the grassroots levels. This will also ensure the regular monitoring of the action items and generate real data for course correction.

Enhance Adaptation Measures:

India should prioritize the development and implementation of adaptation measures to address climate change impacts on health. This involves strengthening health systems to respond to climate-related emergencies, improving early warning systems for extreme weather events, and enhancing capacity for climate-resilient healthcare infrastructure.

Promote Research and Data Collection:

There is a need for increased research and data collection to better understand the specific health risks and vulnerabilities associated with climate change in different regions of India. This includes conducting studies on the health impacts of climate change, building climate-health databases, and promoting interdisciplinary research collaborations.

Foster Awareness and Public Education:

Public awareness and education campaigns can play a crucial role in building resilience and promoting behaviour change. India should invest in initiatives that raise awareness about climate change and its health impacts, disseminate information on preventive measures, and educate communities, healthcare professionals, and policymakers about climate-resilient health practices.

Strengthen Healthcare Infrastructure:

India should prioritize the strengthening of healthcare infrastructure, particularly in vulnerable regions and communities. This includes improving access to quality healthcare services, ensuring availability of essential medicines and medical supplies during climate-related emergencies, and integrating climate resilience into healthcare facility design and planning.

Foster International Collaboration:

Climate change is a global challenge that requires collaborative efforts. India should actively engage in international collaborations, knowledge sharing, and technology transfer to address climate change and health. This involves participation in global initiatives, partnerships, and platforms to share best practices, access funding, and leverage expertise and resources.

3.4   Summary

To effectively address the profound intersection of climate change and health in India, a multifaceted approach is imperative. Firstly, strengthening the policy framework is crucial. While the National Action Plan on Climate Change (NAPCC) lays the foundation, it must continuously evolve and involve a wide array of stakeholders, including local communities and healthcare professionals, to ensure policies are comprehensive and regionally relevant.

Secondly, adaptation measures need to be enhanced. India must prioritize climate-resilient healthcare systems, effective early warning systems, and infrastructure that can withstand the increasing frequency of extreme weather events.

Comprehensive research and data collection are also essential to understand the specific health risks across different regions. Public awareness campaigns should disseminate information on climate change's health impacts and promote resilient health practices. Strengthening healthcare infrastructure, especially in vulnerable regions, and engaging in international collaborations to share knowledge and resources are equally vital.

This comprehensive strategy aims to safeguard public health and enhance resilience in the face of climate change's growing challenges, particularly among marginalized communities.

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04

Advancing Health through integrated Immunization Strategy

4.1   Introduction

Increasing investment in Research and Development for vaccine production for humans and animals is essential and warrants a policy focus.

This chapter explores key components and strategies to achieve holistic protection against vaccine-preventable diseases, benefitting human and animal health while safeguarding the environment in India.

Multispecies Vaccination

Bridging the gap emphasizing integrated vaccination strategies helps bridge the gap between human and animal health. By developing vaccines that target diseases common to both humans and animals, such as zoonotic diseases, a multi-species approach can significantly enhance disease control efforts. This collaborative effort reduces the risk of disease trans-mission between species, protecting both populations and fostering a healthier environment.

Expanded Vaccine Coverage:

Reaching the Unreachable Expanding vaccine coverage is crucial to ensure a wide-reaching impact. By implementing comprehensive immunization programs that target vulnerable populations in both human and animal communities, broader protection can be achieved. Ensuring equitable access to vaccines for under-served areas and marginalized populations plays a key role in reducing disparities and enhancing overall health outcomes.

Immunization plays a vital role in establishing a comprehensive approach that addresses vaccination needs across humans and animals. A One Health vision can be realized by promoting multispecies vaccination and developing vaccines for diseases affecting both humans and animals, including zoonotic diseases.

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Strengthening Domestic Vaccine:

Development and production and building domestic capabilities for vaccine development and production is essential for long-term sustainability. By investing in research and development, India can enhance its capacity to produce high-quality vaccines locally. This reduces dependence on external suppliers, increases availability, and contributes to national health security. Also, there is an urgency to expedite the transfer of well-established technology from research and development institutions into the industrial sector for commercial implementation.

Robust Surveillance System:

Early Detection and Response Implementing robust surveillance systems are critical for early detection and rapid response to emerging diseases. By establishing efficient monitoring networks, India can detect potential outbreaks, track disease trends, and respond promptly with targeted vaccination campaigns. This proactive approach helps prevent the spread of diseases, safeguarding both human and animal populations.

Training and Capacity Building:

Empowering Healthcare Professionals enhancing training and capacity building programs is vital to ensure a skilled workforce capable of implementing effective immunization strategies. By providing ongoing education and professional development opportunities for healthcare professionals, veterinarians, and researchers, India can strengthen its immunization efforts. This fosters a collaborative environment and empowers individuals to contribute effectively to One Health initiatives.

Public Awareness campaigns and Partnerships:

Engaging Stakeholders Promoting the importance of vaccination and combating vaccine hesitancy require comprehensive public awareness campaigns. By engaging stakeholders, including the public, healthcare providers, policymakers, and community leaders, India can foster knowledge exchange, dispel myths, and encourage informed decision-making regarding immunization. Collaboration and partnerships between public and private sectors, NGOs, and international organizations facilitate resource sharing, research collaboration, and innovation in vaccine development.

Immunization and Vaccination hold the position of the modern world's greatest success stories. Over a period, immunization has been endorsed as a valuable tool to prevent and control a large number of infections and chronic diseases. Globally, vaccinations are available for the prevention of 20-life threatening diseases, thus intending to make life healthier and longer. As of date, immunization prevents 3.5 to 5 million deaths annually from diseases like diphtheria, tetanus, pertussis, influenza, and measles. Being a key component of primary healthcare and an indisputable human right, it is crucial to augment investment in research and development for vaccination production. Shifting the focus to policy can underpin global health security, a vital tool in the battle against life-threatening diseases, and hold broader gains in education and economic development. Expanding immunization access is also crucial to achieving the Sustainable Development Goals (SDGs).
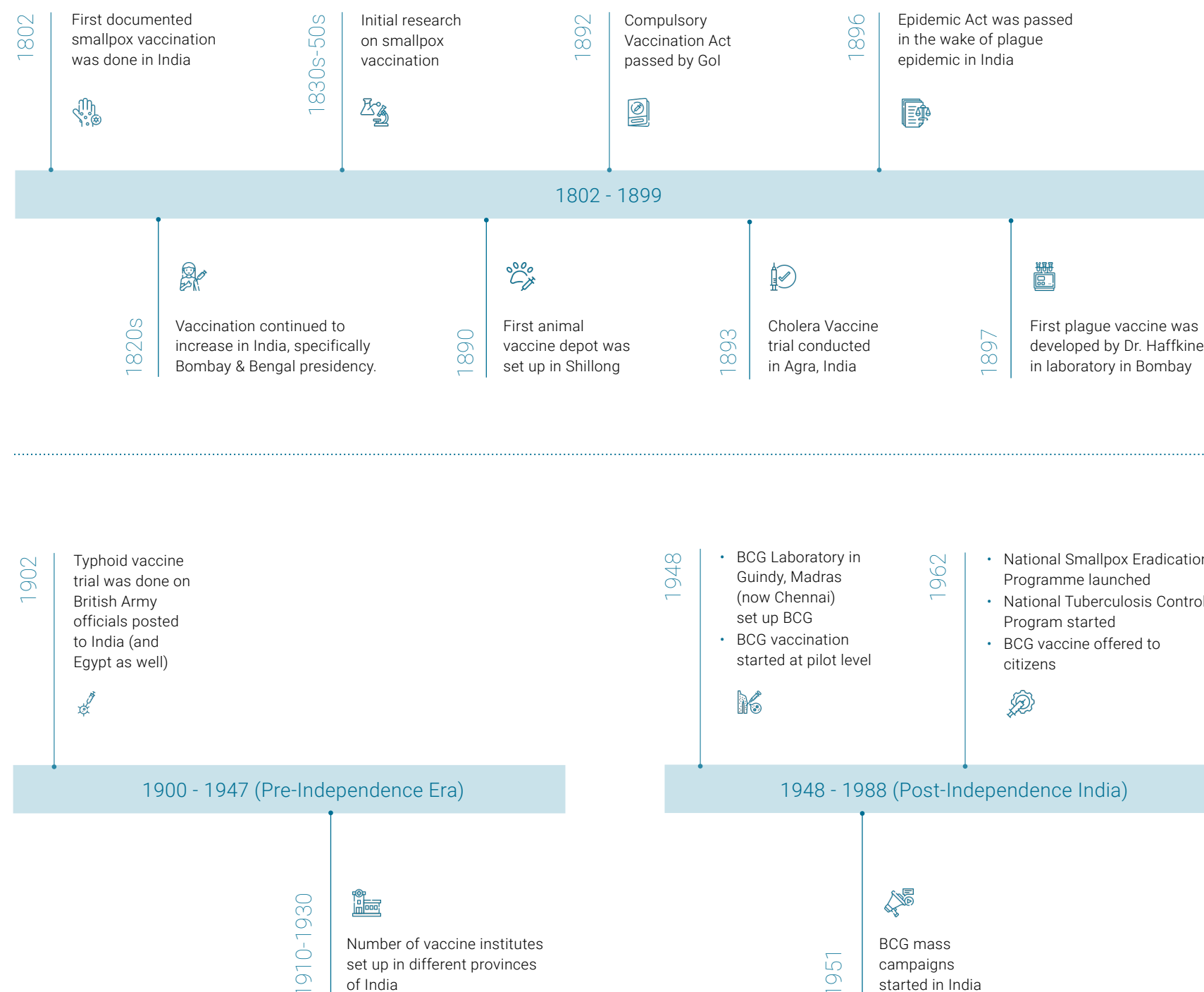
4.2 Vaccination Journey in India

Despite tremendous progress, vaccination coverage has plateaued in recent years and dropped since 2020.

Though a proven cost-effective preventive intervention, the benefit of immunization is not reaching to many who are at the maximum risk of diseases preventable by these vaccines.

As per the recent nationwide survey data, of the targeted annual cohort of 26 million infants in India, only 61% had received all due vaccines. The COVID-19 pandemic and associated disruptions over the past two years have strained health systems, with 25 million children missing out on vaccination in 2021, 6 million more than in 2019, and the highest number since 2009.

1802 — First documented smallpox vaccination was done in India

1830s-50s — Initial research on smallpox vaccination

1892 — Compulsory Vaccination Act passed by GoI

1896 — Epidemic Act was passed in the wake of plague epidemic in India

1802 - 1899

1820s — Vaccination continued to increase in India, specifically Bombay & Bengal presidency.

1890 — First animal vaccine depot was set up in Shillong

1893 — Cholera Vaccine trial conducted in Agra, India

1897 — First plague vaccine was developed by Dr. Haffkine in laboratory in Bombay

1902 — Typhoid vaccine trial was done on British Army officials posted to India (and Egypt as well)

1900 - 1947 (Pre-Independence Era)

1910-1930 — Number of vaccine institutes set up in different provinces of India

1948
- BCG Laboratory in Guindy, Madras (now Chennai) set up BCG
- BCG vaccination started at pilot level

1962
- National Smallpox Eradication Programme launched
- National Tuberculosis Control Program started
- BCG vaccine offered to citizens

1948 - 1988 (Post-Independence India)

1951 — BCG mass campaigns started in India

4.3   The Road Ahead

There is an urgent need to consider and develop long-term, sustainable solutions that are based on extensive research and development for the human, animal, and environmental sectors. Vaccines represent one of these solutions but remain largely under-explored in terms of the potential health and economic benefits. A strategy must be adopted to facilitate the prioritization of vaccine R&D for humans and animals based on identifying the most prevalent infections, diagnosed diseases, availability of vaccines, and the potential for new or improved vaccines to reduce the need for treatment at a later stage. There is a need to be innovative, not only in establishing best practices in human and animal health sectors but in considering the breadth of practical, cost-effective R&D solutions in the field of Vaccinations.

In the ever-evolving landscape of infectious diseases, there's a continuous emergence of new threats that necessitate a dynamic response from the healthcare community. The role of research and development (R&D) in addressing these challenges is paramount. As we encounter new diseases or witness the evolution of existing ones, such as the ongoing battle against COVID-19 variants, the development of effective vaccines becomes a central pillar of our defence.

In this pursuit, it's crucial to foster robust collaboration between industry and academia. Industry brings expertise in large-scale vaccine production and distribution, while academia contributes cutting-edge research and innovation. This synergy between sectors accelerates the discovery **and** deployment of vaccines, as we've witnessed in the rapid development of COVID-19 vaccines through such partnerships.

Innovation must also be at the forefront of vaccine R&D. This entails exploring novel approaches to vaccine development, such as mRNA technology, which has shown remarkable promise in recent times. Additionally, a focus on optimizing vaccine distribution channels, ensuring equitable access, and addressing vaccine hesitancy are equally crucial components of a comprehensive strategy.

As we navigate the complex terrain of infectious diseases and immunization, embracing forward-thinking R&D practices, strengthening industry-academia partnerships, and fostering innovation will be instrumental in safeguarding public health and building a more resilient healthcare ecosystem.

4.4   Summary

The importance of immunization in safeguarding public health cannot be overstated. Despite its effectiveness in preventing life-threatening diseases, vaccination coverage has faced challenges in India, exacerbated by the disruptions caused by the COVID-19 pandemic. To address this, a multifaceted strategy is crucial. This includes adopting a multispecies vaccination approach to bridge the gap between human and animal health, expanding vaccine coverage to reach vulnerable populations, strengthening domestic vaccine production capacity to reduce dependence on external suppliers, establishing robust surveillance systems for early disease detection, and investing in training and capacity building for healthcare professionals. Public awareness campaigns and partnerships with stakeholders are also vital components to combat vaccine hesitancy and promote informed decision-making regarding immunization.

Moreover, the role of research and development (R&D) in vaccine production is paramount, especially in the face of emerging infectious diseases like COVID-19. Collaboration between industry and academia accelerates vaccine development, with a focus on innovative approaches such as mRNA technology.

This comprehensive strategy not only safeguards public health by preventing diseases but also contributes to national health security and global efforts to eradicate diseases while preserving the environment.

By prioritizing immunization and strengthening domestic vaccine production capabilities, India can lead the way towards a healthier, more resilient nation, better prepared to tackle evolving health challenges and support global health security.

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05

Developing an inter-disciplinary workforce

5.1   Introduction

To fully embrace the multi-sectoral and interdisciplinary nature of One Health, it is essential to launch suitable programs/ courses designed for the One Health discipline to address complex health challenges.

India, with its diverse population and ecological landscape, faces numerous health challenges that require a comprehensive and collaborative approach.

The One Health approach has gained recognition in national and international plans and strategies, addressing zoonoses, health security, food safety, and antimicrobial resistance (AMR). This collaborative and transdisciplinary approach focuses on the interconnectedness of people, animals, plants, and the environment.

While One Health has been championed in veterinary medicine and public health, **its early stages.** To effectively tackle emerging diseases, zoonotic infections, antimicrobial resistance, and other global threats, it is crucial to develop an interdisciplinary workforce and incorporate the One Health approach into medical and veterinary education.

Today, the world faces a rising number of emerging and endemic infectious diseases. The COVID-19 pandemic has clearly demonstrated that disease threats know no boundaries and require a unified response. One Health recognizes the need for collaboration between sectors related to human, animal, and environmental health. Failing to act can have severe consequences, making it imperative to embrace a holistic approach to address current and anticipated challenges.

One Health approach recognizes that human health is intricately linked to animal health and the environment. Diseases can spread across species boundaries, leading to significant public health consequences. For instance, zoonotic diseases like Ebola, avian influenza, and COVID-19 have highlighted the need for a collaborative approach that encompasses human, animal, and environmental health.

According to the World Health Organization (WHO), around 75% of emerging infectious diseases are zoonotic in origin. Furthermore, antimicrobial resistance, a pressing global health concern, is closely linked to the misuse of antibiotics in both human and animal healthcare.

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Data across the world underscores the urgency of adopting the One Health approach and developing an interdisciplinary workforce.

Several countries have already recognized the importance of the One Health approach and have taken initiatives to incorporate it into their medical education systems. For instance:

United States

The Canters for Disease Control and Prevention (CDC) in collaboration with other federal agencies, academic institutions, and professional organizations has established the **One Health Education Task Force.** This task force aims to integrate One Health principles into medical and veterinary education.

United Kingdom

The UK government has launched the **'One Health: Working Together for a Safer Future'** initiative, which promotes collaboration between human, animal, and environmental health sectors. This initiative emphasizes interdisciplinary training and research to address complex health challenges effectively.

Australia

The Australian government has invested in the establishment of the **Australian Infectious Diseases Research Centre,** which focuses on addressing emerging infectious diseases through a One Health approach. This centre brings together researchers from various disciplines to work collaboratively on interdisciplinary research projects.

5.2 Integration of One Health Principles in Medical System

It is essential to integrate One Health principles into Veterinary and Medical Schools while emphasizing their widespread adoption. Limited awareness and engagement from the human clinical medical community regarding One Health topics hinder its implementation. Surveys indicate a lack of environmental health knowledge, training, and confidence among clinicians in dealing with zoonoses and related issues.

Embracing the One Health approach offers numerous benefits in terms of disease prevention, reduced morbidity and mortality, and improved health outcomes. By addressing zoonotic diseases, foodborne illnesses, AMR, and non-infectious threats like obesity and cancers, a proactive approach can shift healthcare from reactive outbreak response to prevention. This shift aligns with the goals of the Global Health Security Agenda, which aims to prevent, detect, and respond to disease threats through multisectoral collaboration.

To fully embrace this approach and develop an inter-disciplinary workforce, India must take proactive steps in its medical education system:

One Health Circular Reform:

Integrate One Health principles into medical and veterinary school curricula, incorporating modules on zoonotic diseases, environmental health, and the impact of animal agriculture on public health. This interdisciplinary training will equip future healthcare professionals with the necessary knowledge and skills.

Accesss to Resources:

Increase access to existing One Health guidance, tools, and information resources through online platforms, such as MOOCs (Massive Open Online Courses). Utilize school websites, course syllabi, and lectures to disseminate key One Health content.

Interdisciplinary Collaboration:

Encourage collaboration between medical professionals, veterinarians, environmental scientists, and other relevant disciplines through joint research projects, conferences, and workshops. This will foster a culture of interdisciplinary cooperation.

Information Flow:

Establish communication channels for sharing information beyond immediate spheres of practice. Encourage frontline clinicians to report observations and contribute to disease surveillance. Design information channels with workflow needs and utility for potential users, including clinicians, in mind.

Training and Capacity Building:

Provide opportunities for healthcare professionals to undergo specialized training in One Health. This can include fellowships, certificate programs, and workshops that emphasize the integration of human, animal, and environmental health.

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Ensuring future physicians are equipped with the knowledge and skills necessary to address One Health challenges:

National One Health Training Program:

Establishing a national One Health training and education program open to professionals from all sectors. This program would provide comprehensive training on the interconnectedness of human, animal, and environmental health. It would equip participants with the skills and knowledge needed to work effectively in a One Health setting, fostering collaboration and interdisciplinary approaches.

Research and Surveillance:

Promote research and surveillance programs that monitor zoonotic diseases, antimicrobial resistance, and environmental health indicators. This will generate data-driven evidence to inform policy decisions and preventive strategies.

Establish a One Health Scholarship Program:

Introduction of a One Health scholarship program to provide financial assistance to students pursuing degrees in One Health disciplines. This initiative would encourage talented individuals to enter this field and ensure a diverse workforce of One Health professionals.

International Partnerships:

Foster collaborations with other countries that have made progress in implementing the One Health approach. Sharing best practices and exchanging knowledge will accelerate the adoption of this approach in India.

One Health Research Fund:

India should establish a dedicated One Health research fund to support research on challenges and solutions related to One Health. This fund would provide researchers with resources to conduct studies that contribute to the understanding of complex health issues. It would also help India become a leader in One Health research and innovation.

Public Outreach:

Empower healthcare professionals to communicate urgent threats to public health and promote the importance of a One Health approach. Utilize clear messaging to ensure consistent understanding across sectors and drive action.

5.3　The Road Ahead

Incorporating the One Health approach into medical education in India is essential to address the complex health challenges we face today. By integrating interdisciplinary training, fostering collaboration, and empowering healthcare professionals, we can enhance disease prevention, improve health outcomes, and build a more resilient healthcare system.

Initiatives taken by other countries, such as the Tripartite agreement and academic partnerships, provide valuable examples for India to follow. By embracing a holistic and collaborative approach, India can pave the way for a healthier and sustainable future for its population and t he planet.

5.4　Summary

By taking step towards developing an interdisciplinary workforce and incorporating the One Health approach into medical education in India will be a vital step towards addressing complex health challenges effectively. By preparing future healthcare professionals with a holistic perspective that recognizes the interconnectedness of human, animal, and environmental health, this initiative aims to foster collaboration among various disciplines.

This approach will entail training medical students not only in traditional clinical medicine but also in understanding the broader factors influencing health, including zoonotic diseases and environmental factors. By doing so, it will equip them with the knowledge and skills needed to work across disciplines and tackle emerging health threats more comprehensively.

By developing an interdisciplinary workforce through integrated medical education, India will be able to strengthen disease surveillance, advance research, and improve healthcare practices. This approach will serve as crucial step in nation's preparedness to address evolving health challenges and for promoting a more resilient and interconnected healthcare system.

06

Regulations and Compliances:
Key to Successful Execution

6.1   Introduction

Revisiting existing regulations and compliances in pharmacy, medical devices, information technology, health insurance, BMW, clinical research, and ethics is necessary to ensure they are current, effective, and aligned with the evolving landscape of the healthcare industry.

In an interconnected world where human, animal, and environmental health are deeply intertwined, effective regulation and compliance play a pivotal role in ensuring the successful execution of the One Health approach.

This chapter delves into the multifaceted realm of regulations and compliances essential for the seamless integration of One Health principles in India. To make these critical aspects accessible and practical, we emphasize the need for clear regulations tailored to the Indian context.

Furthermore, we discuss the necessary changes in research and development (R&D) processes to align with One Health regulations.

6.2   Human-Related Compliances

Recognizing the link between animal health, food safety, and human health, regulations are necessary to ensure the safety and quality of food products throughout the production chain. This includes regulations on animal feed, veterinary drug residues, hygiene practices in food production and processing, and labelling requirements. By implementing stringent regulations, the risk of foodborne diseases can be minimized, protecting the health of consumers.

Healthcare Delivery Regulations:

To ensure seamless healthcare delivery, regulations must focus on accessibility, affordability, and quality of healthcare services. Regulations should define standards for healthcare facilities, practitioner qualifications, and patient rights. Compliance monitoring should include measures to guarantee that patients receive comprehensive care that considers zoonotic risks and environmental factors.

Disease Surveillance and Reporting:

Early detection of disease outbreaks is crucial in the One Health paradigm. Regulations should mandate the reporting of suspected zoonotic diseases to relevant health authorities promptly. Compliance in this context involves healthcare providers, laboratories, and even the public, ensuring that information flows efficiently and interventions are timely.

Pharmaceutical Regulations and Compliance:

Regulations and compliance play a crucial role in ensuring the safety, efficacy, and quality of pharmaceutical products. They encompass various aspects, including drug development, manufacturing, distribution, and pharmacovigilance. Compliance with pharmaceutical regulations prevents the circulation of counterfeit or substandard drugs, protects patient safety, and promotes responsible use of medications

Medical Device Regulations and Compliance:

Regulations in the medical device industry establish standards for the design, manufacturing, and use of medical devices. Compliance with these regulations ensures the safety and effectiveness of medical devices, preventing the use of faulty or unsafe devices and promoting innovation while maintaining stringent quality standards.

Collaboration and Information Sharing:

Effective collaboration and information sharing are essential for One Health initiatives. Regulations may be necessary to facilitate cooperation, establish communication networks, and mandate the sharing of data and information among public health agencies, veterinary services, environmental agencies, and other stakeholders. These regulations foster interdisciplinary collaboration, leading to improved disease surveillance, response, and prevention efforts.

Data Privacy and Clinical Research Regulations:

Regulations regarding privacy and security are critical for safeguarding health data in the realm of information technology. Compliance with data privacy regulations ensures secure and confidential handling of personal health information. Clinical research regulations govern the ethical conduct of studies involving humans and animals, protecting the rights and welfare of research participants, and promoting the generation of reliable evidence.

Antimicrobial Resistance Regulations:

Regulations are needed to combat antimicrobial resistance by promoting the responsible use of antibiotics in both human and veterinary medicine. Surveillance systems, guidelines, and regulations control the use of critically important antimicrobials, ensuring cautious practices, and empowering regulatory authorities and healthcare professionals. Compliance with these regulations preserves the efficacy of antimicrobial treatments and safeguards public health.

6.3   Animal-Related Compliances

Regulations regarding animal welfare are integral to the One Health approach. They aim to ensure humane treatment of animals in various settings, including agriculture, research, and companion animal ownership. These regulations cover housing standards, transport conditions, pain management, humane slaughter, and ethical considerations in animal research.

By promoting animal welfare, the well-being of animals is safeguarded, aligning with the principles of One Health.

Livestock and Poultry Regulations:

Given the close interaction between humans and animals, regulations concerning livestock and poultry farming should emphasize animal health, welfare, and disease control. Compliance measures should include guidelines for responsible antibiotic use, vaccination, and hygiene practices on farms. These regulations should be easy to understand so that farmers can implement.

Zoonotic Disease Prevention:

Regulations should outline strategies for preventing zoonotic diseases, including mandatory vaccination of animals, regular health check-ups, and secure waste disposal. Compliance monitoring should ensure that these practices are followed consistently, reducing the risk of disease transmission between animals and humans.

6.4 Environmental Compliances

Regulations addressing environmental factors that impact health are crucial for promoting One Health. These regulations focus on mitigating environmental hazards, such as air and water pollution, waste management, pesticide use, and climate change.

By enforcing these regulations, the health of both humans and animals can be safeguarded, and sustainable practices can be encouraged to preserve ecosystems.

Water and Air Quality Standards:

Environmental regulations should encompass water and air quality standards that directly impact human and animal health. These standards should be clearly defined, with compliance measures that address pollution sources, waste disposal, and habitat preservation.

Wildlife Conservation:

Protecting biodiversity is fundamental to One Health. Regulations should promote wildlife conservation, sustainable land use practices, and habitat protection. Compliance should focus on enforcing laws against illegal wildlife trade, habitat destruction, and unsustainable resource extraction.

Biosafety and Biosecurity:

With advancements in biotechnology, regulations are required to ensure the safe handling, storage, and transport of biological agents. Biosafety and biosecurity regulations encompass laboratory practices, risk assessment, containment measures, and protocols to prevent the accidental or intentional release of harmful agents. These regulations protect public health, prevent the spread of diseases, and ensure responsible use of biotechnological innovations. In the Indian context, emphasizing the importance of farm biosecurity is crucial when considering biosafety and biosecurity measures. Farm biosecurity aims to protect agricultural and livestock operations from potential threats caused by diseases, pests, and contaminants. This involves various practices such as controlling access to farms, implementing quarantine measures, following hygiene protocols, and conducting early disease detection monitoring.

6.5   The Road Ahead

To ensure that regulations are understood and followed, translating legal jargon into understandable language to general people is vital. Government agencies and regulatory bodies should collaborate with experts in communication and public engagement to create accessible materials. Workshops and awareness campaigns can further educate stakeholders on their roles in compliance, demystifying the legal aspects of One Health.

Regulations must be context-specific, accounting for India's unique challenges and diversity. The vast differences in healthcare access, environmental conditions, and agricultural practices across regions require tailored regulations that address local needs while adhering to overarching One Health principles.

R&D processes should adapt to support health systems. This entails increased interdisciplinary collaboration, bringing together experts from human health, animal health, and environmental science. Furthermore, R&D should focus on developing tools and technologies that facilitate compliance monitoring, such as data analytics for disease surveillance and environmental monitoring.

6.6   Summary

The chapter underscores the critical role of regulations in the successful execution of the One Health approach in India, with a primary emphasis on the necessity of stakeholder consultation and mass adoption. It elucidates that while crafting regulations, a consultative approach involving all relevant stakeholders is indispensable.

Regulations designed in isolation are unlikely to be effective; instead, they must be the product of collective wisdom that includes the perspectives of healthcare professionals, researchers, farmers, environmentalists, communities, and more. This ensures that the regulations are pragmatic, comprehensive, and reflective of real-world challenges.

However, formulating regulations is only the first step. Mass adoption and implementation at the grassroots level are equally vital. The chapter recognizes that policies and regulations on paper, no matter how well-crafted, are of limited value if they remain confined to documents.

To truly execute the One Health approach, there must be a robust system in place to ensure adherence to these regulations. This necessitates a multi-pronged effort involving education, awareness campaigns, training programs, and compliance monitoring mechanisms.

In conclusion, the chapter highlights that the success of the One Health approach hinges not just on the quality of regulations but on the inclusivity of their creation and their effective implementation.

Stakeholder consultation guarantees that regulations are relevant and practical, while mass adoption ensures that they translate into tangible improvements in human, animal, and environmental health. It underscores that the One Health vision can only be realized when regulations evolve from being mere words on paper to becoming actionable measures that safeguard the well-being of India's diverse population and ecosystems.

07

Community-Inclusive Approach for Better Health Outcomes

7.1   Overview

The global healthcare landscape is continuously evolving, necessitating a paradigm shift towards a community-inclusive approach to promoting healthy behaviour and preventing the spread of diseases.

Recognizing the significance of community engagement and collaboration in promoting healthy behaviour and preventing the spread of diseases, several global initiatives have been undertaken to implement this approach. For instance:

- The World Health Organization (WHO), Food and Agriculture Organization (FAO), and World Organization for Animal Health (OIE) have collaborated to establish a joint platform on zoonotic diseases. This platform aims to enhance global cooperation, communication, and coordination in preventing, detecting, and responding to zoonotic disease outbreaks.

- International organizations, such as the Global One Health Initiative and the Eco Health Alliance, have been working on interdisciplinary research and capacity-building programs to address the health challenges at the human-animal-environment interface.

- Global Health Security Agenda (GHSA): GHSA is a global partnership of nations, international organizations, and stakeholders committed to preventing, detecting, and responding to infectious disease threats. It emphasizes the importance of community engagement and a multisectoral approach to strengthen health systems and prevent disease outbreaks.

Formulating a concrete roadmap to effectively utilise Social and Behaviour Change Communications (SBCC) strategies, including mass media, community-level activities, interpersonal communication, ICT, to empower individuals and communities to contribute to One Health initiatives.

7.2   Social Determinants of Health

In India, the implementation of a One Health approach is of utmost importance given its diverse population, socio-economic complexities, and distinctive healthcare system.

Consequently, it is essential to consider the social determinants of health, including socio-economic status, education, neighbourhood, and physical environment, employment, social support

networks, and access to healthcare. Addressing these factors is crucial for enhancing health outcomes and diminishing health disparities.

Furthermore, the COVID-19 pandemic has not only disproportionately impacted the health of marginalized communities and high-risk groups but has also exacerbated the economic and social inequities they face.

ECONOMIC STABILITY

Employment, Income, Medical Bills, Debt etc.

PHYSICAL ENVIRONMENT

House, Transport etc.

EDUCATION

Literacy, Language, Training etc.

FOOD

Food Security etc.

COMMUNITY, SAFETY & SOCIAL CONTEXT

Social Integration, Community Engagement, Stress, Support Systems etc.

HEALTH CARE SYSTEMS

Health Coverage, Provider & Pharmacy, Quality of Care etc.

Health and Well-being

Mortality

Morbidity

Life Expectancy

Health Expenditure

Health Status

In the context of One Health, it is essential to adopt a community-inclusive approach that addresses these determinants to promote holistic health.

Health Equity:

By addressing social determinants of health, such as income inequality, education, and access to healthcare, a community-inclusive approach ensures that all individuals have an equal opportunity to achieve optimal health outcomes. This helps in reducing health disparities and promoting health equity within communities.

Empowerment and Participation:

Engaging communities in decision-making processes and actively involving them in the planning and implementation of One Health interventions foster a sense of ownership and empowerment.

Behaviour Change and Health Problems:

Addressing social determinants involves promoting healthy behaviours and lifestyles within communities. By targeting factors such as education, income, and social support networks, a community-inclusive approach can facilitate behaviour change and health promotion initiatives that benefit both humans and animals. This can include education campaigns, access to nutritious food, and opportunities for physical activity.

Sustainable Interventions:

Social determinants, such as employment, economic stability, and access to resources, influence the long-term sustainability of health interventions. A community-inclusive approach considers these factors, ensuring that interventions are sustainable and have a lasting impact on the health and well-being of communities.

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The Government of India and various states have implemented public policy initiatives in alignment with the community-inclusive approach and with the aim to improve health outcomes.

The National Health Policy 2017 recognizes the importance of addressing zoonotic diseases and highlights the need for intersectoral collaboration and community participation.

Additionally, the Ministry of Health and Family Welfare (MoHFW) has established the Integrated Disease Surveillance Program (IDSP) to strengthen disease surveillance and response capacities at the grassroots level. Additionally, the Ministry has launched national campaigns to educate the public on preventive measures, such as vaccination, hand hygiene, and sanitation practices.

States like Kerala have launched innovative initiatives, such as the One Health Kerala Program, which integrates human, animal, and environmental health for effective disease control. This program emphasizes community engagement, capacity building, and the integration of traditional and modern knowledge systems to promote healthy behaviour and prevent disease transmission.

The Mukhyamantri Kishori Swasthya Yojana in Rajasthan focuses on adolescent health.

Mukhyamantri Amrutum Yojana in Gujarat provides free healthcare services to low-income families.

The Swachh Bharat Abhiyan (Clean India Campaign), launched in 2014, is a nationwide cleanliness and sanitation campaign. It focuses on creating awareness about the importance of hygiene, safe sanitation practices, and waste management, thereby preventing the spread of diseases.

The National Health Mission (NHM) is a flagship program of the Government of India that aims to provide accessible, affordable, and quality healthcare to all. It emphasizes community participation and behaviour change through various initiatives, including health education, capacity building, and awareness campaigns.

As evidence for the importance of inclusive healthcare practices and research continues to grow, a broader view needs to be embraced beyond day-to-day service delivery. Although there has been a continuous effort taken by global and Indian stakeholders to improve the healthcare sector, it is critical to bridge the gap between healthcare professionals and communities. Education in diversity and inclusion for all health professions, both in basic training and continuing professional education, is paramount. At the national level, advocacy is needed to enshrine inclusive practices in health service accreditation schemes, as well as in national guidelines for health research.

Healthcare decision-makers must make the inclusive approach a serious goal, through strategies that will improve both short-term service delivery and establish systemic changes to boost long-term outcomes.

7.3   The Road Ahead

To further strengthen the community-inclusive approach for One Health, the following recommendations and suggestions can be considered at the public policy level in India:

Leveraging Digital Platforms and Technologies

In the digital age, leveraging digital platforms and technologies is essential for reaching a wider audience and inculcating change in conduct. Through social media, websites, mobile applications, and other digital tools, information can be disseminated effectively.

In recent years, India has witnessed rapid advancements in digital platforms and technologies, providing an opportunity to leverage these tools as a means for behaviour change promotion. The National Health Portal, a government initiative, serves as a comprehensive online resource for health information and empowers individuals to make informed decisions. Mobile applications, such as Aarogya Setu, have been instrumental in disseminating health-related information and facilitating contact tracing during the COVID-19 pandemic. These platforms also provide opportunities for interactive engagement, enabling individuals to participate in discussions, ask questions, and share their experiences.

Invest in improving disease surveillance and early warning systems, particularly at the community level. Enhance the capacity of healthcare professionals and veterinarians in disease detection, reporting, and response. Furthermore, digital technologies can facilitate monitoring and evaluation, allowing for the assessment of the impact of interventions and the identification of areas for improvement.

Promoting Education and Awareness

In order to raise awareness, emphasis should be on the potential consequences of unhealthy behaviours and the benefits of adopting responsible practices. By understanding the shared risks and responsibilities, individuals and communities can be motivated to take proactive measures to prevent the spread of diseases. Incorporation of One Health principles into the curricula of medical, veterinary, and environmental sciences.

Invest in interdisciplinary research to better understand the dynamics of disease transmission and the impacts of human activities on the environment. Establish robust surveillance systems for zoonotic diseases and antimicrobial resistance.

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Effective Communication is the Key:

Building communication skills among individuals and communities is essential to enable them to convey accurate and relevant information, engage in productive dialogue, and influence behaviour change. Training programs can be developed to enhance the communication capabilities of healthcare professionals, community leaders, and other stakeholders. By fostering effective communication, the community-inclusive approach empowers individuals to become agents of change within their communities.

Enhancing Intersectional Collaboration:

Foster stronger collaboration and coordination among health, veterinary, and environmental sectors at national, state, and local levels. Develop mechanisms to facilitate information sharing, joint decision-making, and coordinated actions.

India recognizes the importance of collaboration and partnerships with international organizations to foster knowledge sharing and joint efforts in promoting One Health. The country actively participates in forums like the World Health Organization (WHO), World Organisation for Animal Health (OIE), and Food and Agriculture Organization (FAO). These collaborations facilitate the exchange of best practices, technical expertise, and resources to strengthen India's healthcare system and address global health challenges. Collaboration and partnerships with international organizations are essential for fostering knowledge sharing and joint efforts in

promoting One Health. By working together, organizations can pool resources, share expertise, and develop comprehensive strategies that transcend geographical boundaries.

Social and Behaviour Change Communication (SBCC):

In India, SBCC initiatives are being implemented at various levels, ranging from mass media campaigns to community-level activities. Information and Communication Technologies (ICT), including mobile phones and the internet, are harnessed to deliver targeted health messages and promote healthy behaviours. The use of new media platforms, such as social media and online communities, further amplifies the reach and impact of SBCC initiatives. The integration of Social and Behaviour Change Communication (SBCC) strategies further strengthens the community-inclusive approach.

Community Engagement:

Engage communities through participatory approaches, empowering them to actively contribute to disease prevention and control efforts. Promote community-led initiatives, such as local health committees, to drive behaviour change and sustainable practices.

Advocate for policies that support the integration of One Health approaches into national health agendas. Promote policies that incentivize collaboration, innovation, and sustainable practices in the healthcare, veterinary, and environmental sectors.

7.4   Summary

By adopting a comprehensive strategy that emphasizes education, behaviour change, and stakeholder engagement, societies can work towards a healthier and more sustainable future.

Through collaboration with international organizations, implementation of public policy initiatives, and the application of social and behaviour change communication tools, communities can actively contribute to the One Health agenda, leading to improved health outcomes for humans, animals, and the environment.

Leveraging the expertise and resources of diverse stakeholders, a comprehensive strategy can be developed to address the challenges posed by disease transmission across species boundaries.

A few strategies may be -

Establishment of Local One Health Task Forces

Create community-based Health task with Panchayati Raj people comprising representatives from the health sector, veterinary services, environmental agencies, and local communities. These task forces should collaborate on disease surveillance, health promotion, and education initiatives tailored to the specific needs of each community.

Development of Cross Sectoral Education:

Develop educational programs that emphasize the interconnectedness of human, animal, and environmental health. Implement these programs in schools, community centres, and through online resources to raise awareness and understanding of One Health principles.

Community-Based Outreach:

Encourage research initiatives that involve local communities in data collection and analysis, fostering a sense of ownership and trust in scientific findings. Use research findings to tailor interventions to specific community needs.

08

Strengthening infrastructure with a focus on diagnostics and research

8.1   Introduction

Enhancing health infrastructure with an emphasis on diagnostics and research is of utmost importance in promoting the progress of One Health research. To improve the existing state of health infrastructure, several measures are needed.

First, there is an immediate need to increase public spending on healthcare to at least 2.5% of GDP, even though it is lower than the global average of 5.4%. This increased investment will provide the necessary resources to strengthen health infrastructure, research capabilities, and diagnostics.

‣ Increase Laboratory capacity and creation of state-of-the-art genetic and genome sequencing labs.

‣ Establishing dedicated research facilities for One Health to focus on interdisciplinary research including zoonotic diseases, antimicrobial resistance, etc., for better understanding and management.

Additionally, the performance of Health and Wellness centres is critical for achieving a comprehensive and distress-free wellness system. These centres can reduce the burden of out-of-pocket healthcare expenditures, so investments should be made to enhance their effectiveness and reach.

To move away from inconsistent and insufficient increases in health spending, sustained investments in public health are required over the next decade. This will ensure that the healthcare system is adequately supported and can meet the evolving health needs of the population.

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Announced as a long-term health infrastructure development scheme in the Union Budget 2021-22, **PM-ABHIM** has an allocated outlay of ₹4,810 crore over five years.

The scheme received approval from the Union Cabinet in September 2021. Comprising mostly centrally sponsored schemes (CSS) and some central schemes (CS), PM-ABHIM incorporates an element of state government funding in CSS, while CS remains 100% centrally funded.

The health infrastructure development scheme comprises three crucial components:

Robust Infectious Disease Surveillance:

The mission will establish health and wellness centers in rural and urban areas, equipped for early disease detection. These centers will offer free medical consultations, tests, and medications to facilitate prompt intervention.

Enhanced Diagnostics and Treatment Facilities:

The mission will develop testing infrastructure across all 730 districts, including integrated public health labs, and 3,000 blocks will receive public health units. Additionally, there will be the establishment of five disease control centers, 20 metropolitan units, and 15 BSL labs to strengthen the overall network.

Comprehensive Pandemic Research:

Strengthening of existing 80 viral diagnostic and research labs, the establishment of four new National Institutes of Virology (NIVs), and a dedicated National Institute for One Health will contribute to comprehensive pandemic research. Furthermore, laboratory capacity at the National Centre for Disease Control, the Indian Council of Medical Research, and national research institutions will be bolstered. Fifteen bio-safety level III labs will enhance the ability to control infectious diseases and ensure biosecurity.

8.2 Current status of Health Infrastructure

85.7 per 100,000 people

In 2017, India had a **physician density** of 85.7 per 100,000 people, which was lower compared to 98 in Pakistan, 100 in Sri Lanka, and 241 in Japan.

53.0 per 100,000 people

The **bed density** was 53 per 100,000 people, lower than 63 in Pakistan, 79.5 in Bangladesh, 415 in Sri Lanka, and 1,298 in Japan.

172.7 per 100,000 people

The **nurse and midwife density** in India was 172.7 per 100,000 people, lower than 220 in Sri Lanka, 40 in Bangladesh, 70 in Pakistan, and 1,220 in Japan.

62% Out-of-Pocket (OOP) Health Expenditure

India has **one of the highest OOP expenditures in the world,** with 62% of the total health expenditure being OOP.

Source: World Bank

India's vast population of 1.3 billion, living in both urban and rural areas, poses a distinctive healthcare challenge. According to a United Nations report, around 75% of all healthcare infrastructure, including medical specialists and doctors, is concentrated in urban regions, where only 27% of the population resides.

In contrast, rural areas, accommodating about 72% of the remaining population (approximately 716 million people), face a chronic shortage of primary healthcare facilities. Moreover, private hospitals and quality healthcare options are predominantly limited to urban areas, leaving rural communities with restricted access to essential medical services.

An extensive effort has been made by Government of India to map the laboratory capabilities at various biosafety levels (BSL-2, BSL-3, and BSL-4). This crucial initiative aims to provide a comprehensive overview of our nation's capabilities and resources, both existing and forthcoming. The goal is to integrate these critical lab infrastructures into a cohesive national network. Such integration is pivotal for optimizing resource utilization and fostering capacity building, which is essential for routine disease control and effectively addressing emerging pandemics.

To map institutional capabilities, robust strengths within various government and non-government departments across India were identified under One Health Mission. Through a meticulous assessment process, the core competencies of these institutions and pinpointed how they can contribute to the overarching mission have been outlined. This collective understanding helps in shaping a cohesive One Health ecosystem, where all stakeholders understand their roles and collaborate seamlessly.

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8.3   The Road Ahead

In recent years, the Indian healthcare industry has experienced remarkable growth due to various factors, including rise in an aging population, lifestyle disorders, technological advancements, and increased public and private sector investments in health infrastructure.

The focus should be on implementing an IT-enabled disease surveillance system creating a network of surveillance labs to detect and prevent health emergencies.

Including preventive health measures in strengthening the healthcare system is essential for promoting overall well-being and reducing the burden on healthcare resources.

By prioritizing prevention, healthcare systems can minimize the occurrence of preventable illnesses, thus reducing the strain on hospitals and clinics. This approach not only saves lives but also leads to significant cost savings in the long run.

Moreover, it empowers individuals to take charge of their health, fostering a healthier population and enhancing the resilience of the healthcare system to cope with emerging challenges, such as pandemics and chronic diseases. Integrating preventive health measures into the healthcare system is a prudent investment in the future of public health.

Recognizing the significance of digital health, IT implementation is accelerated for effective care. Initiatives like the Co-Win app and the ABDM showcase the country's commitment to digital healthcare.

Strengthening Sub-centres/ Health and Wellness Centres is vital in achieving a comprehensive and accessible wellness for all, reducing the burden of out-of-pocket healthcare expenditures. Sustained investments in public health over the next decade are essential to ensure that the healthcare system is adequately supported and can meet evolving health needs.

Currently, India faces healthcare challenges due to a significant portion of its population residing in rural areas with limited access to primary, secondary, and tertiary healthcare. Most healthcare infrastructure and quality healthcare options are concentrated in urban regions. Bridging this urban-rural healthcare divide is a priority.

Moving forward, ensuring a continuum of care and efficient referral mechanism is vital for a well-functioning healthcare system. Effective supply chain management of medicines, oxygen equipment, and biomedical equipment, etc. for both animal and human healthcare, must be a priority.

These holistic efforts, encompassing all health inputs, will contribute to the resilience and effectiveness of the healthcare system and align with the One Health approach.

8.4   Summary

Strengthening health infrastructure is essential as it forms the backbone for delivering accessible and affordable healthcare services to the population. Upgrading public health institutions and governance capacities is crucial to providing comprehensive diagnostics and treatment, including critical care services.

Moreover, prioritizing research on infectious diseases, along with genomics, will generate evidence to inform effective responses to pandemics in the short and medium term. Additionally, the government's focus is on building core capacity to implement the 'One Health' approach, enabling proactive measures to prevent, detect, and respond to infectious disease outbreaks in both humans and animals.

Strengthening health infrastructure with an emphasis on diagnostics and research involves enhancing the core elements of a healthcare system to improve both patient care and medical advancements. This includes investing in cutting-edge diagnostic tools, fostering research institutions, promoting collaboration, advancing data management, Digital Health building capacity, expanding physical infra-structure, raising public awareness, and securing sustainable funding.

By prioritizing these areas, a healthcare system becomes better equipped to address health challenges, deliver quality care, and drive scientific progress in medicine and public health.

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09

Inclusion of Integrative Medicine

9.1   Introduction

Traditional Medicine has garnered widespread acceptance and appreciation in recent years, not only as a supportive therapy but also as a mainstream preventive and curative medicine backed by studies and clinical evidence.

Traditional medicine, such as herbal medicines, indigenous therapies, and others is estimated to be used in 88% of all countries. The sociocultural practice and biodiversity heritages of traditional medicine are invaluable resources for evolving inclusive, diverse sustainable development. Traditional medicine is also a part of the global health, wellness, beauty, and pharmaceutical industries, which are worth trillions of dollars. Over 40% of pharmaceutical formulations are based on natural products, and landmark drugs such as aspirin and artemisinin, have their origins in traditional medicine. [12]

[12]   WHO Global Centre for Traditional Medicine

One Health framework should encompass the integration of alternative or traditional medicine with mainstream healthcare practices to ensure a comprehensive and holistic approach to health.

Some traditional medicine systems are supported by huge volumes of literature and records of theoretical concepts and practical skills; others are passed down verbally from generation to generation. To date, in some parts of the world, the majority of the population continues to rely on their own traditional medicine to meet their primary healthcare needs. Among others, the most widely used traditional medicine systems today include those of India and Africa. [13] The World Health Organization (WHO) has been increasingly involved in developing international standards and technical guidelines for Traditional Medicine, and also in increasing communication and cooperation between countries and WHO Traditional Medicine Strategy 2014–23 has two key goals, one of which is to support Member States in harnessing the potential contribution of traditional and complementary medicine to health, wellness and people-centred health care. [14]

While synthetically produced medicines have undeniable benefits, it is essential to acknowledge that they may also have side effects. Excessive usage or improper administration without medical advice can lead to the development of antimicrobial resistance (AMR) in patients. The concerning aspect is that the mutated strain of bacteria can transfer between different lifeforms through consumption, triggering a domino effect of resistance. Therefore, it is crucial to use such medicines judiciously and under the guidance of healthcare professionals to minimize risks and promote responsible healthcare practices. Traditional Medicine uses naturally occurring substances to produce medicines and supplements, which do not alter the natural state of the being and provide a holistic therapy.

[13]   C.-T. Che, V. George, T.P. Ijinu, P. Pushpangadan, K. Andrae-Marobela, Chapter 2 - Traditional Medicine, Editor(s): Simone Badal, Rupika Delgoda, Pharmacognosy, Academic Press, 2017, Pages 15-30, ISBN 9780128021040

[14]   Oyebode O, Kandala NB, Chilton PJ, Lilford RJ. Use of traditional medicine in middle-income countries: a WHO-SAGE study. Health Policy Plan. 2016;31(8):984-991. doi:10.1093/heapol/czw022

9.2 Evidence-Based Traditional Medicine

The use of Traditional Medicine as a mainstream practice has gone through a lot of scrutiny especially by allopathic practitioners as these practices are ancient and faith-based with little formal research to back the efficacy against diseases. However, in recent times, Traditional Medicine practitioners have realised the importance of producing credible, peer-reviewed data to support the potential of Traditional Medicine in a multitude of ways in mainstream healthcare. Traditional Medicine is accepted and regulated as one of the healthcare systems in many countries where medical pluralism exists, and traditional medicine is well integrated into the mainstream healthcare delivery system. In other countries where the Traditional Medicine systems are accepted albeit not as a primary health system, traditional system(s) of medicine are often complemented with biomedicine, especially for the prevention and management of lifestyle diseases.

Australia, Brazil, Canada, Germany, the UK, US are some of the many countries that have shown keen interest in investing in the scaling up of evidence-based Traditional Medicine practices and have taken action towards recognising Traditional Medicine as a mode of treatment in a multitude of conditions.

The establishment of research centres, formal education, and development of policy for Traditional Medicine has been taken up by many countries like Argentina, Indonesia, Japan, Mexico, and Saudi Arabia as well.

As globalization changes sociocultural contexts, one can expect that the current development will have an impact on the utilization of Traditional Medicine also.

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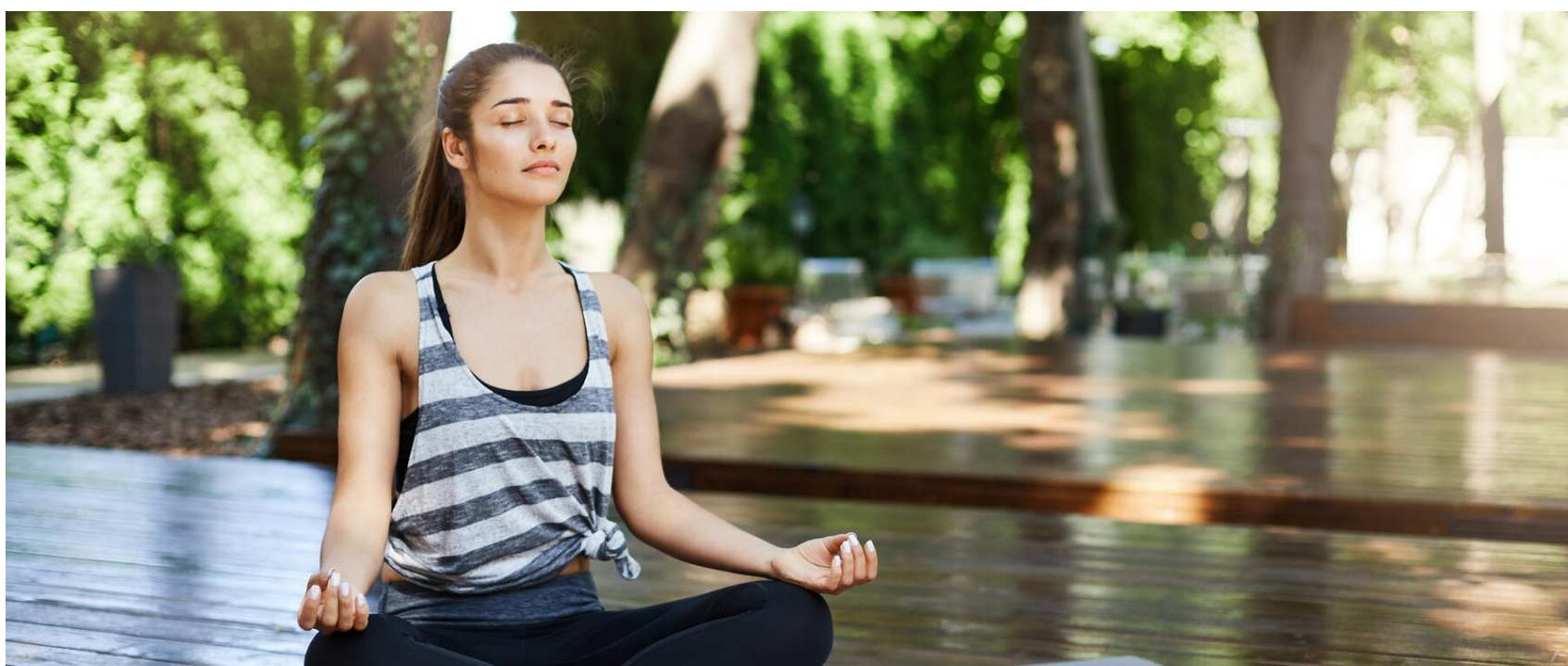
9.3 Traditional Medicine in the One Health Approach

The One Health approach recognizes the inter-connectedness of human, animal, and environmental health. It promotes collaboration among various disciplines, including traditional medicine, to achieve optimal health outcomes.

Traditional medicine, which encompasses indigenous healing practices and knowledge passed down through generations, can contribute to the One Health approach in several ways:

Ethnobotanical Research:

Traditional medicine often relies on the use of plant-based remedies. Ethnobotanical research involves documenting and studying the traditional uses of plants for medicinal purposes. This knowledge can help identify potential therapeutic compounds, guide drug development, and contribute to the conservation of biodiversity.

Zoonotic Disease Management:

Traditional medicine incorporates knowledge and practices related to zoonotic diseases (those transmitted between animals and humans). Traditional healers may possess knowledge about local disease outbreaks, symptoms, and treatments, which can complement the efforts of modern healthcare systems in the surveillance, prevention, and control of zoonotic diseases.

Indigenous Knowledge of Animal Health:

Traditional medicine also includes remedies and practices for animal health. Indigenous communities often possess valuable knowledge about animal diseases, herbal treatments, and ethnoveterinary practices. Integrating this knowledge into animal healthcare systems can enhance disease management and promote sustainable livestock production.

Mental Health and Well-being:

Traditional healing practices often address mental health and well-being, acknowledging the interconnectedness of mind, body, and environment. Traditional healing methods, such as meditation, herbal treatments, and spiritual rituals, can contribute to holistic approaches to mental health care, complementing conventional treatments.

Cultural Preservation:

Traditional medicine is deeply rooted in cultural and spiritual beliefs. Incorporating traditional healing practices in the One Health approach helps preserve cultural heritage and foster respect for indigenous communities. It also enhances cultural sensitivity and inclusivity in healthcare systems, which is essential for effective and equitable health service delivery.

Health Education and Awareness:

Traditional healers are often trusted members of their communities and play a crucial role in health education and awareness. They can contribute to health promotion campaigns, disseminate information about disease prevention, and advocate for sustainable practices that promote overall health and well-being.

9.4   The Road Ahead

End-to-End Supply Chain Management:

Establish a robust supply chain system to ensure that traditional medicine molecules and remedies are efficiently transported to every Primary Health Centre (PHC). This ensures that these treatments are readily available to patients, facilitating the healing process. A well-organized supply chain ensures that traditional medicines are not only produced but also reach the end-users effectively.

Curriculum Integration:

Revise and adapt educational curriculum to integrate AYUSH practices seamlessly with modern medicine. This integration should aim to bridge the gap between traditional and allopathic medicine, fostering a more holistic approach to healthcare education.

Trust Building through Evidence:

Build trust among the general population by providing evidence-based treatments over time. Conduct rigorous research and clinical trials to demonstrate the effectiveness and safety of AYUSH treatments. Public awareness campaigns should emphasize the scientific basis of traditional medicine, dispelling myths, and misconceptions. This evidence-based approach can enhance the acceptance of traditional medicine among the larger population.

Research and Development:

Invest in research and development for AYUSH drugs and therapies. Promote studies that generate supporting evidence for the efficacy and safety of traditional treatments. Standardize production processes to ensure consistent quality and collaboration between AYUSH, modern medical researchers, Biotech, and pharmaceutical companies can drive innovation and validate traditional remedies.

Holistic Treatment Packages

Develop comprehensive healthcare packages that incorporate the right balance of traditional, complementary, and modern medicine. Such packages can provide patients with holistic health solutions, minimizing side effects, and promoting overall well-being. Tailor treatments to individual needs, drawing from the strengths of each healthcare system for optimal results. One such example can be nutritional packages.

9.5   Summary

Integrating traditional medicine into the One Health approach is a significant step towards achieving comprehensive and holistic healthcare. However, it is vital to approach this integration with scientific rigor, considering factors such as safety and efficacy.

Traditional medicine has been passed down through generations and holds immense knowledge about natural remedies and healing practices.

To harness its potential fully, Collaborations between traditional healers, modern healthcare professionals, and researchers are necessary to ensure appropriate validation, standardization, and regulation of traditional practices for optimal health outcomes.

Traditional medicine's integration into the One Health approach, holds promise in various aspects. Recommendations include improving supply chain management, integrating traditional medicine into educational curricula, building trust through evidence-based practices, investing in research and development, and creating holistic treatment packages that combine traditional and modern medicine to ensure comprehensive and effective healthcare.

In short, traditional medicine, offers valuable contributions to healthcare when integrated effectively. It combines ancient wisdom with modern science to promote holistic well-being and should be further supported and researched for its potential benefits.

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10

Tech Fusion:
For Robust & Interoperable System

10.1 Overview

India has made significant strides in incorporating technology into healthcare services, setting a precedent for others to follow.

The Ayushman Bharat Digital Mission (ABDM) and various IT platforms such as the CoWIN app, Jan Aushadhi Pariyojana, e-Sanjeevani, e-Aushadhi, and e-Shushrut have garnered global acclaim for their innovative and effective approaches to healthcare delivery.

These initiatives have been widely recognized and appreciated for their impact on improving access to healthcare and enhancing the efficiency and effectiveness of medical services.

Utilizing digitalization to implement One Health involves the deployment of digital technologies, such as Artificial Intelligence (AI), big data, and related tools. This approach aims to strengthen our capacity to address the escalating climate challenges and the associated risks to human, animal, and plant health.

It is the need of the hour to use digital intervention to further the agenda of One Health and reach such a large and scattered population in the country.

▸ Creation of a robust and interoperable Information technology solution for One Health.

▸ There is a need to define the One Health solution architecture and integrate and interphase existing solutions with the use of AI, data analytics, etc.

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Digital Surveillance Systems:

Establish robust systems for real-time monitoring of disease trends and early detection of outbreaks. A digital surveillance system for One Health refers to the use of technology and digital platforms to monitor and track health-related data across human, animal, and environmental sectors. This system enables the collection, analysis, and sharing of information to detect and respond to emerging health threats, identify disease patterns, and assess the impact of interventions on public health. By integrating data from multiple sources and sectors, a digital surveillance system for One Health enhances early warning capabilities, facilitates timely decision-making, and supports collaborative efforts in promoting the health and well-being of all living beings and ecosystems.

Mobile Health (mHealth) Solutions:

Develop mobile applications and platforms for health information, remote consultations, and disease reporting. The development of mobile applications and platforms for health information, remote consultations, and disease reporting plays a crucial role in advancing the principles of One Health. These digital solutions provide individuals with easy access to reliable health information, empowering them to make informed decisions about their own well-being and that of their pets or livestock. By enabling remote consultations, these platforms facilitate timely and convenient interactions between healthcare providers and

patients, regardless of geographical barriers. Additionally, mobile applications can be utilized for efficient disease reporting, allowing for real-time data collection and analysis to identify and respond to public health threats promptly. Through these innovative technologies, the One Health approach becomes more accessible, inclusive, and responsive, promoting the overall health and resilience of communities and ecosystems.

Telemedicine and Telehealth:

Promote virtual consultations and remote veterinary services to enhance access to healthcare. These digital solutions enable virtual consultations and remote veterinary services, allowing individuals to seek medical advice, receive diagnoses, and access treatment options from the comfort of their homes. By leveraging technologies, patients can connect with healthcare professionals, including veterinarians, regardless of geographic location, thus overcoming barriers such as distance and limited access to healthcare facilities. This not only improves convenience for individuals seeking healthcare for themselves or their animals but also enhances overall healthcare outcomes, reduces the need for physical travel, and minimizes the risk of disease transmission. Telemedicine and telehealth contribute to the advancement of One Health by promoting inclusivity, efficiency, and accessibility in healthcare delivery.

Digital Records:

Implement integrated digital health records for comprehensive health information management. By digitizing health records across human, animal health sectors, these systems enable seamless sharing and analysis of data, fostering collaboration and enhancing healthcare outcomes. Integrated digital health records provide a centralized repository for storing and accessing patient information, medical histories, laboratory results, and other relevant data, ensuring that healthcare providers have a holistic view of an individual's health across different domains. This comprehensive approach enables more accurate diagnoses, improved treatment planning, and better coordination among healthcare professionals from various disciplines. Additionally, these digital records support research, surveillance, and public health interventions by facilitating data analysis and identifying trends or patterns that may impact the health of humans, animals, and ecosystems. By promoting interoperability and information exchange, integrated digital health records strengthen the foundation of One Health and contribute to the overall well-being of individuals and the environment.

Data Analytics and Artificial Intelligence (AI):

Utilize AI and data analytics, etc. for disease prediction and accurate diagnosis. By analysing vast amounts of data from various sources, including health records, environmental data, and animal health data, AI algorithms can identify patterns, trends, and potential risk factors associated with disease outbreaks. This predictive analysis helps in early detection and timely intervention, allowing for proactive measures to be taken to prevent or mitigate the spread of diseases.

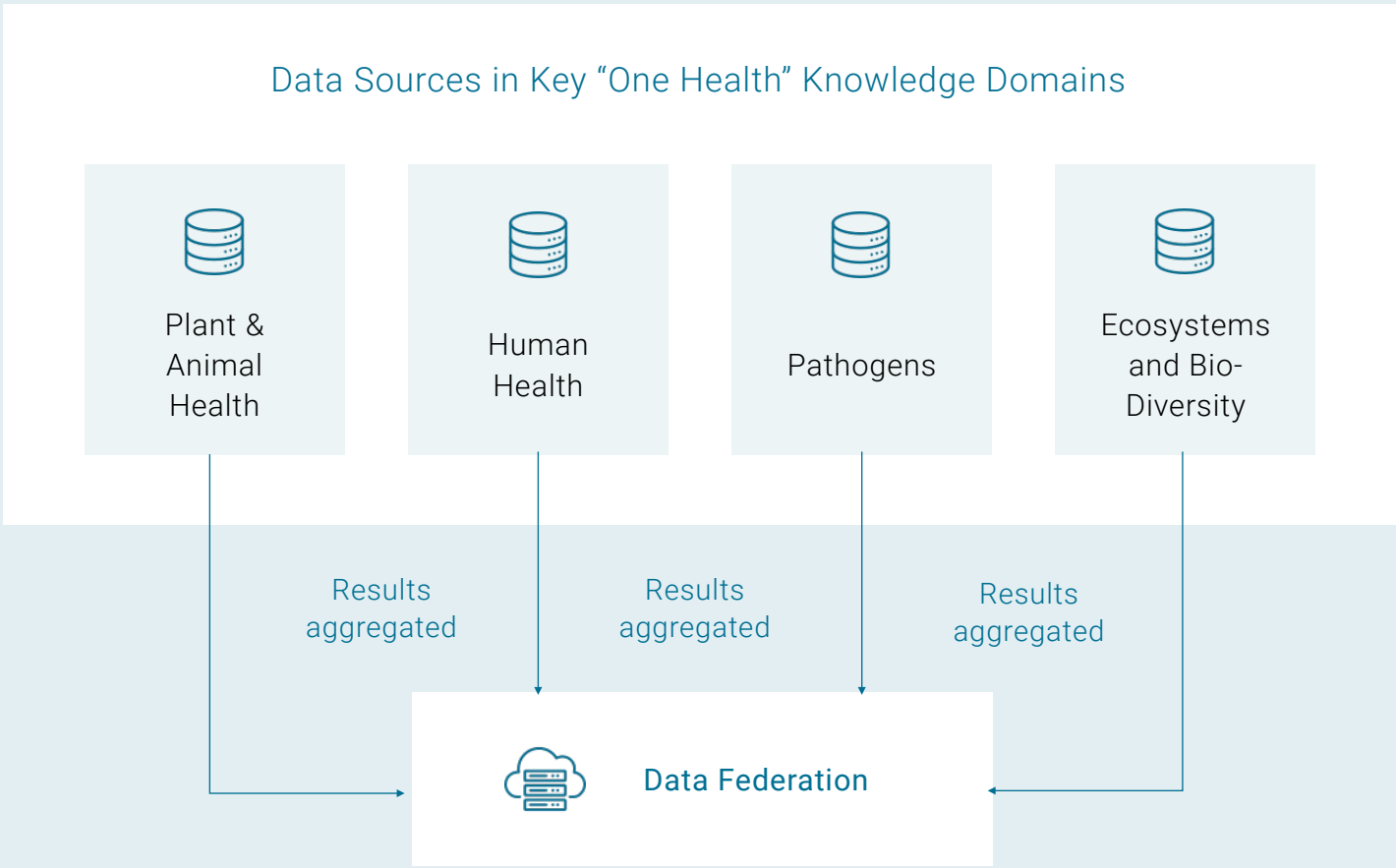@ Confederation of Indian Industry

AI-powered Diagnostic Tools

Furthermore, AI-powered diagnostic tools can enhance the efficiency of disease diagnosis. These tools can analyze medical images, laboratory test results, and patient symptoms to provide healthcare professionals with more precise and timely diagnostic insights. By leveraging machine learning algorithms, AI systems continuously learn from new data inputs and improve their diagnostic capabilities over time, leading to more effective and personalized treatment strategies.

The integration of AI and data analytics in One Health not only enables proactive disease surveillance but also supports evidence-based decision-making for public health interventions. By identifying high-risk populations, predicting disease outbreaks, and recommending targeted interventions, these technologies empower healthcare professionals and policymakers to allocate resources more effectively, implement preventive measures, and ultimately improve health outcomes for humans, animals, and the ecosystem.

Model of Federated Data Systems

Data Sources in Key "One Health" Knowledge Domains

Plant & Animal Health

Human Health

Pathogens

Ecosystems and Bio-Diversity

Results aggregated

Results aggregated

Results aggregated

Data Federation

E-Learning and Capacity Building:

Provide online training and digital resources for capacity building in One Health. Online programs cover various topics related to One Health, including disease surveillance, outbreak investigation, ecosystem health, antimicrobial resistance, and the interconnectedness of human, animal, and environmental health. They often include multimedia resources, such as videos, interactive simulations, case studies, and virtual laboratories, to facilitate active learning and practical application of concepts. E-learning platforms also provide opportunities for networking and collaboration among learners, fostering knowledge exchange and sharing of experiences across different sectors and geographic locations. Engaging in discussion forums, webinars, and virtual conferences provides participants with the opportunity to interact with both experts and peers, thereby deepening their grasp of One Health principles and practices. By incorporating digital health initiatives into community-based programs, a more sustainable approach to digital literacy can be achieved compared to piecemeal efforts. By making education and training accessible anytime and anywhere, e-learning and digital resources play a crucial role in building capacity in One Health, especially in regions with limited access to traditional training programs. These initiatives empower individuals to acquire the necessary skills and competencies to address complex health challenges and promote collaborative approaches that integrate human, animal, and environmental perspectives for the benefit of global health and wellbeing.

Public Health Messaging and Awareness:

Leverage digital platforms and social media for public health messaging and behaviour change. Through these channels, relevant stakeholders can disseminate targeted messages, educational content, and engaging visuals to reach a wide audience and foster positive behavioral changes. Digital platforms provide an efficient and cost-effective means to share information about the interconnected-ness of human, animal, and environmental health.

By utilizing compelling visuals and storytelling techniques, public health messages can capture attention, increase understanding, and motivate individuals to adopt healthier practices and behaviours.

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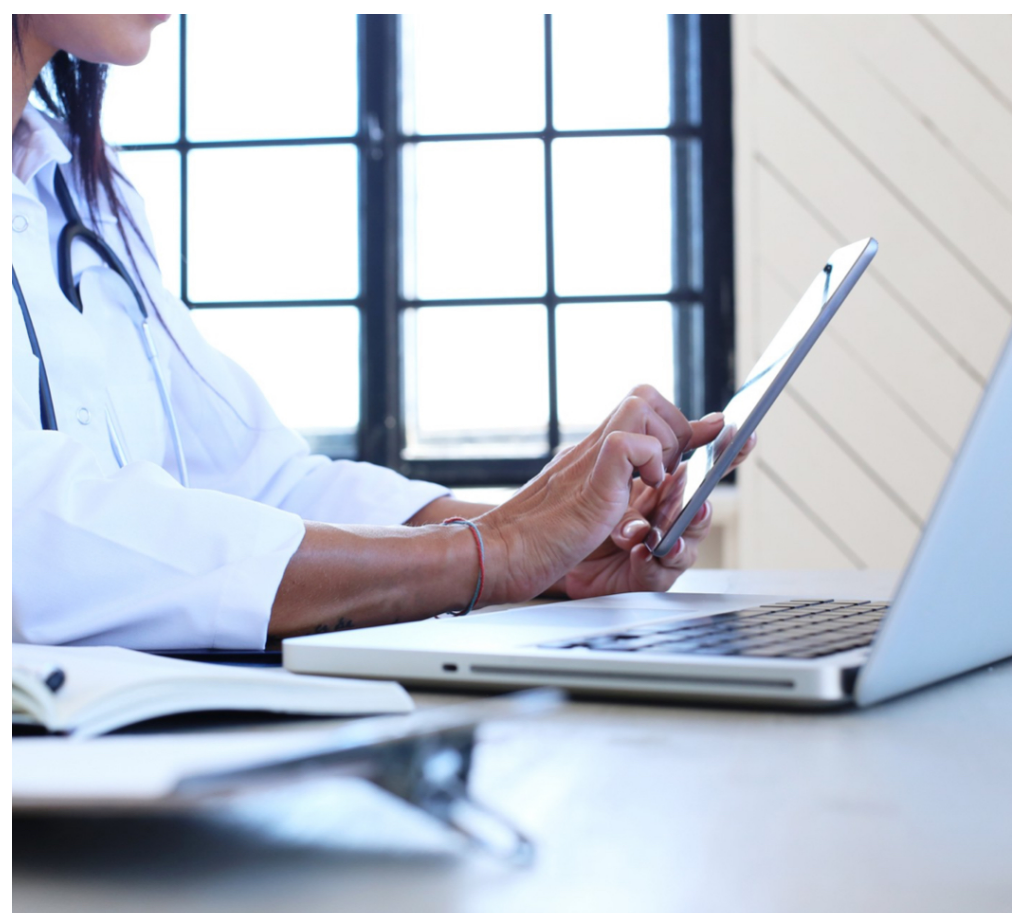
10.2 The Road Ahead

Data Governance Framework:

Establish a comprehensive data governance framework to define roles, responsibilities, and processes for data management, quality assurance, and integrity maintenance.

Digital Health and Infrastructure:

Invest in a robust digital health infrastructure, including high-speed internet access in rural areas, to ensure that even remote healthcare facilities can access and utilize the IT system effectively.

Health Information Exchange (HIE):

Create a nationwide or regional health information exchange network to facilitate the secure sharing of human, animal & environmental data among all relevant stakeholders.

User Training and Support:

Develop training programs and provide ongoing technical support to all relevant professionals and end users to maximize the utilization of the IT system, ensuring that they can use it effectively in their daily routines.

10.3 Summary

The road ahead for digital use is filled with immense opportunities and advancements. With the advent of new technologies Digital platforms have the potential to transform the way we access, manage, and utilize information, leading to improved efficiency, effectiveness, and accessibility in different domains.

In the context of One Health, digital platforms offer numerous benefits and possibilities. One of the key areas where digital platforms can make a significant impact is data integration and interoperability. By integrating health data from diverse sources, such as electronic health records, veterinary systems, environmental monitoring devices, and public health databases, a more comprehensive and holistic understanding of health can be achieved. This integrated data can facilitate early detection of disease outbreaks, identification of emerging health threats, and in timely intervention.

Digital platforms enable real-time data sharing and collaboration among various stakeholders involved in One Health, including healthcare professionals, veterinarians, environmental experts, researchers, policymakers, and communities. This promotes effective communication, coordination, and knowledge exchange, leading to better decision-making and response strategies. Digital platforms can also facilitate remote consultations, and telehealth services, allowing individuals to access healthcare services regardless of their geographical location. Another important aspect of the road ahead for digital platforms is the utilization of advanced technologies like artificial intelligence (AI), machine learning, and data analytics. These technologies can analyse large volumes of data, identify patterns, predict disease outbreaks, and provide valuable insights for preventive measures. AI-powered tools can aid in accurate diagnosis.

Fostering A Quality Culture: A Core Component

11.1 Introduction

It is essential to recognize that quality management is a continual process, evolving from traditional approaches to more advanced and mature methodologies.

By implementing robust quality management practices, the entire spectrum of disease control, encompassing prevention, detection, preparedness, response, and management, can be effectively addressed. This ensures a comprehensive and coordinated approach to safeguarding human health, animal health, and environmental well-being within the One Health framework.

A quality culture is essential to provide excellent care and enhance clinical outcomes. Regular checks and audits play a crucial role in establishing and nurturing a culture of quality within these organizations.

Various factors, including regulatory requirements, accreditation standards, cost-control pressures, and increased consumer activism, contribute to the acceleration of the quality journey in healthcare service organizations.

These external influences exert pressure on healthcare providers to prioritize and expedite their quality improvement efforts, leading to enhanced patient care and better overall outcomes.

In line with the One Health framework, a comprehensive Quality policy should be formulated, considering the interplay of human, animal, and environmental factors, to ensure the highest standards of healthcare.

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11.2 Safety

Emphasizing safety measures, including the implementation of protocols to reduce Anti-Microbial Resistance, minimize risks, monitoring, and reporting of adverse events, is vital in the One Health framework.

Accreditation and certification programs further contribute to maintaining high-quality standards in healthcare delivery, research, and environmental management.

Adherence to Good Manufacturing Practices (GMP) ensures the safety and quality of products, such as pharmaceuticals and vaccines, safeguarding the well-being of both humans and animals.

11.3 Effective Quality Management for Animal Welfare and Food Safety

Quality management is often discussed in the context of healthcare facilities, clinical protocols, and evidence-based medicine, with animals being primarily associated as mere "products." However, there is a growing recognition that animal health, animal welfare, food safety are critical concerns across various sectors. These issues have gained prominence in policy discussions, retailer strategies, consumer concerns, and even among producers themselves.

Enhancing animal health is imperative for several reasons. The expanding global trade of animals and their products, the movement of people, and the diverse nature of animal health conditions contribute to the potential risks associated with introducing and spreading infectious disease agents within regions or farms. Furthermore, meeting consumer expectations for safe and high-quality food necessitates a focus on animal health.

As national disease control systems face mounting challenges, farmers find themselves shouldering greater responsibility for disease prevention. This shift in accountability emphasizes the need for proactive measures to safeguard animal health and mitigate the risks associated with disease transmission. By prioritizing animal health, stakeholders can address the complex challenges posed by international trade, mobility, and the growing demand for safe food while ensuring sustainable and responsible agricultural practices. In response to this shift, several food production sectors have taken proactive steps to implement integrated quality assurance programs that span the entire supply chain, including farms. This holistic approach ensures that quality standards are upheld at every stage, from animal welfare and health on farms to food safety and public health considerations throughout the production process. By extending the focus of quality management beyond healthcare facilities and incorporating animal health, welfare, food safety, and public health concerns, stakeholders can address the complexities of the entire system. This comprehensive approach aligns with evolving policies, meets consumer expectations, and promotes sustainable and responsible practices within the production and supply chain.

- Customer Requirement
- Supplier Quality
- Identification/Traceability

Process and Production Control

Change Management

- Design Change management
- QMS Change management
- Risk review

Design Control

- Risk management
- Inputs/Outputs
- Verification/ Validation

QUALITY MANAGEMENT SYSTEM

Corrective & Preventive Action

- Eliminate nonconformities
- QMS improvement
- Verify effectiveness

- Complaint Handling
- Risk Monitoring
- Vigilance

Production & Surveillance

Management Control

- Management Review
- Inspection Readiness
- Internal Audit

Quality management within the framework of One Health encompasses several key aspects that contribute to the sustainable balance and optimization of health outcomes for people, animals, and ecosystems. These aspects are as follows:

Sustainable Health Balance:

Quality management aims to achieve a harmonious and sustainable equilibrium of health outcomes across all components of One Health. By implementing measures that promote the well-being of humans, animals, and ecosystems, quality management endeavours to minimize adverse impacts on any one sector. This approach helps prevent the spread of diseases and ecological disruptions, ensuring the long-term health and stability of interconnected systems.

Comprehensive Disease Control:

Quality management strategies play a vital role in comprehensive disease control. They encompass various stages of disease management, including prevention, detection, preparedness, response, and management. Through effective quality management practices, preventive measures can be implemented to reduce the occurrence and transmission of diseases.

Data-Driven Decision Making:

Quality relies on robust data collection, analysis, and interpretation to inform evidence-based decision-making. By implementing rigorous data quality assurance processes, such as standardized data collection methods, accurate laboratory testing, and reliable reporting systems, decision-makers have access to high-quality information. This reliable data helps in formulating policies, designing interventions, and evaluating the effectiveness of One Health initiatives. Data-driven decision-making improves the efficiency and efficacy of health interventions and contributes to better health outcomes.

Continual Improvement:

Regular monitoring, evaluation, and feedback mechanisms are established to assess the performance of One Health programs. By identifying areas for improvement and addressing gaps, quality management ensures that strategies and interventions remain relevant and responsive to emerging challenges. This iterative approach enables the optimization of One Health initiatives, fostering innovation, adaptation, and alignment with evolving global health priorities.

11.4 The Road Ahead

Moving forward, the integration of quality management within the One Health framework presents a multifaceted path to strengthen our global health systems. It requires a commitment to sustained interdisciplinary collaboration, both nationally and internationally, to tackle complex health challenges effectively.

Robust data systems and technology-driven innovations must be harnessed to enhance disease surveillance, early detection, and informed decision-making. Prioritizing preventive measures, public awareness campaigns, and vaccination efforts will be essential in reducing the burden of preventable diseases.

Quality assurance should extend across sectors, from healthcare facilities to health programs to agricultural supply chains, fostering sustainable practices and ensuring the safety of both humans and animals.

Capacity building and workforce development will empower healthcare professionals, veterinarians, and environmental experts to implement One Health initiatives. India's leadership in championing these principles, especially in the context of the G20 presidency, can set an example for the global community.

Ultimately, a dynamic, adaptive, and innovative approach to quality management within the One Health framework will equip us to address the evolving health challenges of our interconnected world and promote the well-being of all living beings.

11.5   Summary

The global recognition of the One Health approach has surged during the COVID-19 pandemic, driving increased investments in research and development. Nations are now prioritizing the creation of integrated health ecosystems to address various preventable health issues, including zoonotic diseases, vector-borne diseases, non-communicable diseases linked to climate change and pollution, food security, and antimicrobial resistance (AMR).

In India, where rural and tribal communities with extensive interactions with animals and the environment are disproportionately affected, adopting the One Health approach is paramount. The primary goal is to reduce the burden of preventable diseases on both the population and the primary healthcare system. This approach underscores the importance of intersectoral collaboration to achieve improved health outcomes and overall well-being. India, as it takes on the G20 presidency, reaffirms its commitment to One Health principles and the fight against AMR. India has been a pioneer in addressing AMR, with a comprehensive National Action Plan on AMR (NAP AMR) developed in 2017, and further prioritizes state-level action plans for effective implementation. Surveillance and research are pivotal in combating AMR, with a focus on innovative, affordable interventions, and implementation research to tackle AMR effectively.

Ensuring quality in healthcare extends beyond hospital premises, emphasizing the necessity of high-quality testing labs and data. Robust frameworks and inter-sectoral collaboration are crucial for implementation and evaluation. Quality data and Health Management Information Systems (HMIS) is essential for addressing issues like AMR, with a strong emphasis on incidence reporting. Quality in healthcare should be holistic, addressing all aspects of healthcare delivery.

Low, clear.

The One Health Paradigm
Unifying health for a sustainable future

CII

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As India strategizes for the next 25 years to India@100, Indian industry must scale the competitiveness ladder to drive growth. It must also internalize the tenets of sustainability and climate action and accelerate its globalisation journey for leadership in a changing world. The role played by Indian industry will be central to the country's progress and success as a nation. CII, with the Theme for 2023-24 as 'Towards a Competitive and Sustainable India@100: Growth, Inclusiveness, Globalisation, Building Trust' has prioritized 6 action themes that will catalyze the journey of the country towards the vision of India@100.

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