

# Internship Report-2021-22

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## “ONE HEALTH APPROACH”: RESEARCHABLE AREAS FOR STAKEHOLDERS

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**(Dr. Shamali Phand)**

## **ABBREVIATIONS**

- WHO- World Health Organization
- DBT- Department of Biotechnology.
- GADVASU- Guru Anand Dev Veterinary and Animal Sciences University
- TANUVAS- Tamil Nadu Veterinary and Animal Sciences University
- IVRI – Indian Institute of Veterinary Sciences
- AIIMS- All India Institute of Medical Sciences
- ICMR- The Indian Council of Medical Research
- ICAR- The Indian Council of Agricultural Research
- MAFSU- Maharashtra Animal and Fishery Sciences University
- PCR- Polymerase Chain Reaction
- FAO- Food and Agriculture Organization
- AMR- Antimicrobial Resistance
- OIE- World Organization for Animal Health
- CSR- Corporate Social Responsibility
- PHC- Primary Healthcare Centre
- OH- One Health
- NCD- Non-Communicable Diseases
- NAARM- National Academy of Agricultural Research Management
- SDG- Sustainability Development Goal

## **ABSTRACT**

One Health is a collaborative, multisectoral, and transdisciplinary approach working at the local, regional, national, and global levels with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment. One health is approach which recognizes that health of people is closely associated with animal health and our shared environment. In 2004, Wildlife conservation society gave the concept of “One World, One Health”. One health approach is very important factor to safeguard human health and increase the pandemic preparedness like COVID19. Increased animal human interface indicates the need of one health approach. A desktop research was conducted with objectives to explore researchable areas of one health approach for different stakeholders. A total 37 published articles were studied and explored the researchable areas from 25 articles which cited as review of literature in present report. The present study is supported with primary data by collecting responses from various stakeholders viz, Medical Officers, Veterinary Officers, Soil Scientist, Public Health Experts and Farmers with total sample size of 25. Further, to seek the expert opinion on researchable areas in One Health Approach, online panel discussion was conducted with five renowned experts. The study has shown some of the broad researchable areas like Disease burden and surveillance, Scope of genomics in one health, Antibiotic resistance, Food safety and nutrition, Climate change and One Health, Occupational hazards and one health, Soil and Health mapping etc. Finally, the study has concluded by recommending few researchable areas in One Health Approach like identification of stakeholders and defining their role in One Health, Sector specific intensive research and documentations on One Health, Development of common platform for all stakeholders to share information and line of action, Application of ICT and social media to create awareness about One Health, Capacity building of stakeholders on One Health, Study on global experiences in safeguarding One Health etc.

**Key words-** One Health, Antimicrobial Resistance, Zoonosis, One World, Optimal Health, Plant health, Animal health, Environment.

## **1. INTRODUCTION-**

One Health Approach is a project combining "the collaborative efforts of multiple disciplines working locally, nationally, and globally, to attain optimal health for people, animals and our environment", as defined by the One Health Initiative Task Force.

The COVID-19 pandemic has irreversibly changed the world like never before. Though this is not the first pandemic which has originated from aberrations at the human-animal environment interface, it is the phenomenal impact on global health and economy that has forced the global community to perceive and respond to pandemics in a greater scientific way. COVID-19 pandemic is neither the first and nor the last to have developed from close contact between humans and wildlife. The Severe Acute Respiratory Syndrome (SARS) pandemic in 2002–2003 and the Middle-East Respiratory Syndrome (MERS) event in 2011 were traced to human interaction with animals. Nipah virus in Kerala 2018 records the death of 17 patients amongst total 19 cases show 89.4% fatality rate. It is well established that 75 per cent of new or emerging infectious diseases originate from animals. Union health minister Dr. Harsh Vardhan said that human health cannot be seen in isolation in an era that has increased interaction between humans and animals resulting in a need for One Health Approach "India is one of four global hotspots where there is a huge risk of emergence of infectious zoonotic diseases, drug resistance and foodborne infections," he warned.

One Health Approach is gaining recognition in the United States and globally as an effective way to fight health issues at the human-animal-environment interface, including zoonotic diseases. Successful public health interventions require the cooperation of human, animal, and environmental health partners. Professionals in human health (Doctors, Nurses, Public Health Professionals, epidemiologists), animal health (Veterinarians, Paraprofessionals, Agricultural workers), environment (Ecologists, Wildlife experts), and other areas of expertise need to communicate, collaborate on, and coordinate activities. Other relevant players in a One Health Approach could include law enforcement, policymakers, agriculture, communities, and

even pet owners. No one person, organization, or sector can address issues at the animal-human-environment interface alone. The One Health Approach can:

- Prevent outbreaks of zoonotic disease in animals and people.
- Improve food safety and security.
- Reduce antibiotic-resistant infections and improve human and animal health.
- Protect global health security.

By promoting collaboration across all sectors, a One Health Approach can achieve the best health outcomes for people, animals, and plants in a shared environment.

## **2. OBJECTIVES-**

- 1) To review the existing literature on One Health Approach.
- 2) To identify researchable areas in One Health Approach.
- 3) To identify line of action for extension/public health organizations in One Health Approach.

### 3. REVIEW OF LITERATURE-

In any scientific investigation, a comprehensive review of literature is of paramount importance to any research endeavour. It helps to acquire general background in the field and also helps to find out available information which is related to objectives of proposed research and assist not only in delineation of problem areas but also provide a basis for theoretical frame work and for interpretation of findings. The studies are reviewed and presented under the following major heads,

- 1) Zoonoses and One Health Approach.
- 2) Overall initiatives for One Health Approach
- 3) Antimicrobial resistance and One Health Approach Approach
- 4) Stakeholders in One Health Approach
- 5) One Health Approach w.r.t. climate change and pollution.
- 6) Soil health and One Health Approach
- 7) Environment and One Health Approach
- 8) Plants and agricultural practices w.r.t. One Health Approach

#### 1) Zoonoses and One Health Approach

**Bidaisee *et al.*, (2014)** studied available literature on one health in zoonoses. No publications noted in 1985,1990, 1991. In 1995 only 8 resources found but in 2009 total 43 resources were available. 2010 and 2012 were most productive years as there was 71% production. A total of 335 emerging infectious diseases were identified between 1940 and 2004]. Considering that more than 60% of infectious diseases are zoonotic, they have an important and increasing impact on human health. Agriculture, livestock production, and food safety practices are intimately linked with the prevention and control of zoonoses through the one health approach. Considering the significance of agriculture and food safety, it was surprising that these scopes did not have a greater representation in the literature reviewed.

**Aggarwal *et al.*, (2020)** studied the one health approach in Indian context and came up with major findings that in India, one health approach is strategically gaining more importance from stakeholders such as public health professionals, veterinarians, agriculturist, healthcare providers, policymakers

etc. The threat for the zoonotic diseases like avian flu, rabies is major in India. More attention needed in wild zoonotic diseases as its increasing day by day. To make this happen the integration of multiple sectors such as agriculture, animal health and human health. Owing to the public health importance of zoonotic diseases in India, a National Standing Committee on Zoonoses was formed in 2007. The Food Safety and Standard Act, India, stipulates the limits for contaminants, naturally occurring toxic materials, antibiotic residues, pesticides, heavy metals, veterinary drug residues, etc., Government-initiated control programs for zoonotic and highly communicable diseases such as rabies, brucellosis, and food-and-mouth disease are available. There is “Make in India” initiative which supports the development of medical equipment, drug, vaccines, and technology innovations that can be used to address zoonotic diseases. Growing population is one of the challenges for the spread of zoonotic diseases in India. Though we are focusing more on the prevention aspect instead of curative one, the surveillance and control of the animal diseases somehow lacking. It is necessary to create a national illness registry for zoonotic diseases.

**D. Katterine Bonilla-Aldana *et al.*, (2020)** studied One Health Approach in context to covid19. COVID-19 has presently spread to more than 82 countries, apart from China from where it originated. As per the most recent situation report of World Health Organization (WHO), a total of 94,355 confirmed cases and 3,222 human deaths have been reported till March 4, 2020. This virus was designated as a Public Health International Emergency on January 30, 2020 and a potential pandemic. Seeing the rapid increase in the number of cases affected and its further spread to many countries in all the populated regions of the world, except Antarctica. Virus was designated as a Public Health International Emergency on January 30, 2020. The possibility of a fourth outbreak can be expected in the coming future.

**Falzon, L. C., *et.al* (2019)** studied the monetary and non-monetary outcomes of one health approach globally. This study gives the total number of literature present on monetary, non-monetary and mixed benefits of using one health approach in university of Nottingham. Study shows a greater number of biotic study than abiotic. This data will give insight to policymaker of target area to be

taken into consideration. Funding distribution process of one health approach will get smoother with the help of such quantitative data.

## **2) Overall Initiatives in One Health Approach**

**The Indian Express (2021)** stated that Human health cannot be seen in isolation in an era that has increased interaction between humans and animals resulting in a need for 'One Health' approach. With increased interaction between humans and animals, human health cannot be seen in isolation and covid 19 is reminder to this fact. COVID-19 demonstrates the rapid spread of novel pathogens which can have a significant impact on the global economy. Preparedness for, and mitigation of such events require a 'One Health' approach. The present international symposium is focused on 'one health approach' which recognises that the health of people is closely connected to the health of animals and our shared environment. sixty-four per cent of all infectious diseases that emerged between 1973 and 1994 had aetiology which was zoonotic in nature. India is one of four global hotspots where there is a huge risk of emergence of infectious zoonotic diseases, drug resistance and foodborne infections.

**Times of India, (2021)** The Department of Biotechnology has launched a 'One Health' consortium that envisages carrying out surveillance of important bacterial, viral and parasitic infections of zoonotic as well as transboundary pathogens in the country. The project also looks into the use of existing diagnostic tests and the development of additional methodologies for the surveillance and understanding the spread of emerging diseases. This Consortium, consisting of 27 organisations led by DBT-National Institute of Animal Biotechnology, Hyderabad, is one of the biggest one health programs launched by Govt of India in post-COVID times. The One health consortium consists of AIIMS, Delhi, AIIMS Jodhpur, IVRI, Bareilly, GADVASU, Ludhiana, TANUVAS, Chennai, MAFSU, Nagpur, Assam agricultural and veterinary university and many more ICAR, ICMR centres and wild life agencies.

**Sandeep P. Chaudhari (2021)** speaks about the journey towards the National institute of one health in Nagpur. Issues such as emerging and re-emerging infectious diseases, antimicrobial resistance, food security, biosafety and

biosecurity are associated with changes in land use, population growth, urbanization, global travel and trade and climate change. As a result, a trans-disciplinary approach among human, animal and environmental health disciplines gained support. The Indian Council of Medical Research (ICMR) and Indian Council of Agricultural Research (ICAR) decided to establish a National Institute of One Health at Nagpur, Maharashtra, India. In this context, two collaborative research projects, funded by the ICAR and ICMR were initiated to conduct the epidemiological surveillance of selected zoonotic diseases in Central India. In animals, the seropositivity's for listeriosis (7.66%) and brucellosis (11.69%) were recorded. The occurrence of tuberculosis (3.8%) and leptospirosis (6.33%) was detected by PCR. Through cross-sectional studies from suspected human population with associated risk factors for zoonotic diseases, the seropositivity of brucellosis (1.83-11%), listeriosis (1.01-10.18%), leptospirosis (8.14-12.67%) and scrub typhus (1.78-20.34%) was recorded. The investigations on scrub typhus indicated bimodal pattern during the months of pre-monsoon and post-monsoon season with a peak in post-monsoon in human cases. *Ornithonyssus bacoti* mites were identified from the rodents as a vector harbouring *Orientia tsutsugamushi*. The bovine tuberculosis was detected in 1.43 per cent human cases employing molecular assay.

**Food and Agriculture Organisation of United Nations (UN-FAO) 2021** One health, one planet summit was held in Rome which talks about need of adoption on one health approach. an integrated approach that recognizes the fundamental and interconnected relationship between the health of people, animals, plants and the environment. It ensures that specialists in multiple sectors work together to tackle associated health threats, while protecting biodiversity. The One Health approach should be a foundation strategy to prevent other zoonotic pandemics while providing the long-term resilience, sustainable agri-food systems, and healthy environments we need to better re-orient, reshape and rebuild our future. FAO, collaborating closely with the World Health Organization (WHO) and the World Organisation for Animal Health (OIE), promotes One Health in work on food security, sustainable agriculture, food safety, antimicrobial resistance (AMR), nutrition, animal and plant health, fisheries, and livelihoods. Ensuring a One Health approach is essential for

progress to anticipate, prevent, detect and control diseases that spread between animals and humans, tackle antimicrobial resistance, ensure food safety, prevent environment-related human and animal health threats, as well as combatting many other challenges.

### **3) Antimicrobial Resistance and One Health**

#### **Food and Agriculture Organization of United Nations (UN-FAO) (2021)**

Emergence and spread of AMR is linked with extensive and irrational use of antibiotics in animal health, agricultural sectors and sewage from health care and manufacturing 1 Introduction and definitions 1 institution. The antibiotics are used in animals for therapeutic and prophylactic purposes. In addition, these agents are used for a growth promotion role as a low-cost alternative to poor sanitation in and around animal habitat. Indiscriminate use of antimicrobial agents causes emergence and selection of resistant pathogens having a potential to spread through animal-human interaction or food chain. These resistant pathogens cause diseases in humans that inadequately respond to affordable antimicrobials. AMR is now recognized as one of the biggest challenges in mankind's fight against infectious diseases. One Health approach is the globally accepted solution to mitigate AMR. 3.5% GDP reduction will be there by 2050. One Trillion dollar will be the additional healthcare cost. 100 trillion-dollar loss of global economy by 2050.

### **4) Stakeholders in One Health Approach**

**Mazet *et al.*, 2014** explored the groups and institutions with an interest in safeguarding the health of people, domestic animals and ecosystems and came with stakeholders like government sectors which comprises of health, animal health, environmental health, forest and wildlife etc. Non-government sectors such as Private sector for animal and human. Non-government organisations etc. and international organisations such as World health organisation, centre of disease control and FAO etc.

**Forster, (2009)** One World, One Health” The “One World, One Health” concept first emerged at a 2004 symposium organised by the Wildlife Conservation

Society in New York. The event focused on disease movements among human, domestic animal, and wildlife populations, and identified priorities for an international, interdisciplinary approach to combat threats to animal, human and eco-system health. The resulting “Manhattan Principles” listed 12 recommendations for establishing a more holistic approach to preventing epidemic/epizootic disease and for maintaining ecosystem integrity and biodiversity. These ideas were picked up at the 2007 Delhi International Ministerial Conference on Avian and Pandemic Influenza, at which a road map was developed encouraging governments to build links between human and animal health systems and invest in capacity for preventing and controlling infectious diseases in animals, both internally and with neighbour nations.

**Rajib Dasgupta et.al. (2021)** says that there is need to adopt intersectoral one health approach in India by one health committees. Bottom to top approach should be operationalise through frontline community workers, animal health workers, forest officers and farmers etc. So that interventions can be done for the grassroot level. A deeper understanding of local priorities shall help shape the nature of one health collaborations. Strategies and activities need to be based on common and shared values and nested within existing infrastructure. Effective governance will be shaped by legal and policy frameworks that are aligned with current structures and comply with relevant national and international standards. The role of strong sectoral systems cannot be overemphasized as operational aspects shall be shaped by these in the final analysis. Academic institutions will play a crucial role in shaping and facilitating OH education.

## **5) One Health w.r.t Climate Change and Pollution**

**Zinsstag, J. et al., 2018** studied the effect of climate change on one health adaption. Came up with major findings that Integrated human and animal surveillance and response systems (ISRS) are one of the most important contributions of a One Health approach to mitigate effects of climate change. Climate change contributes in increase in pathogens and viruses. Climate change usually makes environment which is favourable for microbes and

viruses to grow. This directly impacts the crop yield. Scarcity in crop will result in food security.

**McMichael, A. J., (2006)** Over the past 150 years, the harnessing of fossil fuel energy and major technological advances in industry and agriculture have yielded great (albeit unevenly shared) gains in population health. Now, though, the wider environmental consequences of those intensified and expanded economic activities are beginning to jeopardize the natural environmental foundations of human population health. Human-induced climate change is a major, and clear, example. The topic is of great importance because, if human-induced climate change continues for long, there will inevitably be many, predominantly adverse, consequences for human health. As the understanding of climate change impacts on the environment, human societies and human biology increases, it becomes clearer that the risks to human well-being, health and survival are the real 'bottom line' issue. Nearly all of the other adverse impacts of climate change (food yields, water flows, sea-level rise, infrastructural damage, etc.) will converge on human biological well-being. The health sector therefore has an opportunity to engage in the arresting of this potentially great, emerging, source of risk to human health. This includes promoting research, educating health personnel, informing both public and policy-makers about present and future risks and the preventive actions needed and contributing to overall mitigation effort by working to lower the 'carbon footprint' of the health care system.

**Burney J. et al., (2014)** studied the effect of climate change and air pollution on Indian Agriculture. Air pollution in India has become so severe that yields of crops are being cut by almost half. The yield of the crops like wheat, rice is decreased. Researchers analysed yields for wheat and rice alongside pollution data, and concluded significant decreases in yield could be attributed to two air pollutants, Black Carbon and ground level Ozone. These two pollutants affect the crop yield and results into food insecurity and scarcity.

**Jessica Brown (2019)** studied the impact of air pollution on crops and came up with findings that Researchers has found that between 1980 - 2010 yields were lowered up to 36% due to pollution. This 36% of those which was expected

considering no pollution is there. The significant decrease in yield is there. In 2010, this loss was the equivalent of more than 24 million tonnes of wheat in India, worth around \$5 billion. Ozone is causing between 5% and 12% yield losses globally in staple crops, (Wheat, Rice, Maize, Soybean). These are the majorly used crops will questions the food security.

**Esawy Kasem Mahmoud, et al. (2016)** studied in Egypt to evaluate the effect of polluted water on soil and plants. They found that there was bioaccumulation of heavy metals seen in water and the plants present in water. These plants were eaten by aquatic animals and enters into the main food system. Bioaccumulation of heavy metals in plants is increased in area which causing health hazards in nearby population.

## **6) Soil Health and One Health.**

**Brevik et al., (2020)** studied the current status and future needs of soil health and came up with findings The idea that soils are important to human health is widely accepted in the modern scientific community. Soils are recognized for their contributions in areas such as the supply of adequate quantities of nutritious food products, medications, and for their assistance in developing the human immune system. Negative health impacts also occur when foods are grown in soils that have nutrient deficiencies or when people are exposed to toxic levels of chemicals or pathogenic organisms through contact with soil or soil products. However, there are still many things we do not know about the links between soils and human health. As the global population grows, we will need to produce more food that maintains or enhances its nutrient content on essentially the same land area, assuming we can reverse our current losses of arable land to degradational processes. A large amount of work has focused on heavy metals pollution, plastics, pesticides, and related organic chemicals, but this work typically focuses on a given pollutant as a stand-alone issue. In actuality, the soil is a mixture of many chemicals that are in a very chemically and biologically active environment; research into the health effect of chemical mixtures and how those mixtures react and interact in the soil environment is badly needed.

**Steffan et al., (2018)** studied the effect of soil on human health states that soil is major source of nutrients to plants so as to humans. The concept of soil security needs special focus and study. Soil also works as filtration medium for waster and supply the clean water. Awareness about the soil is needs to be done in context of reducing these concerned risks. Soil contains the large number of heavy metals, chemicals, insecticides, pesticides and other toxins which has direct and indirect effect on human health.

## **7) Environment and One Health**

**Brulle et al., (2006)** studied the human health in terms of environmental inequalities. This study shows that environmental pollution in one of the major contributors in inequalities which leads to many health problems. Environment is integral part of the food system so it plays important role in food security. Environmental pollution decreases the crop yield as well.

**Albering et al., (1999)** studied the two fresh water lakes in the Netherlands to assess the health risk relation and came up with the findings that sediments of the lake contain the heavy metals like Polyhydroxyalkanoates. Fish ingest heavy metal and get accumulated in them. These fish enter in food system and causes toxicity to human. The two lakes are cause for the heavy metal toxicity.

## **8) Plants and Agricultural Practices w.r.t. One Health.**

**Deng L. et al., (2018)** explains the effect of indoor plants on human health. Indoor plants affect the human health in both aspects. The one is physical aspect and other one is mental aspect. It is proven that indoor plants do purification of air. It has psychological benefits as well noticed by experts. As indoor plants decrease the Co<sub>2</sub> level and increases the oxygen level in the house. Increase in oxygen concentration helps to improve the blood circulation as well as mood.

**Bonasila, (2021)** explained the three effects of the plants on human health. Plants helps in the regulating temperature so it helps to maintain environment cool which helps to keep pathogenicity low. Plants decreases the pollutants in the air and keeps the Co<sub>2</sub> level low. Plants are used to prepare medicines in many pharmaceuticals. Plant keeps the overall Oxygen level high.

**Onder, M., et.al., (2011)** studied the effect of agricultural practices on environment. And came up with the findings Modern agriculture practices are making environment polluted due to use of chemical fertilizers, insecticides, pesticides use. These chemicals are entering into food system through plants. These chemicals cause the toxicity to human body. Chemicals used in modern farming causes toxicity to non-targeted animals as well which can be good for human body.

**Rohila, A. K., (2017)** studied the impact of agricultural practices on environment. Water, soil. Air and biodiversity are major components of environment which is altering day by day due to modern agricultural practices. There is requirement National policy for natural farming which will help to make the farming practices sustainable. Total 20% of the Co2 emission is done to various agricultural practices which causes the many health hazards.

#### **4. RESEARCH METHODOLOGY-**

##### **Study Design-**

This study is done by doing desktop research with the duration of two months supported by google form questionnaire for concerned stakeholders and expert panel discussion.

##### **Selection of Respondents-**

Five stakeholders from each category of stakeholders contain Soil Scientist, Progressive farmers, Medical Officers working in rural area, Public Health Experts and veterinarians. These are major stakeholders in One Health. To know their awareness and knowledge about one health these respondents are selected. And considering the expertise of the individual five experts are selected for panel discussion.

##### **Data Collection-**

1. Secondary data were collected by reviewing the already existing articles, research papers, book chapters, news letters etc. from authenticated sources like Google Scholar, Scopus etc.
2. Primary data collection was done from the five types of concerned stakeholders, five each with a total sample size of 25.
3. Primary data collection is done by conducting an online expert panel discussion on the Webex platform with five renowned experts.

##### **Tools and Techniques for Data Collection-**

The secondary data is collected from online available authenticated sources like Google Scholar, Scopus etc. Primary data was collected by circulating the google form structured questionnaire amongst all concerned stakeholders. The questionnaire for farmers was constructed in Marathi as all farmers were familiar with this language. And if needed explained to them all questions via one-to-one telephonic conversation.

## Data Analysis-

The data collected is qualitative one. A wide variety of data was summarised and categorised in different ways for ease of presentation and comprehension.

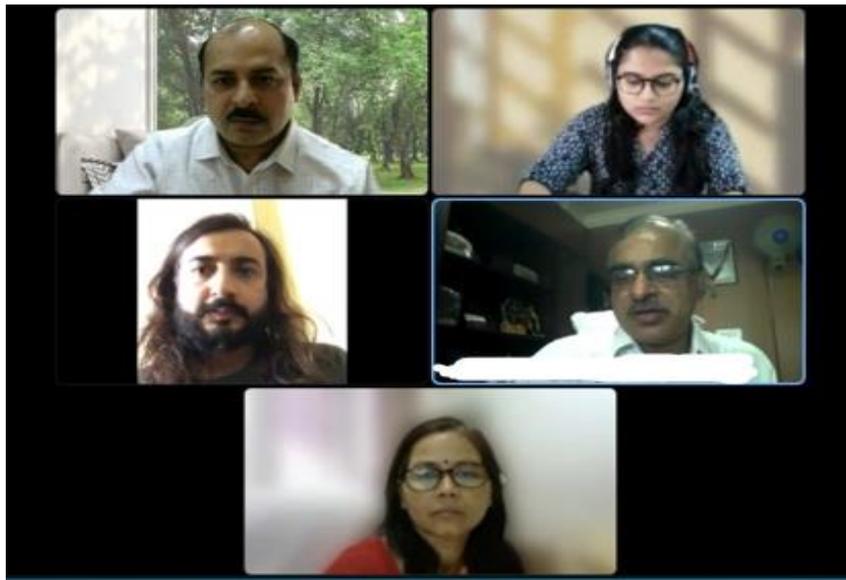


The image shows a screenshot of a Google Form interface. At the top, there are navigation tabs: 'Questions' (highlighted in orange), 'Responses' (with a count of 5), and 'Settings'. Below the navigation is a header section with a logo on the left consisting of a circle of colored dots (orange, teal, grey) and the text 'one HEALTH' on the right. The main content area of the form is titled 'Research on One Health Concept' and contains the following text: 'Special form for Soil scientists.', 'Research Title- "Thrust areas for research in one health for different stakeholders".', 'At National institute of agriculture extension management, MANAGE, Hyderabad.', 'By- Dr. Shamali Phand, Intern (MANAGE) Hyderabad', 'Under- Dr. Vineeta Kumari (Deputy director, Gender studies, MANAGE)', 'Dr. Shahaji sir (Assistant Director, Agriculture allied sector, MANAGE)', 'Please attempt all the questions.', and 'This data will be used for research purpose only.' On the right side of the form, there is a vertical toolbar with icons for adding, deleting, and other editing functions.

**Fig No. 1 Google form questionnaire**



**Fig No. 2. Expert Panel discussion**



**Fig No 3. Expert Panel Discussion**

## **5. RESULTS AND DISCUSSION**

There is a need to increase research on zoonoses, food safety, and agriculture and to improve the understanding of the one health concept. Developing countries do lack in infrastructure which affects the human health, well-being and environmental health. Acceptance of one health is seen where there was impact of infectious diseases. Only 8% of publications were there in agriculture perspective. There is scope to study and publish more data with relevance to one health in agricultural context. It is seen that the prevalence of zoonotic diseases and need of one health approach is becoming the crucial part in disease prevention. (Bdaisee *et al.*,2014)

Animal health surveillance should be carefully enforced. It is critical to keep track on newly developing epidemics throughout the world. To increase surveillance and monitoring, a robust multidisciplinary network of collaborators is required. Farmers, livestock management, and environmentalists all need to be more aware of the OH approach and zoonotic illnesses. Increased use of technology to enhance animal living conditions and illness monitoring and treatment should be encouraged. Increased vaccination coverage should be aimed for prevention. Best practises must be created and accepted based on what has been learned through the use of the OH strategy to control zoonotic diseases around the world. (Aggarwal *et al.*, 2020)

There is need of transdisciplinary approach towards the spread of zoonotic diseases like covid 19. The One health is only multisectoral approach can be effective in such pandemic situations where the various stakeholders like Public Health Experts, agriculture specialist, veterinarian etc. The world has suffered from the covid 19 pandemic and its consequences. The increasing population, temperature, eating habits all serves as contributing factors for pandemic like covid. Next wave of the covid 19 is unpredictable by taking all situation into consideration. This text very well explains the interlinkage between human health, animal health and environment health. Various organisations should come together and should develop a prevention and risk management policy and strategy to overcome such pandemics. In this direction, one health approach is

also critical for countering COVID-19 and other emerging coronaviral and viral zoonotic diseases. (D. Katterine Bonilla-Aldana *et al.*, 2020)

Study gives the total number of literature present on monetary, non-monetary and mixed benefits of using one health approach in university of Nottingham. Study shows a greater number of biotic study than abiotic. This data will give insight to policymaker of target area to be taken into consideration. Funding distribution process of one health will get smoother with the help of such quantitative data. (Falzon, L. C., *et.a.,/*2019). It is clearly saying that protection of human health needs the collaborative approach towards the plant health, animal health and its shared environment. Covid 19 is rising alarm for this. Threat of zoonotic diseases like covid 19 is very well explained. For the ICMR and ICAR are coming up with national institute on one health in Nagpur. (The Indian Express, 2021).

Incorporation of one health into the education system will help us to improve the awareness about this concept amongst all sectors. There is necessity of same initiative in Indian education system as well. Indiscriminate use of antimicrobial agents causes AMR. Excessive use of antimicrobials in plants and animals lead to entry of antimicrobials in food chain and becomes a threat to human health. The threat of emerging pandemic is explained with the supportive statistics. The influencing factors for emergence of pandemics are enlisted so that we can bring out the changes by focusing those. Those contributing factors should be divided according to particular stakeholder. This bifurcation will provide the proper guideline for stakeholders to work on. Lack of utilising the one health concept not only shows the decoration of the health but also other factors like climate change, economic loses etc. The economic burden of pandemics is explained using statistical figures given by World Bank. Those pandemics between year 1997 to 2007, 80 billion dollars was total economic loss was there and if the prevention was used earlier, it would have cost only 25 billion dollars. Economic evaluation of one health should be discussed and reach to the stakeholders to improve awareness. Many SDGs have linkage with one health, to complete the agenda 2030 the implication of One Health Approach is prime requisite (Food and Agriculture Organisation, 2021). It's definitely proven with examples that one health is catalyst

for SDG agenda 2030. SDG also needs a multisectoral approach like One Health. To improve the interlinkage between the various concerned sectors is key for this. One health approach will be used in disease prevention and control. Main task to use one health as catalyst for SDG to bring out all stakeholders together. Planning of sustainable health programmes and the implementation is necessary to achieve goal 2030.

Better coordination between all stakeholders is required. One health should be the part of educational curriculum for all the universities and school. Concerned stakeholders must be aware of their responsibilities. There should one governance body by the central government on all stakeholders which can monitor them. The term One health is not yet in the wide use which have limited the ability of literature search is one of the finding mentions in discussion of paper. We rarely find study which have used one health approach in their method. It indicates the need of incorporating One Health Approach in educational curriculum to have knowledge and awareness about it. It will be guiding light for those who are already doing study by interconnecting the plant, animal and human health. This review highlights the need for larger and more controlled comparative studies of one health disease prediction and control strategies. (Peter M *et al.*, 2013). As per discussion above, it's clear that one health approach is necessary for prevention of long-term pandemics like covid 19. The coming threats for all living beings can be tackled only by incorporating all the concerned sectors together and their joint interventions for same. Importance and need of the hour for one health approach is explained by Director General of FAO in one planet summit in Rome. One health approach not only important for prevention of new diseases but also for food safety, antimicrobial resistance, nutrition, and prevention of the environment.

## **I. Results of Google Form Questionnaire from Concerned Stakeholders.**

Stakeholders were consisting of five Soil Scientist currently working for ICMR, five Medical Officers working with PHC from rural Maharashtra, five veterinarians working in government institutes, five Public Health Experts currently working in government projects and five progressive farmers from rural Maharashtra with total count of 25.

## **Responses from Medical Officers**

### **Qualification**

A review of the data revealed that all of the Medical Officers held a Bachelor of Medicine and a Bachelor of Surgery degree, with one of them also having completed a Post-Graduation in Doctor of Medicine with a specialization in Community Medicine.

### **Experience**

The medical officers' experience ranged from one and a half years to ten years. It was found that two of the five Medical Officers had the same work experience of eight years, while the remaining three officers had work experience of one and a half years, two years, and ten years, respectively.

### **Opinion of Medical Officers regarding the common prevalence in their locality**

According to the data, three of the Medical Officers reported that Diabetes was a common disease in their area, in addition to Dengue, Malaria, Rabies, Rickettsia, and Tuberculosis for the first medical officer. The second medical officer, on the other hand, only reported Diabetes. Aside from Diabetes Mellitus, the third medical officer reported that Hypertension, Hypothyroidism, Upper respiratory tract infection, and Lower respiratory tract infection were some of the common diseases in his area. The fourth medical officer only reported Rabies, while the fifth medical officer reported normal infections as the prevalent disease.

### **Opinion of Medical Officers regarding common causes of disease prevalence**

When asked to respond to a question about the common causes of disease prevalence in their area, the Medical Officers revealed that the most common cause of the prevalent diseases in their area was a lack of hygiene. Aside from a lack of hygiene, the first medical officer reported the following causes as the most common reasons for diseases in his area: unsanitary civilization practices, a lack of awareness about good hand washing practices, environmental issues such as temperature and humidity, domestic rearing of dogs and cats for Rabies, and some unusual job profiles such as Indian Army and army mobilization in forests causing Rickettsia. The second medical officer stated that lack of exercise, obesity, and sedentary lifestyle were the leading causes of disease in his community. The third medical officer, like the first,

revealed that poor hygiene was the main cause of the increase in diseases, with weight gain and overcrowding of families in small homes also playing a role. The fourth medical officer stated that the close relationship between humans and animals has emerged as the primary cause of the increase in diseases in his area. The fifth and final medical officer emphasized that poor water quality and a lack of hygiene were the leading causes of the rising number of diseases in his region.

### **Opinion of Medical Officers regarding the association of human health with plant and soil health**

According to the data, the first respondent revealed that plant and soil health are inextricably linked to human lives. If plants are unhealthy in their natural environment, how can humans be healthy if they consume a lot of vegetables derived from plants. Second, soil health is essential for plant growth and development, and it eventually aids in the development of human immunity, as we consume plant-derived products. As a result, it should be our top priority to ensure the health of the soil and plants in the most organic and natural way possible. The second medical officer responded that soil is the most abundant source of minerals and pathogenic agents, and thus human health is directly linked to plant and soil health. According to the third medical officer, the increased use of pesticides and fertilizers reduces the nutritional value of food, and infected soil with waste disposal has led to increased exposure to pathogens, chemicals, and heavy metals, all of which have a negative impact on human health. The fourth medical officer emphasized that soil has an impact on human health through the nutrients that plants absorb while ingested soil can potentially supply essential nutrients, it can also lead to exposure to heavy metals, organic chemicals, or pathogens in large amounts, which can cause diseases. According to the fifth medical officer, increased deforestation has resulted in a lack of naturally controlling air pollution, leading to an increase in cases of lungs and breathing problems.

### **Opinion of Medical Officers on the association of human health with animal health**

According to the data collected for the association of human health with animal health, the first medical officer revealed that since the beginning of human civilization thousands of years ago, the interaction of humans and animals has been documented,

with humans rearing animals for livelihood and substantial farming occupation. Throughout history, humans have domesticated animals for both commercial and non-commercial purposes such as transportation and meat consumption. Mishandling of milk and meat for human consumption has resulted in a source of infection for diseases such as tuberculosis, brucellosis, and others. The first medical officer also stated that Rabies is a 100% fatal disease once infected, so an unimmunized stray dog or pet dog could cause critical harm to a child, an elderly person, or a pregnant woman. According to WHO data, one rabies death is reported every four minutes around the world. As a result, multispectral work from all stakeholders in public health organizations is required. As a result, scientific management of livestock breeds, pet animals, environmental issues, and soil health issues is critical at this time. The implementation of the One Health Approach to its fundamental points is also required. The second medical officer emphasized that the close association of humans and animals may result in zoonotic diseases in humans from animals or reverse zoonosis, also known as zoonoses, in which infection is transmitted from humans to animals. The third medical officer, like the first two, agreed that animal health affects human health when there is a close association between the two causing diseases such as Rabies, Ringworm, and so on. According to the fourth medical officer, human and animal health are closely intertwined. The majority of human infectious diseases, such as rabies, are transmitted by animals. Maintaining good animal health benefits not only human health but also the environment. The fifth medical officer concluded the question by stating that animal health is associated with the hygiene of animal products consumed by humans.

### **Opinion of Medical Officer on the association of human health with environmental health.**

The examination of data revealed the Medical Officer's thoughts on how human health is related to environmental health. It was discovered that the first medical officer revealed that human life and health are dependent on a variety of variables such as the ecological triad concept, which includes environmental issues, agent-like vectors, and host immunity. Humans live in an environment, and various factors such as temperature, humidity, and air pollution, as well as air pressure, play an important role in maintaining human health. So, without taking into account these various issues when planning a programme for disease eradication and elimination from a

geographical area, no programme is complete, comprehensive, or justifiable. According to the second medical officer, poor environmental mental conditions (pollution) harm human health, whereas good hygiene and environment promote Health Adjusted Life Expectancy (HALE). The third medical officer agreed with the second medical officer, stating that good environmental conditions improve human health, whereas air pollution, sound pollution, and water pollution cause a variety of human diseases such as disturbed intestinal health, lung disease, hypertension, stroke, cancers, and so on. The fourth and fifth Medical Officers agreed on the same point: environmental health is more than just personal well-being. It's also about the well-being of the community. Improving environmental quality in key areas such as air, water, and noise can help to prevent disease and improve human health. Air pollution degrades health and shortens life expectancy. Biodiversity loss reduces the nutritional value of food, as well as the scope and efficacy of medicines.

### **Common Zoonotic diseases enlisted by Medical Officers**

According to all medical officers, the two most common zoonotic diseases in humans are Rabies from dogs, cats, and other animals and Brucellosis from cattle handling. The first medical officer also reported Leptospirosis from rats, mice, and geese; Rickettsia Disease from various animal hosts carrying Rickettsia; Bovine Tuberculosis from unpasteurized milk ingestion; Neurocysticercosis from uncooked beef meat ingestion; and Swine Flu (H1N1) from pigs. Other major zoonotic diseases found in humans, according to the third Medical Officer, are Toxoplasmosis, Plague Cysticercosis, Echinococcosis, and Japanese Encephalitis.

### **Causes of spread of Zoonotic diseases according to Medical Officers**

The data gathered revealed that human-animal interaction in civilized habitats, such as raising pet animals, cats, dogs, livestock breeds, and so on, is the leading cause of the spread of zoonotic diseases. Although many animals should be living in their natural habitat, an increase in disease numbers has been reported as a result of increased interaction with animals. To control zoonotic diseases, proper demarcation must be established. According to the second Medical Officer, the major causes of spread are close contact, inhalation/ingestion of pathogens, and bites by infected animals. The third medical officer emphasized the following factors that contribute to the spread of zoonotic diseases in humans: Coughing, sneezing, and touching

infected bacteria, viruses, or fungi can all lead to disease transmission. The fourth and fifth Medical Officer agreed on the following factors that contribute to the spread of zoonotic diseases in humans: Working in close proximity to infected livestock. Contact with infected animals and pets, Unpasteurized dairy product consumption, Contact with animal-contaminated soil and water inadequate hygiene maintenance.

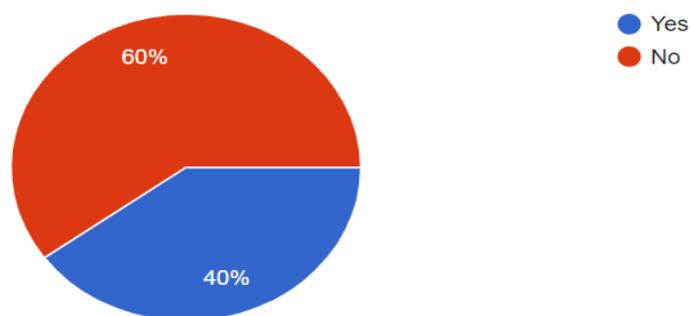
### **Suggetions of Medical Officersto control the spread of Zoonotic diseases**

According to the findings, the first medical officer proposed raising awareness about zoonotic diseases among all citizens of the country. People must first understand the most common diseases and how they are transmitted to humans. The curve can only be bent if proper planning and training of all stakeholders is carried out, teaching them how to control and avoid zoonotic diseases. Continued communication with all stakeholders for any issues that arise regarding programme understanding and addressing their grievances should be made a top priority. One health beneficiary will benefit from training, planning, awareness, and implementation. The second medical officer suggested regular vaccinations and animal hygiene to control the spread of zoonotic diseases. To control the spread of diseases, use gloves, hand wash, mask, do not eat or drink in animal handling areas, avoid going to farm and animal areas if you are sick, care and treatment of sick animals consult doctor if there are sick animals as suggested by the third, fourth and fifth medical officer respectively.

### **Awareness of Medical Officersabout One Health Appraoch**

The data revealed that 60 percent (i.e., 3 Nos.) of the Medical Officers were aware of the One Health Appraoch, whereas 40 percent (i.e., 2 Nos.) were not.

5 responses



**Fig. No. 4 A. One Health Appraoch**

## **Views of Medical Officers on One Health Approach**

The Medical Officers who were aware of the One Health Approach stated that without training of all stakeholders in understanding the One Health concept, the action plan for the health of all, animals, plants, and humans is incomplete, and certification should be made mandatory for all dedicated stakeholders. This certification should be made mandatory for all stakeholders involved in commercial animal, plant, and soil health activities. Everyone should be healthy. Making the environment safe for all humans, animals, plants, and the environment in which they live.

## **Responses from Veterinarians**

### **Qualification**

A review of the data revealed that all of the veterinarians had a Master's Degree in Veterinary Sciences, with the first veterinarian specializing in Animal Biotechnology, the third in Veterinary Pathology, and the fifth in Veterinary Microbiology. The fourth veterinarian also found to have a Doctorate in Veterinary Sciences as well as a PG Diploma in Small Animal Diagnostic Ultrasound.

### **Experience**

The Veterinarians experience ranged from six years to ten years. It was found that two of the five Veterinarians had the same work experience of nine years, whereas the other two veterinarians had work experience of ten years. It was found that only one doctor had a work experience of six years.

## **According to Veterinarians following animals have more potential to spread zoonotic diseases.**

The Veterinarians emphasized that dogs and cats are the most likely animals to spread zoonotic disease. Other animals mentioned by Veterinarians as potential zoonotic disease spreaders include rodents, wild animals, cats, sheep, goats, and monkeys.

## **Suggested management practices to control the Zoonotic diseases by veterinarians**

The most recommended practices for limiting the spread of zoonotic diseases were regular vaccination of animals and raising public awareness through the use of various extension tools. Following strict biosecurity protocols on the farm, rodent

control in residential areas, and following self-care routines while handling animals were the other major recommendations made by the veterinary doctors.

### **Observed trend of Zoonoses by Vetnarians**

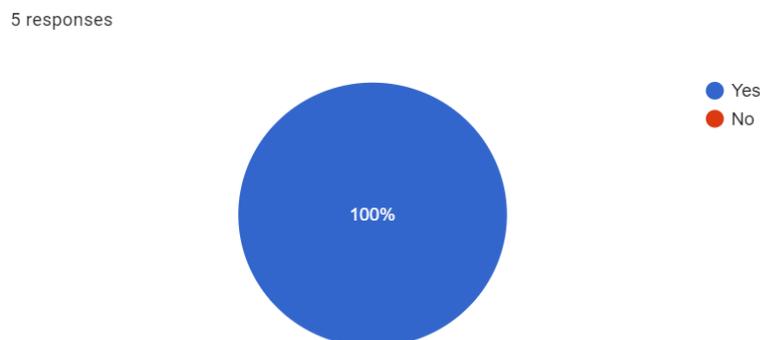
All the veterinary doctors unanimously agreed that there has been an increase in the number of cases related to zoonotic diseases among the human beings.

### **Opinion of Vetnarians on relation of animals with human health and plant health**

A review of the data revealed that the first Vetnarian expressed his belief that it is critical to maintain good animal health, which ultimately protects human health. If the animals become ill, it will undoubtedly have an impact on human health. Similarly, a healthy plant aids in the development of good ecology, which reduces pollution and supports life. The second Vetnarian emphasized that plant health affects herbivore nutrition; if an animal consumes bad plants, the likelihood of zoonotic diseases affecting human health increases. According to the third Vetnarian, sixty percent of diseases are transmitted by animals, so if plants are healthy, we get healthy animals, and if animals are healthy, we get healthy humans, and vice versa. The fourth and fifth Vetnarians agreed with the third Vetnarian on the relationship between animal health and plant and human health.

### **Awareness of Vetnarians about One Health Approach**

The data revealed that all of the veterenarians were aware of the One Health concept.



**Fig. No. 4 B. One Health Approach**

## **Connection of animal health with human health according to Vetnarian**

The first vetnarian expressed his views by emphasizing that in order to control human zoonotic disease and avoid drug resistance, we must first gain knowledge of animal health-related diseases. Only then will we be able to live a healthy human life. While the second Vetnaran stated that most diseases shared by both animals and humans are transmitted amongst themselves, controlling disease only at the human or animal level does not help with disease control. Many diseases are transmitted from animal to human, and vets should share knowledge about their treatment, control, and diagnostic tests with medicos. While the third Vetnarian emphasized the importance of raising awareness about veterinary public health. The fourth Vetnarian shared the third doctor's point of view. The fifth Vetnarian elaborated on his point of view, stating that it is critical to prioritise the ONE Health concept. When it comes to zoonotic disease spread and drug resistance, we are all aware that humans and animals are not far apart. Indiscriminate use of medicines or poor management in one species has a serious indirect effect on the other. Throughout history, it appears that the majority of pandemic diseases were of animal origin, and this trend continues. As a result, it is time to consider both human and animal health in terms of disease prediction and control. It is only possible if both the veterinary and medical fields work together. Then there will be only ONE HEALTH.

## **Suggestion and recommendation of Vetnarians on One Health**

The first vetnarian proposed that a collaboration of different work Medical Officers and veterinarians is required, as well as one zoonotic diseases awareness camp in the majority of villages in each taluka every month. Use various extension tools to provide people with knowledge. The second Vetnarian emphasized the importance of constant sharing of knowledge of various diseases and their control among Vets and Medicos, as well as collaborative efforts to control diseases at both the human and animal levels. The third Vetnarian made the following suggestions and recommendations: There should be combined extension activities maintained by the health department and the Animal Husbandry Department; the government should establish a separate department for Veterinary Public Health or one health that includes experts in respective disciplines. While the fourth Vetnarian suggested that there should be as little disruption to the environment as possible and that

antimicrobial agents be used with caution in animals. The fifth Veterinarian emphasized the importance of veterinarians, stating that one health is worthless without the involvement of Veterinarians and that they are an essential part of One Health.

### **Responses from Public Health Experts**

#### **Qualification**

Data says that 2 out of 5 experts are holding a Masters degree in Public Health and Other three are PhD holders in Public Health.

#### **Experience**

The experience of the Public Health Experts ranged from five to twenty-five years. The first respondent had five years of experience, while the second and third respondents had fifteen and ten years of experience, respectively. The fourth and fifth respondents had seventeen and twenty-five years of public health work experience, respectively.

#### **Opinion of Public Health Expert on association of human health with plant health**

The first Public Health Expert stated that the rise in diseases, deforestation, global warming, and contamination of water and soil have all had a negative impact on human health. The second expert emphasized that we consume plants and thus consume chemo as well as other harmful substances that plants carry. Fertilizers, pesticides, or diseases could all be to blame. Chemical leaching into soil has an impact on plants, and thus on us. The third and fourth experts emphasized that humans are inextricably linked to the ecosystem, which provides a source of nutritious values and nutrients. While the fifth expert stated that soil is directly linked to human health in a variety of ways. The primary source of food production is soil. Soils are an important source of nutrients because they act as natural filters to remove contaminants from drinking water. Soils may contain heavy metals, chemicals, or pathogens that can be harmful to human health. Managing the soil-human relationship with care is an important aspect of human and public health.

## **Opinion of Public Health Expert on association of human health with animal health**

The first expert emphasized that human health is inextricably linked to animal health, with zoonotic diseases caused by animals leading to pandemic-level events. According to the second expert, certain animals are used as food. Chemical and hormonal growth stimulants, as well as illness, have an impact on the quality of produce, and thus on us. The third expert stated that it is critical to keep an eye on animal health because diseases are easily transmitted from animals to humans. The fourth expert had same opinion alike the first three experts. The fifth expert emphasized that animals and humans frequently share the same ecosystem. Many diseases that are similar to it can affect it. Zoonotic diseases are diseases that spread between animals and humans. Animals are responsible for the spread of many human infections. Salmonella and rabies are two such examples.

## **Opinion of Public Health Expert on association of human health with environmental health**

According to the first expert, deteriorating environmental health and rising pollution are causing a slew of NCDs, as well as Global Warming and Cancer. Unhealthy environments make it even more difficult to practise healthy habits. Other experts agreed that pollution, imbalance with nature, and the increased frequency of catastrophic climate events all have an impact on us. The impact of the environment, such as water, air, and so on. Human well-being depends on peaceful coexistence with the environment. Pollutants in the environment contribute to a variety of health issues. Respiratory diseases, heart disease, and cancer are all examples of chronic diseases. Environmental changes have an impact on health; extreme heat and cold can be fatal.

## **Possible reasons for pandemics like Covid19 according to Public Health Experts**

Public health measures are not being implemented due to a lack of awareness. Prior actions had not been taken, increased global interconnectedness, organisms crossing the animal-human barrier, animal origin of disease, and a lack of a mindful development agenda are some of the major possible causes of pandemics like COVID19. The experts also stated that Covid19 is thought to be a Zoonotic disease. Environmental pressures on mammals may result in more ambiguous interactions

between certain animal species and humans, potentially leading to pandemic outbreaks.

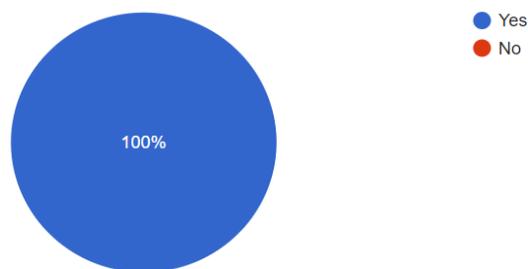
### **Measures suggested by Public Health Experts for safeguarding the Human, Animal, Environmental and Plant health**

Understanding of how each has an impact, as well as their interaction and interdependence approach that is multidisciplinary. Increased comprehension and awareness, as well as responsible consumption. Public Health Experts recommended strengthening health systems at the human-animal-environment interface, sanitation, improving immunity, peaceful coexistence, and reducing carbon footprint as some of the major measures for protecting human, animal, environmental, and plant health.

### **Awareness of Public Health Experts on One Health Approach**

The data revealed that all of the Public Health Experts were aware of the One Health concept.

5 responses



**Fig. No. 4 C. One Health Approach.**

### **Views of Public Health Expert on One Health Approach**

The experts mentioned an approach that takes into account inter- and trans-disciplinary approaches. A multifaceted approach that will benefit everyone. The relationship between health and the environment is well understood. Health has always been a multi-sectoral endeavour. The health of animals, humans, and the environment are all intertwined. Animal, plant, and environmental health are all linked to population health.

## **Different stakeholders of One Health listed by Public Health Experts**

According to the experts, because the One Health Approach encompasses an interdisciplinary approach, it should include all stakeholders from various sectors. Departments of Public Health, Animal Health, Animal Husbandry, Agriculture, Research Institutes, International Organizations, and Professional Bodies involved directly in environmental protection are examples of specific sectors.

## **Opinion of Public Health Experts on implication of One Health Approach**

Proper implementation of the One Health Approach will contribute to increased awareness and comprehension. All contributing factors are given equal weight. Approach to problem solving that is both integrative and holistic. It will aid in gaining a better understanding of human, animal, and environmental health. Health awareness will rise among stakeholders as a result of everyone working together to improve global health.

## **Responses of Soil Scientist**

### **Qualification**

A review of the data revealed that all the Soil Scientist sampled were having Doctorate of Philosophy in Soil Science.

### **Experience**

The Soil Scientist' experience ranged from four to thirty years. The first respondent had nineteen years of experience, while the second and third respondents each had twenty-five years. The fourth and fifth respondents each had thirty and four years of work experience.

## **Soil Health indicators and parameters listed by Soil Scientist**

The Soil Scientist mentioned the pH, EC, SOC, MBC, BD, available nitrogen, phosphorus, and potassium, available micronutrients, and dehydrogenase activity as soil health parameters and indicators. Soil health parameters include soil physical, chemical, and biological properties that influence fertility, productivity, and produce quality. The (soil health) indicators are critical soil health parameters that have an impact on soil health and can be easily measured.

## **Opinion of Soil Scientist about change in soil parameters**

If unsustainable anthropogenic activities are not carried out in tandem with soil health parameters, soil health will deteriorate. Sustainable activities, on the other hand, have a positive impact on soil health parameters. Except for BD, pH, and EC, all other parameters change over time as a result of management intervention. Depending on the climatic condition and moisture content in the soil, different parameters will change at different times. Management practices, cropping pattern, and climate were some of the major causes of soil health parameters that change with time.

## **Association of soil health and human health according to Soil Scientist**

The Soil Scientist stated that the following reasons for soil health affect human health: Excessive nutrient mining of soils for production has harmed human health through a variety of deficiencies over the years. Soil health is linked to human and animal health because healthy soil produces nutrient-rich produce. Good health is provided by healthy soil. Because it adds nutrients to our food. Soil health has an impact on human health by influencing produce quality, nutritive value, and pathogen incidence. The nutrient content of food is determined by the type of soil in which it is grown.

## **Effect of soil health on plant health according to Soil Scientists**

The Soil Scientist mentioned that plant health is improved by management practices that balance soil health parameters. The degradation of any one soil health parameter can have a negative impact on plant health. For example, Liebig's Law of Minimum allows us to understand how a deficient element can affect crop biological produce. Healthy soil produces healthy plants, implying that soil health influences plant health, influencing plant growth, productivity, and produce quality.

## **Effect of soil health on animal health according to Soil Scientists**

The quality of feed and fodder produced in soils with good or poor soil health has a direct impact on animal health. Human and animal health are intertwined because a healthy soil produces nutrient-rich produce, which in turn affects human and animal health. Depending on the nutritive value and pathogen intensity, the plant

produces that animal consume will have an impact on their health. The soil type determines its food availability and environment.

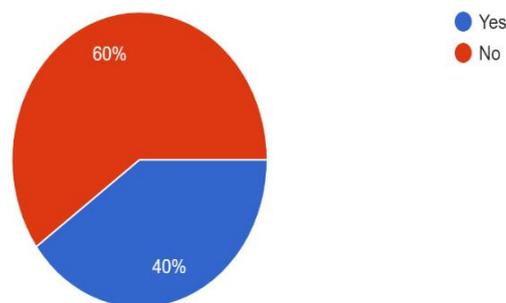
### **Opinion of Soil Scientist on effect of soil health on environment health**

Management practices that are beneficial to soil health will have a positive impact on environmental health, whereas activities that violate soil health parameters will have a negative impact. Pollutants are buffered by soil. It protects ground water from pollution by filtering pollutants. It also sequesters CO<sub>2</sub> from the atmosphere, lowering CO<sub>2</sub> concentrations in the environment. Healthy soil ensures the long-term viability of ecosystems. Soil health is critical to improving environmental health. Polluting the water and environment will result in unhealthy soils, and the type of vegetation is determined by the soil and climate.

### **Awareness of Soil Scientists about One Health Approach**

The data revealed that only three of the five Soil Scientist were aware of the One Health Approach.

12. Have heard about one health concept?  
5 responses



**Fig. No. 4 D. One Health Approach**

### **Recommendation of Soil Scientists on One Health Approach**

The Soil Scientist recommended that there is a need to develop an integrated index that includes soil, human/animal, and environmental components to help sustain soil health, nourish the soil, and save the environment.

## **Responses from Farmers**

### **Experience**

The farmers' years of experience ranged from ten to twenty years. Four of the farmers each had ten years of experience, while only one farmer had twenty years of experience.

### **Qualification**

Out of five 3 farmers are 10<sup>th</sup> pass and One is having diploma in Electrical Engineering and other one is 12<sup>th</sup> pass.

### **Common diseases listed by Farmers in plants and animals**

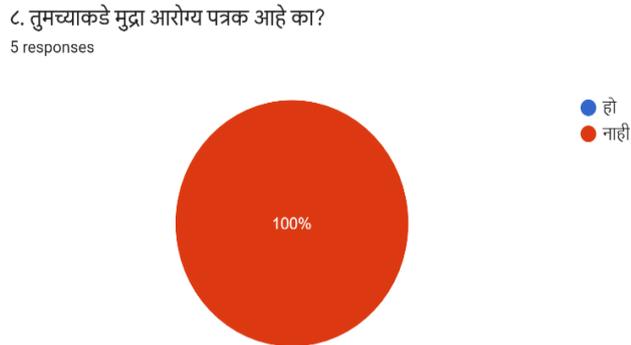
The farmers stated that the most common diseases found in plants and domesticated animals were Query Fever, Foot and Mouth Disease (FMD), Rabies in animals, and bacterial diseases in plants.

### **Reason for the common diseases explained by farmers**

Contaminated food water sources and the use of heavy chemical fertilizers in field practices, as well as a lack of natural and organic farming, Diseases in animals caused by not vaccinating them on a regular basis, as well as climate change Plant diseases caused by viruses and hot, humid weather. Pollution and climate change are also major contributors to rising disease incidences. Plant diseases caused by climate change and excessive use of chemical fertilizers. Animal diseases caused by a lack of cleanliness in their shelter, as well as communication diseases.

## Possesion of Soil Health Card

All the sampled farmers mentioned that they didn't possess Soil Health Card.



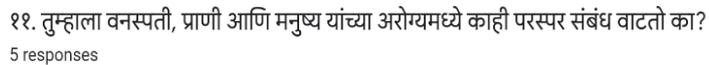
**Fig. No. 5. Soil health card.**

## Agriculture practices followed by Farmers

Two farmers each practiced modern farming and mixed farming, respectively, while the remaining farmer practiced traditional farming.

## Relationship between plant, animal, human and environmental health according to Farmers

Majority of the farmers (80%) agreed that there was a relationship between plants, animal and human health while the remaining 20 percent didn't agree to this relationship.



**Fig. No. 6. Relationship between plant, animal and human health.**

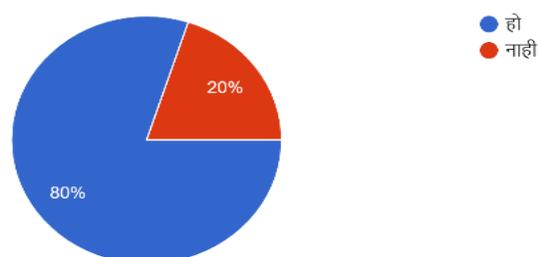
## Health issues listed by Farmers in their community

Cancer, respiratory diseases, blood pressure, B12 deficiency, Covid19 deficiency, viral fever, diabetes, and heart disease were the most common health issues reported by farmers in their surrounding community.

## Farmer's Opinion of doctor's consultation

Majority of the farmers (80%) agreed that they consulted doctors for their health issues while the remaining 20 percent didn't consult any doctor.

१३. त्यासाठी कोणत्या डॉक्टरांचा सल्ला घेतला आहे का?  
5 responses



**Fig. No. 7. Consultation from Doctor.**

## Treatment given by doctor according to Farmers

Aside from general medicine advice such as drinking plenty of water and eating healthy foods, doctors' most common line of treatment was symptomatic treatment.

### II. Results of Expert Panel Discussion-

Expert panel discussion was held on online Webex platform with structured leading questionnaire. The five renowned experts were there in panel with my two mentors Dr. Veenita Kumari, Centre Head, Gender Studies and Dr. Shahaji Phand, Centre Head, Agri-Allied Extension. Panel consists of Prof. Anil K. Gupta, Executive Vice Chair, National Innovation Foundation, Ahmadabad and Padma Shri Awardee 2004, Prof. Pasala Geervani, Former Vice Chancellor of Sri Padmavathi Mahila University, Tirupati, Dr. S. B. Barbuddhe, Director, National Research Centre on Meat, Hyderabad and one of the core members of One health consortium, Prof. Sandeep Chaudhari, Department of Veterinary Public Health and Epidemiology, MAFSU, Nagpur and founder member of National Institute on one health, Nagpur, Dr. Ram,

Visiting Faculty, MIT-World Peace University, Pune is an experienced public health expert along with ayurveda graduate.

### **Opinion of Experts on Importance of One Health Approach**

Panel discussion started with the importance of One Health Approach. One of the panellists gave the background regarding one health that, in 2004, wildlife conservation society gave concept of one world - One Health. Everyone was trying to connect different disciplines with human health like, animal, environment, soil, water, air etc. All the aspects are interconnected to each other; we cannot isolate any single health from that. Co-ordination and collaboration is very important from all the stakeholders in One Health. One health approach is important for the people who are in close proximity with nature, animal and soil. As soil is integral part of human life, one panellist suggests that the concept of one health needs to be redefined to include soil. Soil is highly valuable living medium and soil health affects productivity of soil, micro and macro-organisms present in soil, hence soil resilience is integral part of One Health. In one health, different soils should be studied and data should be maintained, as soil health varies with region. We should focus on the health of individuals and animals. Increase in the zoonotic diseases highlights the importance of one health approach. There is a need to study the healthy individuals and find the factors responsible for their healthy life. Which we can incorporate the system. Health, hygiene and sanitization practices should be practiced to reduce infections. Public health system needs to be improved and awareness about healthy practices should be made amongst parents and children. Two panellists bring everyone's attention towards water. Water is an important nutrient which plays an important role in health and it is the first source of contamination. Regulations should be made for availability of safe drinking water in schools. Apart from above discussions some of the panellists introduced different concepts like, method of gene therapy and advanced technology should examine and execute one health approach, scope of genetic profile needs to be considered in one health concept, mental health is also one of the aspects in one health, etc.

### **Opinion of Experts on Stakeholders in One Health Approach**

Discussion further continues with finding the different stakeholders in One Health. One of the panellists made a very important point regarding the

container/vessels in which food is cooked and served plays an important role in individual's health. This concept is applicable to animals also. For example Aluminium and Lithium has connection with neuro-degenerative disorders, so which metal we are using needs to be checked. Content of metals in water also plays an important role in health. Hence the metallurgy plays an important role in One Health. One panellist points out the need to study plant plasma, animal plasma and human plasma and the comparison should be done. This can lead to further clinical evidence of inter-connection between them. While discussing health there should be knowledge and awareness regarding contamination and sources of contamination. According to one panellist in today's generation consumption of fast food, easily available and packaged food is increasing instead of health and home cooked food. Use of community kitchen is increasing day by day. After multiple discussions we are able to lists the stake holders in one health like, animal sector, agricultural sector, Sociologist which will play important role in convincing people and influencing their attitude, food safety experts and related organizations, farmers, nutrition practitioners. Colleges and institutes will also play an important role here. National Institute of One Health at Nagpur is working for a collaborative action with MAFSU and ICMR, also, NAARM, Hyderabad is working on how one health can help to minimize human wildlife interface. Apart from this innovation and engineering sector will also play an important role in making the world technology savvy. Role of Government bodies in bringing law, standardization of system, execution and monitoring part is very important.

### **Opinion of Experts on Scope of One Health Approach**

They highlights the necessity of this concept. We need to take this concept forward to increase the awareness amongst different stake holders. The importance of collaborative work needs to be explained and understood. One very important and effective point is to incorporate small concepts/chapters in syllabus about one health for children. At this age children listens and follows their teacher. Once this concept becomes habitual to them it will be very impactful. So policy implications at government level for one health need to be done. Monitoring and surveillance in rural areas is necessary in teams of One Health. Also mapping of health issues is necessary.

## **Role of MANAGE in One Health According to Experts**

Institutes like MANAGE will play very important role in this subject by developing the curriculum for institutes, involving in dissemination of innovations and technology on 'One Health'. Multiple institutes can conduct inter-disciplinary sharing of knowledge through academic forums. Capacity building can be done by institutes like MANAGE. Institutes can offer diploma, short educational courses or internship programs on One Health. Educational institutes also can work on how to collaborate one health with different government initiatives like 'Atmanirbhar Bharat'.

## **Researchable Areas in One Health Explained by Experts**

While exploring the researchable areas in one health, one of the panellists explained the already proposed concept in August 2021 i.e. One Health Consortium. This institute works towards the disease burden and surveillance. There are multiple researchable areas in one health we can list such as, scope of genomics in one health, antibiotic resistance, food safety and nutrition, impact of climate change on one health, occupational exposure and one health, mental health and One Health. There is also the need to research the triple burden of communicable disease, non-communicable disease and nutrition. Change in trend and immunological responses is also one of the research areas. In recent COVID19 pandemic it becomes very important to study the impact of heavy use of antibiotics.

As discussed earlier, government plays an important role in One Health. So, taking new initiatives related to one health is the need of time. Establishment of National Institute of One Health in Nagpur by December 2023, National centre for zoonotic disease control for mapping the zoonotic diseases are some of the initiatives from government. ICMR is also working on the One Health. One important point mentioned by one panellist is that we can involve our corporates in this initiative through their CSR and corporate funding. Which will really boost such initiatives.

So, one health is a collaborative approach, individual health cannot be isolated. Sensitization of next generation towards one health approach as early as possible is very necessary. Good food and good nutrition practices have close association with One Health. While considering the good food, good transportation of the food items, grains need to be taken into consideration. One of the panellists spoke about the pet animals. How to take care of pet animals and their hygiene practices have connection

with One Health. It is very important because we are always very close to our pet animals. People who sleep near cow shelter needs to know the ill impacts of cow and human co-existence. Occupational environment is one of the major areas where the awareness regarding hygiene practices should be generated, particularly among those who are closely handling animals. Ex. Veterinarians, Wildlife experts, Farmers etc.

If we think regarding the implementation of One Health Approach, area specific study will play an important role. Health map of India is necessary for area specific study. Mapping of minerals, food chain, water quality, vaccinations is also very necessary.

### **Important findings of google form questionnaire from concerned stakeholders-**

Dengue, malaria, Rabies, tuberculosis, hypertension and diabetes are prevalent diseases in their locality. Poor hygiene, poor food and water quality, lack of exercise, sedentary lifestyle are causes of diseases. Soil and plant health has close relation with human health, soil absorbs heavy metals, pathogens, organic chemicals also cause diseases. Zoonotic diseases like Rabies, Ringworm causes due to close relation of animal and human health. Humans live in environment and various factors like atmosphere temperature, humidity and air pollution, air pressure plays vital role in maintaining human health. Livestock is one of the food sources of human being also a connecting factor. Human animal interaction in civilised habitat like rearing pet animals, cat, dogs, livestock breed, etc. are major causes of zoonotic diseases. 3 out of 5 Medical Officer were not aware about One Health Approach. Adapting health for all and training of concerned stakeholders about one health is suggested interventions.

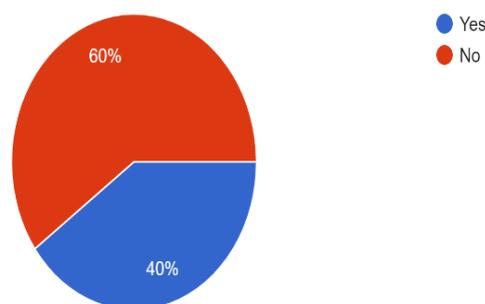
All Veterinarians were aware about one health and according to them Dogs, cats, rodents, birds has more potential in spreading zoonotic diseases. Vaccination, maintaining hygiene, reducing the human interference with animals, wearing protective cloths while handling the animals, and spreading awareness with the help of effective extension will reduce zoonoses. The trend of zoonotic diseases is always increasing. Drug resistance, lowered antibiotic sensitivity shows the relation of human with plant and animals. Plant, animal and human are integral part of food chain. One health awareness camps at village level and combined awareness activities are required to deal with zoonoses. Minimum disturbance to environment and careful

usage of antimicrobial agents in animals. There needs to be constant knowledge sharing platform amongst concerned stakeholders.

Soil health directly affects plant growth, productivity, food produce quality, nutritive values of food and thereby human health. Soil health also affects quality of animal feed and fodder, which have direct impact on animal growth and food quality which ultimately affect human health. Management practices which are friendly to soil health will have positive impact on environmental health and the activities which deteriorate the soil health parameters will have negative impact on environmental health. Need to develop integrated index encompassing soil, human, animal, environmental component. Healthy soil, plants, animal maintains sustainability ecosystem.

Plants are major source of food in humans, so it directly affects human health. Consumption of unhygienic animal food leads to spread of zoonotic diseases. Increased interface between human and animals also major contributing factor to zoonosis. Pollution, climate change has direct impact on health in general. Sanitation, improving immunity, establishing interdisciplinary approach and spreading awareness are suggested interventions to safeguard the human, animal and environmental health. One health approach gives holistic approach to health and focuses the global health. All Public Health Experts are aware about One Health Approach. But 60% of them were not aware about any government initiative for One Health. As shown in below pie chart.

15. Do you know about any present scheme or initiative by government on one health concept?  
5 responses



**Fig. No. 8. Initiative by Government on One Health Approach.**

Query Fever, Foot and Mouth Disease (FMD), Rabies are common diseases in animals, while fungal and bacterial diseases are common in plants. Contamination of water and food resources, poor hygiene, pollution, adverse climate are the common reasons for diseases. COVID 19, viral fever, vitamin deficiency, cancer are more common diseases in their locality. Mostly symptomatic treatment is given by doctor for the illness at primary level. 1 out of 5 respondents do not find any relation between plant, animal and human w. r. t. health. None of the respondent have found soil health card of their agricultural land.

## **IMPORTANT FINDINGS FROM EXPERT PANEL DISCUSSION-**

### **Importance of One Health Approach**

Soil resilience is integral part of one health, it is a highly valuable living medium and soil health which comprises of micro and macro-organisms present in soil, micronutrient profile leads production and productivity of soil. More focus is needed with respect to study healthy animal, healthy individuals and healthy plant. One health aspect should be focused, because health expenditure per family is increasing day by day. Public health system needs to be improved and awareness about healthy practices should be made amongst parents and children. Water is important nutrient which plays important role in health and is the first things affecting the health. Healthy hygiene and sanitization practices should be done to reduced infections. Combine research is necessary by all concerned stakeholders. Need of strengthening the public health system. Livestock raising needs to be practice in scientific way. Increase in zoonotic diseases led to think on one health approach. Mental health also one of the aspects in One Health. There is need sensitize and mobilize stakeholders to make common platform to work on One Health.

### **About the stakeholders of One Health**

- Theoretically, everyone is stakeholder in one health
- Soil Scientist
- Medical Practitioners
- Public Health Experts
- Veterinarians
- Environmental Scientists

- Wildlife Experts
- Human Nutritionist
- Metallurgists
- Food Technologists
- Food safety and quality control experts
- Farmers
- Sociologist- Role in convincing people.
- Administrative and legal stakeholders
- Technologists

### **Role of MANAGE in One Health?**

- Capacity building of stakeholders.
- Offering the Diploma or short educational courses.
- Curriculum development for other educational institution.
- Innovative approaches need to be practiced to create wide spread awareness among the stakeholders in Agri-allied sectors.
- Linking and sharing of information among the stakeholders on one health at various level for better collaboration.
- Conducting comprehensive action research on One Health.

### **Researchable areas in One Health**

- Disease burden and surveillance.
- Scope of genomics in one health
- Antibiotic resistance.
- Food safety and nutrition
- Climate change and One Health.
- Occupational hazards and one health
- Mental health and One Health.
- Research on the triple burden on human health
- Area specific study is necessary for better implementation.
- Health map of India is necessary for area specific study.
- Change in disease trend and immunological responses to pathogens needs to be studied.

## 6. CONCLUSION-

### **Researchable areas found in Review of Literature w.r.t. One Health for different Stakeholders-**

1. Chronology and pathway of various zoonotic diseases.
2. Forecasting and preparedness of pandemic outbreaks.
3. Study on abiotic factors responsible to guard One Health.
4. Surveillance and understanding spread of emerging diseases.
5. Study on antimicrobial resistance and thereby economic burden on farm family.
6. Mutation in pathogens in view of climate change.
7. Study on exploring stakeholders and their intersectoral collaboration in One Health.
8. Impact of air, water and soil pollution on various agriculture crops.
9. Study on emergence of pathogens in view of climate change.
10. Study on role of indoor plants to improve environmental health and thereby human health.
11. Study on effect of agricultural practices on environment.

### **Researchable areas found in Stakeholders w.r.t. One Health for different Stakeholders**

1. Study on consequences of human and animal interaction in civilised habitat
2. Study on factors affecting drug resistance and lowered antibiotic sensitivity w.r.t. genetic profile
3. Study on role of extension/sociologist in making awareness one health
4. Study on eco-friendly agricultural practices.

### **Researchable areas found in Panel Discussion w.r.t. One Health for different Stakeholders**

1. Study on chemicals present in soil
2. Study of healthy individuals should be done for the assessment of factors responsible for their healthy life
3. Study on gene therapy and advanced technology to safeguard one health
4. Role of water in human health

5. Soil health mapping
6. Study on healthy cooking practices
7. Study of healthy plant, animal and human plasma for mapping of micronutrient profiles
8. Study on source of contaminations food, water, environment etc.
9. Study on health map of India

## **7. RECOMMENDATIONS-**

- ✓ Identification of stakeholders and defining their role in One Health.
- ✓ Policy interventions on One Health.
- ✓ Sector specific intensive research and documentations on One Health.
- ✓ Development of common platform for all stakeholders to share information and line of action.
- ✓ Application of ICT and social media to create awareness about One Health.
- ✓ Incorporation of one health approach in early educational curriculum to create awareness.
- ✓ Incorporation of one health approach in higher educational curriculum to discover dimensions of One Health.
- ✓ Capacity building of stakeholders on One Health.
- ✓ Study on global experiences in safeguarding One Health.
- ✓ Study on grassroot level awareness about one health among the stakeholders.
- ✓ Study on innovative methods to achieve One Health.

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