Review Article

Advancing the one health approach through integration of Ayush systems: Opportunities and way forward

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Abstract

The Ayush systems in India, specifically Ayurveda, have a large pool of infrastructure, human resources, and unique modalities for disease prevention, wellness, and management. These systems have seen significant growth in recent years, with the budget allocation for the Ayush Ministry increasing fourfold from INR 691 crore to INR 3050 crore over the last seven years. The Ayush systems can contribute significantly to the One Health approach, which addresses the interconnectedness of human, animal, and environmental health. The current commentary explores the areas of work related to the One Health approach, the potential role of the Ayush system in addressing these existing policies that support the integration of Ayush in the One Health approach, and future perspectives on the role of Ayush in One Health. Ayush systems advocate preventive measures, such as daily and seasonal regimens and the use of rejuvenating herbs and drugs, as well as therapeutic interventions for a range of health issues. Ayurveda also addresses environmental, animal, and plant health issues and promotes the creation of a healthy ecosystem between humans, animals, and the environment. In addition, Ayush can play a role in addressing zoonotic diseases, noncommunicable diseases, antimicrobial resistance, food safety and health of the elderly, children, and environment. To fully utilize the potential of Ayush in the One Health approach, these systems should be integrated into the healthcare infrastructure and network. Furthermore, initiation of collaborative projects, focused research, training and sensitization of Ayush human resources, and promotion of Ayush-based lifestyles and practices are some of the critical steps required to be taken.

Keywords: AMR, Ayush, ayurveda, environment, one health

Introduction

The One Health approach recognizes that the health of humans, animals, and the environment is interconnected and that addressing issues in one area can impact others. This approach has gained increasing attention in recent years due to several factors that have changed the relationships between humans, animals, and the environment such as population growth, climate change, globalization, urbanization, industrialization, and the movement of humans and animals.[1] The emergence and re-emergence of zoonotic diseases and pandemics like COVID-19 have also contributed toward the increased focus on One Health that aims to address the complex health issues of the present day.

A coordinated effort across multiple disciplines and sectors, such as public health, veterinary science, and environment, at all levels of society is needed to address the issues related to One health including food safety and nutrition, zoonotic

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disease control, neglected tropical diseases, laboratory services, disease surveillance, climate resilience, and antimicrobial resistance (AMR). Many organizations worldwide are working to address these issues through the One Health approach. The Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP), the World Health Organization (WHO), and the World Organization for Animal Health (WOAH) have collaborated to develop a One Health Joint Plan of Action to address these issues in a coordinated manner.[2] The five-year One Health Joint Plan of Action aims to foster and grow capacities related to the One Health approach.

India has also recognized the importance of the One Health approach and has taken various initiatives to address threats related to zoonotic diseases, neglected tropical diseases, and antimicrobial resistance. However, there are still growing threats in areas related to One Health such as AMR, which is recognized by the WHO as one of humanity's top 10 global public health threats.[3] According to the Global Research on Anti-microbial Resistance study's findings, almost five million people died from drug-resistant bacterial infections in 2019, making AMR the world's leading cause of mortality.[4] The misuse and overuse of antimicrobials in veterinary, human, and agriculture have accelerated AMR. Holistic efforts are required to address such issues related to One Health. National Health Policy 2017 (NHP 2017) supports these holistic efforts through its emphasize on "Pluralism," which enables patient to have access to Ayush care providers and also ensure Government support in research and supervision to develop and enrich their contribution to meeting the national health goals and objectives through integrative practices.

The Ayush systems, which encompass traditional Indian medicine and practices, can contribute significantly to the One Health approach.

Ayurveda believes that all that exists in the universe also exist in an individual, for instance, "*Loka Purusha Samayata Siddhanta*," given by Acharya Charaka. It recognizes the interconnectedness of all living things and their environments and the importance of maintaining balance and harmony. This philosophy may help prevent environmental harm in the current Anthropocene age. Its broad domains also include environmental health, veterinary science, and plant science and. talk about creating an ecosystem between humans, animals, and environment through Ayurveda, Pashuayurveda (Ayurvedic Veterinary Science), and Vrikshayurveda (Ayurveda science of Plant life). This demonstrates that the One Health approach has conceptual similarities to the approaches used in Ayurveda and the Ayush systems, and these systems can contribute significantly to the One Health approach. The widespread availability of Ayush infrastructure and human resources adds to its potential impact. The successful contribution of Ayush in addressing the COVID-19 pandemic demonstrates the value of collaborative efforts in addressing global health issues. There are already policies in place that support the integration and partnership of Ayush in the One Health approach, and it should be considered a potential partner in addressing these issues.

The current commentary talks about the areas of work related to the One Health approach and current threats, the potential role of the Ayush system in addressing these issues, existing policies that support the integration of Ayush in the One Health approach, and future perspectives on the role of Ayush in One Health.

Defining the areas related to the one health approach

The areas of work in which the "One Health approach" is particularly relevant as per the WHO include food safety, control of zoonotic diseases, laboratory services, neglected tropical diseases, environmental health, and antimicrobial resistance. Furthermore, noncommunicable diseases (NCDs) are also one area that must be considered under the One Health umbrella. NITI Aayog has rightly emphasized the significance of including NCDs in the One Health approach in the document "Vision 2035 Public Health Surveillance in India."[5] It is important to discuss existing threats in the context of One Health [Table 1].

Recent efforts of India in addressing one health-related issue

The Indian government has taken several initiatives pertaining to the One Health approach and public health surveillance issues. For example, the Department of Biotechnology (DBT) has established a consortium on "One Health" consisting of 27 organizations to study the prevalence of 10 selected zoonotic diseases and five transboundary animal diseases and analyze risks to provide early warning to stakeholders. The government has also approved the establishment of the National Institute of One Health in Nagpur as a satellite institute of the National Institute of Virology in Pune, which is part of the Indian Council of Medical Research (ICMR). The ICMR has played a vital role in strengthening surveillance and research related to One Health and currently has a network of 106 viral research and diagnostic centers across the country.

The ICMR has a network of 106 viral research and diagnostic laboratories (VRDLs), 35 diagnostic centers, and several other institutions involved in One Health research and surveillance. In 2004, the Indian government launched the Integrated Disease Surveillance Project (IDSP) to improve disease surveillance and response. In 2019, the WHO partnered with the government of India to launch the Integrated Health Information Platform (IHIP) within the IDSP program. IHIP is a digital, Web-based platform that captures individualized data in almost real time and generates weekly and monthly reports on epidemic outbreaks, and provides early warning of potential outbreaks.

In addition to the IHIP and the IDSP, other data sources that capture information on diseases of national importance are also in place in India, such as the Nikshay platform for tuberculosis.

Table 1: Potential areas related to the One Health approach and current threats

Potential Areas of work	Current Threats
Communicable Diseases	• 75% of emerging and re-emerging diseases are zoonotic, contributing to significant morbidity and mortality.[6] For instance, COVID-19 pandemic caused 616,777,700 confirmed cases and 6,527,192 deaths as of October 2022.[7]
Antimicrobial Resistance (AMR)	• Rapid growth in the prevalence and complexity of AMR. For instance, penicillin and ampicillin are ineffective against India's 80% staphylococcus strains. • It affects both animals and humans. • Drug-resistant bacteria can transmit to humans through food, environment, direct animal contacts, or hospital settings with poor hygiene.
Food safety and Security	• As per WHO, approximately 50% of malnutrition is caused due to poor water and sanitation facilities and unhygienic practices leading to life-threatening diseases and infections such as diarrhea.[8] • Unsafe food also means food that can harm through unhealthy fats, high energy density, and high salt content, contributing to an increased risk of noncommunicable diseases.
Environmental factors	• Environmental hazards to health are related to climate change, lack of access to clean water and sanitation, exposure to hazardous chemicals, air pollution, unsafe agricultural practices, animal husbandry and lack of waste management guidelines, lack of food safety, and occupational risk. • 24% of all deaths worldwide were attributable to the environment in 2016.[9] • Children under five and adults between 50 and 75 years are most affected by the environment, per the WHO. • Lower- and middle-income countries bear the most significant share of environmental diseases.
Non-communicable diseases (NCDs)	• NCDs account for more than 74% of all mortality across the globe and kill 41 million people each year.[10] • In India also, sixty-two percent of the mortality and fifty-five percent of disability-adjusted life years were caused by NCDs in 2016 (MoH&FW).[11]

These data sources serve as valuable tools for estimating the burden of disease and tracking disease trends and outcomes. The government of India has also launched a "National Programme on AMR Containment" to address antimicrobial resistance (AMR) and has developed the National Action Plan on Anti-microbial Resistance (NAP-AMR) 2017-2021. The NAP-AMR involves the Ayush Research Councils and other organizations' participation in developing strategies related to innovations and research interventions for developing alternatives to antimicrobials and adjuvant remedies for infectious diseases. The IDSP has also integrated a component for NCD surveillance and has a division of NCD that includes surveillance and other pilot programs focused on diabetes, cardiovascular disease, and cancers. These various institutions, networks, and programs have been effective in addressing public health issues in India.

Potential role of Ayush in one health approach

Ayush systems can play an essential role in the One Health approach in several ways:

Firstly, Ayush systems, such as Ayurveda and Yoga, strongly emphasize prevention and wellness. They view health as a state of balance and harmony and advocate for lifestyle practices such as diet, exercise, code of conduct, and stress management to maintain this balance. By promoting preventive care and a holistic approach to health, Ayush systems can help reduce the burden of chronic diseases, which significantly contribute to the global disease burden.

Secondly, Ayush systems often use natural remedies, such as herbs and minerals, which can have fewer side effects and are more accessible and affordable for people in underserved or resource-poor communities. This can be especially important in addressing the health needs of rural or remote populations, where access to modern health care may be limited.

Thirdly, Ayush systems have a long tradition of using plants and other natural substances to treat many conditions including infections. This can particularly be useful in addressing the growing problem of antimicrobial resistance by reducing the overuse of antibiotics.

Finally, Ayush systems can also play a role in addressing issues related to environmental and animal health. Ayush systems often emphasize the importance of living in harmony with nature, which can help to promote environmentally responsible behaviors. Vrikshayurveda and Pashuayurveda are also relevant in this context.

Overall, Ayush systems can make a valuable contribution to the One Health approach by promoting prevention and wellness, using natural remedies that are accessible and affordable, addressing antimicrobial resistance, and promoting environmentally responsible behaviors.

There are unique and relevant areas under Ayush that can contribute significantly to the One Health approach.

Ayush systems and priority areas related to one health

Role of Ayush in Zoonotic and tropical diseases

Ayush systems offer a range of preventive measures, dietary guidelines, rejuvenating herbs and drugs, and therapeutic interventions for disease prevention and management. In addition, Ayurveda also addresses environmental, animal, and plant health, making it a holistic approach. The Ayush systems headed by Ministry of Ayush at the central level have already demonstrated the potential of Ayush systems in managing and mitigating the COVID-19 pandemic through their widespread infrastructure and human resources, as well as through the issuance of health preventive, promotive, therapeutic guidelines,

and initiation of research studies. The success of these efforts highlights the potential for collaboration and resource-sharing in addressing One Health issues.

Traditional practices involving medicinal plants in the form of ethno-veterinary practices (EVM) are an integral part of animal husbandry in many parts of the world. In India, Pashuayurveda can contribute to controlling diseases at the source through the use of simple herbal remedies.

Role of Ayush in NCDs

Ayush systems have the potential to contribute significantly to the prevention and management of noncommunicable diseases (NCDs) such as diabetes, cardiovascular disease, cancer, and stroke. The 12th five-year plan on health in India recommends mainstreaming Ayush systems, especially in their areas of strength, including preventive and promotive health care, diseases, and health conditions relating to women and children, the elderly, NCDs, mental diseases, palliative care, and rehabilitation. The Indian Government's National Programme for Prevention and Control of Cancers, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS) has integrated Ayush interventions to address the growing burden of NCDs and common risk factors at some pilot sites and set an example. Early screening, identification, and referral through these integrated programs and propagation/adoption of Ayush-based lifestyle practices can be beneficial in preventing and managing NCDs.

Role in Antimicrobial Resistance (AMR)

According to estimates, India has a crude infectious disease death rate of 416.75 per 100,000 people, which is twice the rate seen in the United States.[12] India is among the nations with the highest burden of bacterial infections. An estimated 410,000 children aged five years or less die from pneumonia in India annually.[13] In May 2015, the 68th World Health Assembly (WHA) acknowledged this situation and adopted the global action plan on AMR (GAP-AMR), which listed five strategic objectives. One of the objectives is to reduce the incidence of infection through adequate sanitation, hygiene, and infection prevention measures. The action plan underscores the need for an effective "One Health" approach involving multiple stakeholders. With this interest, the Ayush system of medicine has a significant role.

The Ayush systems can potentially provide alternative solutions to antibiotics in humans and animals. Ayurveda has remedies called Rasaushadhi that may contribute in addressing issues related to AMR. Unique Ayurvedic procedures like medicated fumigation and sprinkling of medicine powder/water can also be used for environmental decontamination.

Widespread Ayush infrastructure and human resources can also be utilized to create awareness and provide alternative solutions to antimicrobial drugs.

Pashuayurveda can play a pivotal role in reducing AMR through alternative solutions and improved care for the common diseases of animals. These practices have great potential as it uses local resource-based applications that are safe, efficient, cost-effective, and sustainable. Thereby it helps to reduce the use of antibiotics for animal health and eventually helps to combat the growing threats of AMR.[14] Many communities in India still use medicinal plants for ailments of cattle. For instance, a case study highlights that the community selected under the survey in Tamil Nadu reports the use of a wide range of herbal plants (38) for cattle ailments. Research evidence suggests the effectiveness of herbal formulations in preventing and managing diseases such as bovine mastitis, foot and mouth disease (FMD), diarrhea, udder pox, repeat breeding, bloat, indigestion, and maggot wound, and reduction in the use of antibiotics.[15-17] It also helps in the reduction of antibiotic residues in the milk contributing to food safety. National Diary Development Board (NDDB) Annual Report 2020-21 documents an average savings of 30 percent in drug costs and reduction in medicine purchases, especially antibiotics, to the tune of 1 million per month as a result of EVM use in Mastitis Control Popularization Project (MCPP) areas across nine states.

Food safety and environmental health

Food safety and environmental health directly affect the health of human beings. Environmental risks take a more significant impact on children under five and adults aged 50 to 75 years. Food safety, nutrition, and food security are in-separately interlinked.

Adoption of traditional methods for the preparation of foods and food intake, traditional water purification methods can play an essential role in food safety. Ayurveda advocates avoiding antagonistic food and food containing preservatives, frozen foods, and the use of wholesome food for better health. Special provisions like dietary regimen and lifestyle advocacy per the consumer's constitution, seasonal variation, and habitat are essential in this context. Again, pediatric and geriatric care are well-established branches of Ayurveda and can address the issues related to these areas. Rasayana is an evidence-based therapy for maintaining health.

Safe agriculture practices can significantly contribute to food safety and environmental health. Indiscriminate use of agrochemicals such as insecticides and pesticides leads to soil, water, and air pollution, biodiversity loss, and chemical residues in food. Vrikshayurveda systematically describes natural and environment-friendly methods for procuring, preserving, and treating seeds before planting; preparing pits for planting saplings; selecting soil; method of watering; nourishments and fertilizers; plant diseases and disease management, including pest control. Govt. of India has been promoting natural farming as Bharatiya Prakritik Krishi Paddhati (BPKP) since 2019. The principles of natural farming, such as seed treatment using natural inputs and plant protection measures using herbal concoctions, can be traced back to Vrikshayurveda. Hence, scaling up Vrikshayurveda methods can contribute to food and nutritional security by producing safe food without negative environmental impact. Growing medicinal plants sustainably and producing medications

free of dangerous ingredients are excellent prospects for Vrikshayurveda.[18]

Overall, integrating evidence-based Ayush interventions in national programs and promoting Ayush-based lifestyles and dietary practices can contribute to better health outcomes in India.

Existing enablers to one health approach concerning Ayush systems

There are many existing enablers for establishing linkages and integration of Ayush systems in addressing issues related to One Health, as shown in Table 2.

Way forward

The potential role of Ayush systems, in addressing One Health issues, such as zoonotic diseases, noncommunicable diseases, AMR food safety, and environmental health, has been recognized by the Indian government. The National Health Policy 2017 recommends promoting healthy living and prevention strategies from Ayush systems and Yoga at the workplace, in schools, and community. At least 88% of WHO member states report using Traditional Medicine (TM), and 65% of the population in rural India reported using traditional medicine to meet their primary healthcare needs. The above discussed existing enablers can play a crucial role in the integration of Ayush system in addressing One Health-related issues. Furthermore, several steps can be

Table 2: Existing enablers for integration of Ayush systems in One health approach

Existing Enablers	Provisions
The Drugs and Cosmetics Act of 1940	It provides legal status to the use of ASU drugs in animals.[19]
National Health Policy (NHP) 2017	The NHP 2017 has highlighted the idea of pluralism as one of the fundamental policy principles, extending the horizon of the AYUSH system of medicine and vigorously promoting mainstreaming Ayush's potential for a holistic healthcare approach.[20]
CCRAS Research Policy	Under its ambit, veterinary Ayurveda products have been identified as one of the priority areas under drug research, while Vrikshayurveda/Veterinary Ayurveda are identified as areas for collaborative research. This provides an opportunity to support and scale up the research in both Vrikshayurveda and Pashuayurveda.
Food Safety and Standards (Ayurveda Aahara) Regulations, 2022	It will ensure the production of high-quality Ayurvedic food products.[21]
Poshan Abhiyan 2.0	The Ministry of Ayush and the Ministry of WCD would be working together towards integrating Ayush in POSHAN Abhiyaan 2.0 and management of malnutrition through the principles and practices of Ayurveda, Yoga, and other Ayush systems. This shows that the Ayush system is working to ensure food quality and address the challenge of malnutrition through the principles and practices of the Ayush systems. It will contribute to food safety and nutrition. It is also worth mentioning that food safety, food security, and nutrition are closely interlinked.
Ayurvedic Formulary of India (AFI), Part-IV (Veterinary)	It details various ayurvedic formulations and their indications, including their definition, method of preparation, general precautions, characteristics, dose, and storage for drugs to be used in veterinary.[22]
Programs/schemes like NAM, NPCDCS, etc.	National AYUSH Mission (NAM) is a flagship scheme of the Ministry of AYUSH and has multiple public health-related components. Ayush is integrated into NPCDCS at some of the pilot sites. The integration can be scaled up at a more significant level. This provides an opportunity to integrate Ayush into various public health programs to address issues related to One Health.
Ayush Grid and ABDM	Ayush Grid is an IT-related initiative of Ministry of Ayush and has different components, including AHMIS, Tele-consultation, education, and e-Aushadhi .[23] Ayush grid will be an integral part of ABDM During the COVID-19 pandemic, Telemedicine and teleconsultation act as game changers and can reach out to a large section of the population, including hard-to-reach geographical areas. Digital tools aid in making evidence-based policies. It helps monitor communicable and noncommunicable diseases and can play a pivotal role in anticipating epidemics. It can also help in strong cross-referrals. It shows its relevance in addressing One Health-related issues.
Extensive Ayush infrastructure and Co-located facilities under NHM	12,500 Health and Wellness Centres (HWCs) under Ayushman Bharat are being upgraded by the Ministry of Ayush,[24] which envisaged delivering an expanded range of Comprehensive Primary Healthcare Services. As per the National Health Profile 2021 report, there are 646013 Ayush doctors, 745 Ayush colleges with attached teaching hospitals, 4022 hospitals (public), and 30999 dispensaries (public). There are 7032 Primary Health Centres (PHCs), 2793 Community Health Centres (CHCs), and 484 District Hospitals (DHs) co-located with Ayush facilities.[25] This provides an excellent opportunity to utilize Ayush systems to address one health-related issue.
Clinical Establishments Act (Registration and Regulation), 2010	Several states have been able to create directories of clinical establishments and use this information to build upon and enhance notification for disease, death, and births, especially within the private sector, as per the provisions of the Clinical Establishments Act (Registration and Regulation), 2010. Ayush systems are also covered under it.
e-GOAPLA App	Ministry of Fisheries, Animal Husbandry and Dairying has developed an android and Web-based application called e-GOPALA to help dairy farmers for managing their animals. It helps farmers in the management of nearly 29 common ailments of dairy animals e.g., mastitis, indigestion, diarrhea, etc., using Ethno-Veterinary Medicine (EVM).

taken further to optimize the use of Ayush in the One Health approach.

- Firstly, Ayush interventions especially those from Ayurveda have the potential to be valuable tools in addressing various health issues, including NCDs, AMR, and zoonotic diseases. However, further high-impact research is needed to expand the scientific basis and to increase confidence among healthcare providers and the public. Integration of Ayush interventions into healthcare systems and national programs at a large scale, such as the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS), can augment the outcomes of these programs. This can be performed through the use of Ayush infrastructure, human resources, and IT systems in One Health and disease/health surveillance at all three levels of health care. In addition, focused research in Ayush can help to develop solutions for tackling AMR and zoonotic diseases. Awareness campaigns about the safe and effective use of antimicrobials and consideration of alternative therapies can be performed through Ayush institutions and HR also. Another potential area for integration is livestock telemedicine, which could help improve animals' health and reduce the need for antimicrobials. Finally, Ayush Health and Wellness Centres and state dispensaries/hospitals can be utilized to monitor infectious diseases, NCDs, and occupational health and their management.
- Secondly, to ensure the safe and appropriate use of Ayush interventions, it will be essential to effectively implement policies and guidelines. This can include strict compliance with standards for producing, labeling, and distributing Ayush products and creating training and certification programs for practitioners of Ayush systems. In addition, incorporating Ayurveda or Ayush principles into school education and health programs can promote their use.
- Thirdly, to promote the integration of Ayush systems into mainstream health care, it is necessary to incorporate Ayush practices and remedies into clinical guidelines and include Ayush practitioners in healthcare teams. Additionally, referral systems and other mechanisms should be developed to facilitate collaboration between Ayush practitioners and modern healthcare providers. The potential contributions of Vrikshayurveda and Pashuayurveda should also be explored, and best practices should be introduced and propagated among communities. The practice of Ayush Veterinary medicine should also be formalized.
- Fourthly, to effectively integrate Ayush systems into mainstream health care, it will be necessary to address various barriers, such as lack of awareness and understanding, skewed distribution of infrastructure and resources (in States/UTs), and regulatory and legal challenges. This can be performed through generating awareness and providing training to Ayush HR on One Health and health surveillance, as well as promoting the use of Ayush-based dietary regimens and lifestyles and traditional water purification and diet preparation methods. It will also be essential to establish linkages and integrate health services and programs under the health infrastructure and institutional network affiliated with the Ministry of Ayush. Creation of common public health standards in line with Indian Public Health Standards for modern medicine will be a critical step in defining standards required for Ayush infrastructure, HR, and services in public sector in states/UTs. Scaling up the contribution of Ayurveda/Ayush in the area of food and nutrition through Poshan Abhiyaan-2.0 is another priority area.
- Finally, it will be essential to continue to engage with and seek input from a wide range of stakeholders, including healthcare providers, policymakers, researchers, and community members, to ensure that the integration of Ayush systems into the One Health approach is done in a way that is inclusive, equitable, and responsive to the needs of diverse populations.

Conclusion

India has a rich heritage of traditional medicine, which is well-regulated. It provides an opportunity to give an integrative model to deal with the unique challenges of the 21st century. To fully integrate Ayush systems into the One Health approach, it will be necessary to conduct high impact research to document the effectiveness and safety of Ayush interventions, establish policies and guidelines for the safe and appropriate use of these interventions, integrate Ayush practices into mainstream health care, and address barriers to adoption. Engagement with a wide range of stakeholders, including healthcare providers, policymakers, researchers, and community members, is also crucial to ensure that the integration of Ayush systems is inclusive and responsive to the needs of diverse populations.

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