



Bridging Sectors with a One Health Approach: The Role of Veterinarians in Disease Prevention and Control

Policy Paper



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Bridging Sectors with a One Health Approach: The Role of Veterinarians in Disease Prevention and Control

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Abstract

This policy paper emphasises veterinarians' essential role in combating epidemic infectious diseases that pose significant socio-economic and health risks. Veterinarians are vital for zoonotic disease control and food safety, bridging animal welfare and human health. This policy paper advocates for enhanced veterinary education, cross-sector collaboration, and a robust One Health approach to strengthen veterinarians' frontline defence against global health threats.

It draws on initiatives from the International Veterinary Students' Association (IVSA), the Berlin Principles, and the Competencies for One Health Field Epidemiology (COHFE) Framework to recommend strategies for improving disease surveillance, response, and resilience. Historical outbreaks like Avian Influenza, Ebola, H1N1, and COVID-19 highlight the need for coordinated, interdisciplinary efforts. The risks of pet travel-related diseases, such as rabies, are also discussed.

This policy paper urges governments, organisations, and educational institutions to take immediate action to develop a well-equipped veterinary workforce within a One Health framework, ensuring a secure and healthy future for all. This entails

1. **Investing** in the veterinary workforce by strengthening curricula;
2. **Promoting** interdisciplinary training programs and a One Health Approach (OHA);
3. **Advocating** for increased resources for research and biosecurity measures;
4. **Applying** of the Berlin Principles to build a more resilient and effective health system;
5. **Including** veterinarians in decision-making processes to ensure informed policies.



Introduction

The International Veterinary Students' Association (IVSA) is a non-profit and non-governmental organisation serving as a global platform to unite veterinary students worldwide. It is the largest veterinary student association in the world, representing over 70 Member Organisations (countries). IVSA aims to benefit the animals and people of the world by harnessing the potential and dedication of veterinary students to promote the international application of veterinary skills, education, and knowledge [27]. The Pathology Network (PN) and the Standing Committee on One Health (SCOH), two groups within IVSA, were involved in preparing this policy paper. The PN is dedicated to engaging veterinary students and professionals passionate about the paraclinical aspects of Veterinary Medicine. Their mission is to raise awareness of Veterinary Pathology, connect IVSA members, facilitate global knowledge exchange, promote veterinary paraclinical skills, provide career information, build professional relationships, and encourage advocacy on relevant issues [27]. SCOH promotes the One Health approach, which acknowledges the interconnectedness of human, animal, and environmental health. SCOH's objectives include educating students about One Health, highlighting the role of veterinarians in public health, promoting transdisciplinary collaboration, providing a framework for collaborative projects, and advocating for a holistic, sustainable health strategy [28].

In recent years, the global landscape of infectious diseases has underscored the necessity for a comprehensive framework that recognises the interconnectedness of sectors such as human and animal health, environmental health, agriculture, economics, education, policy and governance, technology and innovation, social and cultural factors, emergency response and preparedness, and legal and ethical aspects [29]. The Berlin Principles [Appendix 1] addresses this concern by promoting a holistic One Health approach (OHA). They highlight the necessity of interdisciplinary collaboration, preventive strategies, and science-based policies to manage and mitigate emerging infectious diseases effectively [1].



Integrating these principles will enhance the capacity to detect, respond to, and prevent health threats.

The recent release of the Competencies for One Health Field Epidemiology (COHFE) Framework by FAO, WHO, and WOAHA represents a pivotal advancement in this approach, standardising training for frontline responders to improve prevention, preparedness, and response to health threats [2]. The COHFE Framework outlines essential D1 competencies, including foundational skills in epidemiology, disease investigation, and response. These competencies are crucial for developing a resilient and well-trained One Health workforce capable of preventing and controlling epidemic infectious diseases.

Infectious diseases, including epidemics and pandemics affecting both animals and humans, have emerged as substantial threats to global economies, public health, societal well-being, and environmental stability, as evidenced by a growing body of research [3-13, 15-16]. Historically, impactful epidemic infectious diseases, such as Avian Influenza, Ebola Virus Disease, Foot and Mouth Disease, H1N1 Influenza, Nipah Virus, and COVID-19, have demonstrated the need for a coordinated response that encompasses animal and human health, environmental considerations, and socioeconomic factors. Non-zoonotic infectious diseases, such as African Swine Fever, have social impacts that cannot be overlooked. The risk of travelling with pets, such as rabies and canine monocytic ehrlichiosis, should also be considered.

In response to this growing concern, this paper seeks to highlight the indispensable role of veterinarians in mitigating the consequences of such disease outbreaks. It emphasises the intricate relationship between animal health and socio-economic stability, recognising the profound impact that epidemic infectious diseases and zoonoses, which are transmitted between animals and humans, can have on both human and animal populations [3-14, 15-16].

By understanding the interconnectedness of these systems and working together, stakeholders can develop holistic strategies to mitigate the consequences of epidemic



infectious diseases and promote the well-being of both animals and humans. Veterinarians, as guardians of animal health and sentinels of public safety, stand at the intersection of animal health and welfare and human health and well-being, making their expertise essential in safeguarding both populations against the threats posed by infectious diseases [3-14, 15-16]

Materials and Methods

The insights on this topic were gathered by reviewing relevant literature sources, including peer-reviewed articles and research papers, along with reports and statements from IVSA Global's Partners. This knowledge was compiled into a comprehensive policy paper draft. The draft was subsequently revised by IVSA Global teams and IVSA Global partners to ensure the position presented is representative of the collective perspective.



I. Animal Health Impact and Animal Welfare

Veterinarians are frontline defenders, employing protective measures such as monitoring and surveillance, early detection and rapid response to prevent the spread of (zoonotic) diseases within and among domestic and wild animal populations, thus protecting animal and human health [3-14, 16].

Through surveillance, veterinarians identify emerging threats and track the spread of infectious diseases, allowing for timely intervention. Early detection is crucial in implementing effective control measures, which may include quarantine, vaccination campaigns and treatment protocols. During outbreaks, veterinarians are at the forefront of supervising and managing the health of animal populations [3-14, 16].

Additionally, veterinarians are vital in coordinating responses across sectors and collaborating with relevant stakeholders to implement management and control strategies. This may involve working with animal caretakers, government agencies, national competent authorities and international organisations to contain outbreaks and mitigate their impact on animal health and welfare [3-14, 16]. For instance, during the 2009 H1N1 influenza pandemic, veterinarians were critical in monitoring and managing the virus transmission between humans and animals [17, 24-25]. Similarly, their role was indispensable in controlling avian influenza, which has led to the culling of over 400 million domestic birds globally since 2003, and in managing the 2014-2016 Ebola virus outbreak in West Africa that resulted in more than 28,000 cases and over 11,000 deaths [18,19]. In the UK's 2001 Foot and Mouth Disease outbreak, veterinary interventions helped manage the culling of over 6 million animals [20-23]. During the Nipah virus outbreak in Singapore and Malaysia (1998-1999), which caused over 100 human deaths and required the culling of over one million pigs, veterinarians were crucial in identifying the source of infection and implementing control measures [26]. Most recently, the COVID-19 pandemic has highlighted

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the role of veterinarians in researching SARS-CoV-2 in animals and ensuring the safety of the food supply chain [3,16].

To address animal welfare, veterinarians implement monitoring systems such as weekly health checks, quarantine protocols, all-in-all-out systems, and vaccination programs. These measures prioritise animal health beyond merely controlling disease transmission. For example, during the avian influenza outbreak, vaccination and biosecurity measures were employed alongside culling to protect animal welfare. These preventive systems decrease the risk of animal diseases and reduce antimicrobial use [3-16, 18].

In the context of wild animals, veterinarians contribute to ecosystem stability and biodiversity preservation by monitoring wildlife health and preventing disease spillover into human and domestic animal populations. During the 2014-2016 Ebola outbreak, efforts included monitoring and managing the health of wild primate populations to prevent further transmission [3-16, 19].

Quantifying the impact of epidemic diseases on animal health and welfare strengthens the argument for veterinary involvement, emphasising the need for investment in veterinary education and infrastructure [3-16]. By prioritising animal health and welfare, veterinarians contribute to the well-being of individual animals and provide important overlooked benefits for society and the planet. Improved animal health through prevention systems, such as vaccines and proper biosecurity, decreases the risk of animal diseases, reducing new outbreaks and antimicrobial use [3-16]. Furthermore, animal health in the context of farm animals is crucial to food security and food safety. In contrast, in the context of wild animals, it contributes to the stability of ecosystems and the preservation of biodiversity. Through their expertise and dedication, veterinarians play a crucial role in safeguarding animal populations and minimising the spread of infectious diseases within and between species [3-16].



2. Socio-economic Impact

Veterinarians also leverage their expertise to minimise economic losses and ensure the sustainability of animal-related industries. During disease outbreaks, veterinarians are instrumental in implementing control measures to contain the spread of infectious agents, thereby safeguarding the health and productivity of animal populations [3-5, 8, 10-16]. For example, the 2009 H1N1 influenza pandemic resulted in an estimated 151,700 to 575,400 deaths worldwide. [17, 24-25].

However, the socio-economic impact of epidemic infectious diseases extends beyond immediate losses in productivity and revenue. Disruptions of supply chains, trade restrictions and market closures can have long-term consequences for communities dependent on animal agriculture and related industries, and companion animals. Additionally, the loss of livestock due to disease outbreaks can threaten food security and safety, as well as the provision of healthy food, and exacerbate poverty, particularly in vulnerable populations [3-5, 8, 10-16]. For instance, the 2001 Foot-and-Mouth disease outbreak in the United Kingdom resulted in economic losses exceeding £8 billion, demonstrating the profound financial impact of such diseases [20-23]. Since 2003, avian influenza outbreaks have resulted in the culling of over 400 million domestic birds globally [18]. These outbreaks have also caused economic losses estimated at around \$20 billion, highlighting the significant impact on the poultry industry and related sectors [18]. Ethical considerations of mass culling and lost lives are rightfully taken into account as well [30].

By advocating for investment in biosecurity measures, disease surveillance, preventive measures and emergency response capabilities, veterinarians contribute to the resilience of animal-related industries and the overall economy [3-5, 8, 10-16]. Zoonotic diseases are responsible for an estimated 2.5 billion cases of human illness and 2.7 million deaths globally each year, significantly impacting socio-economic factors [31]. These diseases impose substantial healthcare costs, decrease productivity in affected communities, and strain



healthcare systems, particularly in low-resource regions. The economic burden extends further with losses in agricultural productivity and trade restrictions, underscoring the critical need for comprehensive health measures to mitigate these impacts and safeguard public health [3-5, 8, 10-26, 32].

Epidemic infectious diseases have profound repercussions on livelihoods, food security, food provisions and global trade [3-5, 8, 10-16, 26]. For example, the Nipah virus outbreak in Singapore and Malaysia (1998-1999) resulted in over 100 human deaths and required the culling of over 1 million pigs, causing significant economic disruption[26]. Clarifying the financial implications of poor biosecurity and individual health conditions emphasises the importance of investment in biosecurity measures, disease surveillance, and emergency response capabilities [3-5, 8, 10-16, 26].

Furthermore, veterinarians play a critical role in conducting economic analyses to quantify the financial impact of animal disease outbreaks and evaluate the cost-effectiveness of control measures. By providing evidence-based recommendations, veterinarians inform decision-making processes and guide resource allocation to minimise socio-economic losses and promote sustainable development [3-5, 8, 10-16]. The 2014-2016 Ebola virus outbreak in West Africa, which resulted in more than 28,000 cases and over 11,000 deaths, also highlighted the essential role of veterinary public health in managing such crises. Veterinarians were pivotal in identifying and controlling the animal reservoirs of the Ebola virus, thereby preventing further spillover into human populations. Additionally, they contributed to developing biosecurity measures, surveillance systems, and public health strategies that are critical in managing and mitigating the spread of zoonotic diseases. [19]. Beyond its human toll, the outbreak caused significant economic repercussions, estimated at billions of dollars. These included direct costs related to healthcare, containment efforts, and economic disruptions in heavily affected regions, impacting sectors such as agriculture, trade, and tourism. The outbreak highlighted the need for robust veterinary public health strategies to mitigate both the human and economic impacts of future health crises [19].



In conclusion, addressing the socio-economic impact of epidemic infectious diseases also requires the multi-disciplinary approach discussed in this policy paper, as veterinarians also contribute to promoting economic and societal resilience [3-5, 6, 10-16].

3. Public Health Considerations

Veterinarians make significant contributions to public health by preventing, managing, and controlling zoonotic pathogen transmissions and ensuring the safety of animal food products.

As previously mentioned, veterinarians play a crucial role in surveillance efforts to monitor zoonotic diseases and prevent their spread. By identifying potential transmission routes and implementing control measures, veterinarians mitigate the risk of disease transmission to humans [6, 10, 14]. In addition, veterinarians ensure the safety of animal-derived food products, such as meat, fish, milk, dairy and eggs. Through rigorous monitoring and surveillance programs and subsequent inspection and accreditation programs, veterinarians uphold food safety standards and protect the market from unfit-for-consumption products of animal origin to ultimately avoid consumers contracting foodborne illnesses from these products [6, 10, 14].

Effective communication with the public during outbreaks is crucial to garner support for control measures and dispel misinformation [3-13, 14-16]. Veterinarians serve as trusted sources of information, providing guidance on preventive measures and addressing concerns related to disease transmission. By fostering open communication and transparency, veterinarians promote public trust and cooperation in disease control efforts [3-13, 14-16]. Integrating zoonotic disease education into veterinary curricula and enhancing communication skills for veterinarians are essential for building public trust and fostering collaboration between veterinary and public health professionals. Surveillance systems integrating human and animal health data facilitate early detection and response to emerging



infectious disease threats. This underscores the necessity for interdisciplinary collaboration, as veterinarians work with authorities and stakeholders to develop and implement coordinated public health responses. Using their expertise, veterinarians formulate effective disease prevention and control strategies, thus highlighting their importance in decision-making processes to ensure well-informed policies. Additionally, improving veterinary communication skills and educating about zoonotic diseases are crucial in strengthening overall public health initiatives [3-13, 14-16].

To sum up, veterinarians play a pivotal role in safeguarding public health through their efforts to prevent zoonotic transmissions and ensure the safety of products of animal origin. Effective communication with the public and collaboration with stakeholders are essential components of veterinary public health efforts, ensuring a coordinated and comprehensive approach to disease prevention and control [3-13, 14-16].

4. Collaboration and One Health Approach (OHA)

Given the complexity of epidemic infectious diseases, a collaborative approach involving veterinarians, allied animal health professionals, human doctors, environmental health professionals, policymakers, and other stakeholders is essential. The One Health concept underscores the interconnectedness of human, animal, and environmental health, promoting holistic strategies for effective disease prevention and control through the One Health Approach (OHA). Key factors driving the increased frequency and spread of infectious pandemics include globalisation, increased travel, urbanisation, intensive livestock farming, climate change, and human infringement on wildlife, leading to unprecedented human-animal contact. These factors highlight the need for an interdisciplinary approach, where stakeholders can share knowledge, resources, and expertise to develop comprehensive strategies for disease surveillance, prevention, and control [3-8, 11-16, 33].



Furthermore, collaboration with policymakers and other stakeholders is crucial for implementing OHAs both nationally and internationally. By integrating One Health principles into policy frameworks, governments can promote cross-sectoral collaboration, allocate resources effectively and address the root causes of disease emergence and transmission [3-8, 11-16, 33]. The OHA also emphasises the importance of engaging communities and stakeholders at the local level. By involving community members in disease monitoring efforts, promoting awareness of zoonotic diseases and encouraging responsible animal husbandry practices, stakeholders can empower communities to play an active role in disease prevention and control [3-8, 11-16, 33].

Encouraging interdisciplinary training programs for a diverse range of professionals and stakeholders, including, but not limited to, veterinarians, human health professionals, public health officials, environmental scientists, policymakers, researchers, medical and veterinary students, laboratory technicians, wildlife biologists and conservationists, agricultural professionals, NGOs and international health organisations, and community health workers, and adopting One Health approaches in policies are crucial steps toward building capacity and resilience in the face of emerging infectious disease threats [3-8, 11-16, 33]. The proposals to promote the OHA in academia include developing transdisciplinary competencies across different disciplines and integrating knowledge, skills, and attitudes. This involves encouraging academic dialogue, supporting educators' training, and implementing a harmonised quality assurance approach for academic education. Additionally, creating a legislative framework for interdisciplinary training and facilitating interdisciplinary OH research are recommended to foster a holistic approach in academic institutions [34]

In conclusion, the One Health approach offers a framework for addressing the interconnected health challenges of epidemic infectious diseases. By fostering collaboration between veterinarians, human health professionals, policymakers and other stakeholders, the OHA promotes more effective and sustainable solutions to global health threats [3-8, 11-16, 33].



5. Strategic Implementation of the Berlin Principles and COHFE Framework

The Berlin Principles and the Competencies for One Health Field Epidemiology (COHFE) Framework collectively offer a comprehensive strategy to enhance the response to infectious diseases. By integrating the interconnectedness of health, the need for robust institutions, and the importance of environmental decisions as outlined in Berlin Principles I, II, and IV, a strong foundation for addressing health challenges is established. The COHFE Framework complements this by providing essential training that enhances the capacity of professionals to investigate and respond to disease outbreaks effectively.

Additionally, Berlin Principles II, III, and VII highlight the integration of health knowledge into policy, the urgency of addressing climate crises, and the necessity of cross-sectoral investment in health infrastructure. These principles underscore the importance of incorporating scientific knowledge into policymaking and ensuring that health systems are resilient and adaptive to environmental changes. The COHFE Framework supports these aims by equipping field epidemiologists with the skills needed to address the complexities of zoonotic diseases and other health threats.

Furthermore, Berlin Principles I, VI, and VIII emphasise the health links between humans and animals, the integration of biodiversity conservation with health solutions, and the importance of cross-sectoral health surveillance and information sharing. These principles advocate for a holistic approach to health that considers the interconnectedness of ecosystems and the benefits of synchronised efforts. The COHFE Framework strengthens these initiatives by providing comprehensive training that prepares epidemiologists to address zoonotic diseases effectively and engage in coordinated surveillance and response activities.

Given the complexity of epidemic infectious diseases, a collaborative approach involving veterinarians, allied animal health professionals, human doctors, environmental



health professionals, policymakers, and other stakeholders is essential. The COHFE Framework facilitates such cooperation by establishing standardised competencies for field epidemiologists, fostering a unified and effective response to health threats. Berlin Principles V, IX, and X further emphasise adaptive approaches to disease prevention, collaborative relationships among diverse stakeholders, and the importance of education and awareness for holistic planetary health.

In conclusion, implementing the Berlin Principles and the COHFE Framework offers a robust strategy for improving our approach to infectious disease management. By fostering interdisciplinary collaboration, enhancing professional competencies, and integrating health considerations into environmental and policy decisions, we can build a more resilient and effective health system capable of addressing current and future health challenges.



Discussion

This policy paper underscores the critical role of veterinarians in managing epidemic infectious diseases. There is a need to enhance veterinary education to include comprehensive training in epidemiology, disease monitoring and surveillance, and biosecurity measures. Equipping veterinarians with the necessary skills and knowledge will better prepare them to effectively respond to emerging health threats. This policy paper highlights the importance of fostering collaboration between veterinary, medical, and environmental health sectors, recognising the interconnected nature of health challenges. Evidence-based interventions can be generated through interdisciplinary research initiatives to address the complex dynamics of infectious diseases. Leveraging the expertise of multiple disciplines will facilitate the development of holistic strategies to mitigate health risks and safeguard public health [3-8, 11- 16].

In alignment with the World Veterinary Association's (WVA) comprehensive approach to global health challenges, emphasising One Health principles, the importance of Day-One Competencies (D1Cs) is underscored as foundational to veterinary education and professional practice [34]. From a student perspective within the International Veterinary Students' Association (IVSA), integrating these competencies into veterinary training programs represents a vital step towards preparing future veterinarians to navigate the complexities of modern health landscapes. Building upon the framework established by the World Organisation for Animal Health (WOAH) and in accordance with the principles of One Health, the WVA advocates for integrating a comprehensive set of competencies into veterinary training programs, aligning with global, regional, and local expectations [35]. The COHFE Framework facilitates such collaboration by establishing standardised DI competencies for field epidemiologists, fostering a unified and effective response to health threats. These competencies not only equip veterinary graduates with the essential skills and knowledge needed to ensure animal health, welfare, and public health but also emphasise the



interconnectedness of human, animal, and environmental health [2]. By adhering to these competencies, veterinarians are poised to address emerging challenges in global health security, antimicrobial stewardship, and biodiversity conservation while promoting collaborative efforts across disciplines to safeguard the health and well-being of animals and humans. Moreover, the delineation of D1Cs serves as a cornerstone for professional accreditation and programmatic evaluation in veterinary education, ensuring that graduates are prepared to navigate complex health landscapes and contribute effectively to One Health initiatives worldwide [2, 34-35].

Building upon the principles of One Health, there is a need for the adoption of a comprehensive approach to address global health challenges. This approach integrates validated multidisciplinary strategies encompassing human, animal, and environmental health. This policy paper emphasises integrating One Health principles into national and international health policies to promote collaboration and synergy across sectors, ultimately enhancing the capacity to prevent and control infectious diseases [3-8, 11-16, 36].

Furthermore, this policy paper highlights the importance of seamless communication and integration between local and national surveillance systems. There is a need to promote interoperability and information sharing among surveillance systems to enhance global epidemiological awareness and facilitate prompt responses to health threats. The ability to detect and promptly respond to infectious disease outbreaks can be strengthened by fostering collaboration and data exchange. In conjunction with these efforts, collaboration with governments, international organisations, and relevant stakeholders is imperative to develop and implement coordinated strategies and contingency plans for disease outbreaks. Fostering a unified response to global health threats and establishing systems of early warnings and response enhances preparedness and resilience against infectious diseases [3-8, 11-16].



Additionally, advocating for increased policy support and investment in biosecurity measures at national and international levels is essential. Recognising the critical role of biosecurity in preventing and controlling infectious diseases is vital for ensuring global health security. Clarifying the exact financial losses and repercussions of poor hygiene, health, and welfare conditions in different husbandry contexts informs decision-makers and garners support for preventive measures. Moreover, conducting cost-benefit analyses to quantify the economic impact of epidemic infectious diseases and the potential benefits of investing in preventive measures is crucial. Promoting integrating zoonotic disease education into veterinary curricula and enhancing communication skills for veterinarians to engage with diverse audiences improves public awareness and understanding of infectious disease risks [3-8, 11-16].

Finally, investment in OH research and innovation to develop novel technologies and interventions for preventing, detecting, and controlling epidemic infectious diseases is essential. Addressing the root causes of disease emergence and transmission is instrumental in mitigating future health risks. Through comprehensive efforts, global health security can be advanced, and populations can be protected from the threats posed by infectious diseases[3-8, 11-16, 36].



Conclusion

This policy paper highlights the critical role of veterinarians in combating epidemic infectious diseases. Recognising the interconnectedness of human, animal, and environmental health, as recommended by the OHA, veterinarians are key defenders of both animal and human health and well-being. Implementing the COHFE Framework is crucial for developing a resilient and well-trained One Health workforce capable of preventing and controlling epidemic infectious diseases [2-16, 35-36].

Equipping veterinarians with the necessary knowledge and skills, fostering cross-sector collaboration, and promoting holistic health approaches empower veterinarians to protect both animal and human health. Collaboration between veterinary, medical, and environmental sectors leads to effective health interventions, with guidelines and an OHA being crucial. Enhanced animal disease monitoring, surveillance, and communication improve global responses while coordinated strategies with governments aim to ensure unified health threat responses. Investment in biosecurity and preventive measures, inclusion of veterinarians in decision-making, ongoing education, robust public health infrastructure, and interdisciplinary training are essential. Encouraging the adoption of One Health approaches through National Action Plans on a global level, and investing in research and innovation to develop new technologies for disease prevention, detection, and control will help to address the root causes of disease emergence and transmission [3-13, 14-16].

IVSA recognises the importance of safeguarding global animal and human health, socio-economic stability, and community resilience against infectious diseases. Supporting veterinarians in their efforts to build a resilient future involves implementing the recommendations in this policy paper, investing in the veterinary workforce, and fostering interdisciplinary collaboration. These measures are crucial for strengthening global health security and addressing the interconnected health challenges of epidemic infectious diseases, ensuring a safer, healthier future for generations.



Appendix

The Berlin Principles^[1]

“We urge world leaders, governments, civil society, the global health and conservation communities, academia and scientific institutions, business, finance leaders, and investment holders to:

- 1. Recognize and take action to retain the essential health links between humans, wildlife, domesticated animals and plants, and all nature; and ensure the conservation and protection of biodiversity which, interwoven with intact and functional ecosystems, provides the critical foundational infrastructure of life, health, and wellbeing on our planet;*
- 2. Take action to develop strong institutions that integrate understanding of human and animal health with the health of the environment, and invest in the translation of robust science-based knowledge into policy and practice;*
- 3. Take action to combat the current climate crisis, which is creating new severe threats to human, animal, and environmental health, and exacerbating existing challenges;*
- 4. Recognize that decisions regarding the use of land, air, sea, and freshwater directly impact health and well-being of humans, animals, and ecosystems and that alterations in ecosystems paired with decreased resilience generate shifts in communicable and non-communicable disease emergence, exacerbation and spread; and take action to eliminate or mitigate these impacts;*
- 5. Devise adaptive, holistic, and forward-looking approaches to the detection, prevention, monitoring, control, and mitigation of emerging/resurging diseases and exacerbating communicable and non-communicable diseases, that incorporate the complex interconnections among species, ecosystems, and human society, while accounting fully for harmful economic drivers, and perverse subsidies;*

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6. *Take action to meaningfully integrate biodiversity conservation perspectives and human health and well-being when developing solutions for communicable and non-communicable disease threats;*
7. *Increase cross-sectoral investment in the global human, livestock, wildlife, plant, and ecosystem health infrastructure and international funding mechanisms for the protection of ecosystems, commensurate with the serious nature of emerging/resurging and exacerbating communicable and non-communicable disease threats to life on our planet;*
8. *Enhance capacity for cross-sectoral and trans-disciplinary health surveillance and clear, timely information-sharing to improve coordination of responses among governments and nongovernmental organisations, health, academia and other institutions, the private sector and other stakeholders;*
9. *Form participatory, collaborative relationships among governments, NGOs, Indigenous Peoples, and local communities while strengthening the public sector to meet the challenges of global health and biodiversity conservation;*
10. *Invest in educating and raising awareness for global citizenship and holistic planetary health approaches among children and adults in schools, communities, and universities while also influencing policy processes to increase recognition that human health ultimately depends on ecosystem integrity and a healthy planet.”*



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