IFMSA Policy Proposal

One Health

Proposed by Team of Officials
Presented to the IFMSA General Assembly August Meeting 2022.

Policy Commission
- Muhammad Ibrahim Khan - Liaison Officer to Student Organizations (ioso@ifmsa.org)
- Meriem Benazzouz - IFMSA-Morocco (meriem.benazzouz97@gmail.com)
- Kelvin Emmanuel Gutiérrez Herrera - AMMEF Mexico (kelvinguh.1@gmail.com)

Small Working Group
- Mikolaj Patalong - IFMSA-Poland - SWG Coordinator
- Luise Bődeker - IFMSA-NL
- Ana Teresa Leitão - ANEM Portugal
- Chrysa Panou - HelMSIC Greece
- Charles Kevin Tiu - AMSA Singapore
- Omar Sardina - IFMSA-Egypt
Policy Statement

Introduction:
The environment is shared by every living creature on Earth - each of them is using its resources according to its needs and influencing the outside world in line with its biology. Human civilization has considerably threatened the continuity of the ecological equilibrium, which is reflected in the rise of zoonotic disease outbreaks, non-communicable diseases and adverse consequences of environmental damage. According to the One Health principle, human health is inextricably linked to animal and plant health, and it is only through a coordinated multi-sectoral approach that the well-being of all can ultimately be achieved.

IFMSA position:
The International Federation of Medical Students' Associations (IFMSA) affirms the importance of the One Health approach in the pursuit of health for all. Given the breadth and the gravity of factors affecting humanity's wellbeing - ranging from communicable and non-communicable diseases to nutrition and the environment, maintaining a broad collaborative approach with a focus on environmental, human and animal health is imperative. Policies and programmes for health enacted by the governments and non-governmental organizations must exhibit the spirit of intersectionality and collaboration inherent to the One Health approach. The Federation encourages everyone - governments, teaching institutions, healthcare workers, medical students, and the society at large - to raise awareness, advocate for and act to bring the ideals of One Health in our pursuit of health and wellbeing.

Call to Action:

Therefore, the IFMSA calls on:

The World Health Organization (WHO) to:
- Continue to call upon the WHO Member States to introduce the values and objectives set in the One Health approach to globalize the efforts to reduce the health impact of AMR, zoonotic disease outbreaks and non-communicable disease burden. Educate and upskill the health workers and other relevant professionals about One Health, including in relation to policy development, to equip them with tools for advocating for One Health in their respective national health policies and to educate their patients about sustainable, preventive and positive One Health Practices.
- Continue to develop One Health strategy and programmes in partnership with the Quadripartite group (FAO/OIE/UNEP/WHO) as well as collaborate with organizations through a multi-sectoral approach to promote positive One Health practices, education and encourage interprofessional collaboration.

The World Veterinary Association, Quadripartite group (FAO/OIE/UNEP/WHO) and other relevant organizations to:
- Emphasize the need to align the national and regional health policy in all parts of the world with the Sustainable Development Goals (particularly SDG 2, 6, 13, 14, 15).
• Promote equitable and global climate action in the context of the health and well-being of human and animal populations.
• Work with governments and supranational organizations to unify and organize the efforts to conserve vulnerable ecosystems and protect biodiversity.

**Governments and supranational organizations to:**
• Support and invest in the accomplishment of the Sustainable Development Goals (particularly SDG 2, 6, 13, 14, 15) by aligning the health-related and economic policies to ensure economic growth while saving natural resources.
• Establish strategies, policies and frameworks in consultation with the veterinary sector and key stakeholders for vaccination regimens for humans and animals, including a follow-up on animal living conditions and the safety of agriculture in order to prevent future outbreaks of zoonotic diseases.
• Create universal and legally binding guidelines for the sensible use of antibiotics and other antimicrobials to limit their use to scientifically grounded instances.
• Provide financial and technical support to any collaborations by non-governmental actors that promote awareness about the importance of the One Health approach.

**Food industry companies, farmers and food production specialists to:**
• Comply with the national regulations on antimicrobial use in animals and actively participate in creating future recommendations.
• Ensure that farming development endeavours do not threaten the adjacent ecosystems.
• Participate in creating more sustainable food systems through limiting the use of hazardous chemicals and curbing soil and water pollution.

**Universities (incl. medical and veterinary schools), research institutes, hospitals and clinics to:**
• Include One Health as a constituent topic within every medical and veterinary school curricula.
• Promote collaborations between students from various medicine and veterinary related faculties aiming to promote the One Health approach.
• Put focus on the individual responsibility of every healthcare professional in mitigating the risk of AMR emergence and spread within the healthcare systems and the population at large.
• Create AMR Stewardship programs in hospitals and other medical institutions.

**IFMSA National Member Organizations (NMOs) and all medical students to:**
• Create, promote and enroll activities focusing on One Health and the leading topics encompassed by it.
• Collaborate with other medical student organizations to spark students' interest in building interprofessional collaborations.
• Develop partnerships with other student organizations to advocate for the inclusion of One Health topics in the relevant curricula.
POSITION PAPER

Background information:

One Health is a concept dating back to the 19th century when it was put forward by Rudolf Virchow, a German biologist and anthropologist who was investigating the relationship between farming customs and zoonoses. Then called One Medicine, it was essentially based on the idea that human and animal health are inseparable due to a shared environment and similar disease risk factors and pathogenicity. [1] The World Health Organization (WHO) defines One Health as “an approach to designing and implementing programmes, policies, legislation and research” - one that is focused on a holistic understanding of how health interventions, limited in scope to one particular group of living creatures, may positively or negatively affect others. [2] “The interconnection between people, animals, plants, and their shared environment”, mentioned by the CDC’s definition of One Health, is increasingly being pointed to as being a blind spot of global health policies, due to which significant health outcomes are being missed out on. [3] The One Health High-Level Expert Panel (OHHLEP), acting as an advisory body to the Joint Tripartite of FAO, OIE and WHO, in its One Health definition points to its application on the “subnational, national, regional, and global level”. [4] FAO One Health priorities include a call to develop capacities on each of these levels to facilitate optimal coordination between all relevant stakeholders. [5]

The cornerstone of the One Health approach is to align common regulations and practices to create one unified way of addressing health issues related to the human population, as well as animals and plants, in order to safeguard all these constituent parts of the environment from health-related hazards. [6] Depending on the exact geographical location, human habitats are unequally exposed to various external factors that cause major disease burdens, thereby putting significant pressure upon healthcare systems. [7] These factors include but are not limited to: zoonotic diseases (rabies, brucellosis, West Nile virus), the spread of antimicrobial resistance (AMR), and an increased incidence of certain non-communicable diseases due to environmental pollution present in consumed food and water. [8]

One Health is strongly tied to the epidemiological situation in the world, something that was especially noticeable after the onset of the COVID-19 pandemic changed the way that communicable diseases surveillance and health policy are viewed. [9] Through mass meat production, the large-scale farming industry creates perfect space for emerging viruses and bacteria to mutate and be passed to humans. [10] These animal reservoirs are believed to be the likely starting points for the next epidemics and pandemics that may threaten the global community in the future. Special attention is being paid to the occurrence of various strains of avian influenza (also known as bird flu) that, upon accumulating enough mutations, could become transmissible between humans. [11]

Antimicrobial resistance (AMR) is an ever-growing threat to the effective ways of treatment in the possession of healthcare professionals. [12] Antimicrobials are not only used to treat humans - their use is omnipresent, and in many instances excessive, in animals as well - in particular when their usage is unregulated and frequent as it promotes resistance and creates grounds for the selection
and spread of resistant microbes. [13] Excess use of antimicrobials over time sparks the creation of new mutated strains of pathogens with lessened susceptibility to these medications - very easily, those organisms infect humans and spread through the population, affecting the immunocompromised people the most. [14] Without proper guidance for medical professionals and patients, the world is at risk of jeopardizing access to life-saving therapies. As a consequence, the use of debridement, disinfection, amputation, and isolation will be more invasive, and less successful. Some more worrying examples of emerging bacterial strains include vancomycin-resistant *Enterococcus* and methicillin-resistant *Staphylococcus aureus*. [15] Apart from examples of hospital-acquired infections, instances in which these infections were acquired from within the community have been recorded as well. [16]

Food production and food systems constitute another vital aspect of the shared environment that needs addressing through *One Health* interventions. The ever-growing human population puts a substantial strain on the systems’ ability to produce and distribute enough nutritious food - subsequently, various measures have been taken to increase the average output of modern farming to avoid famines and food insecurity. [17] While many of those methods have proved to be environmentally sustainable and safe, others - like increased use of artificial fertilizers, fragmentation of animal habitats and application of chemicals in the fields and in the meat production - are tied to negative health impacts, for instance increased rate of non-communicable diseases, including different forms of cancer. [18] Sadly, these effects on the quality of the soil cannot be immediately reversed as the involved chemical compounds accumulate and persist there for years or even decades. It leads to the conclusion that any damage done at present is likely to influence life on earth for generations to come, and that the ultimate toll is not easily measurable. [19]

The main requirement for the *One Health* approach to succeed is for it to become a constituent part of the healthcare-related policy, agricultural legal regulations and common practices and education of all involved professionals as well as the general population. [20] Increased awareness of the connection between present environmental measures and the intensity and urgency of future health crises can spark popular support for essential reforms to safeguard human populational health while ensuring that the remaining elements of the environment are included. [21] There is ample space for interprofessional collaborative practices to fill the knowledge void by presenting more specialist perspectives related to particular fields of science in order to contribute to the future of *One Health* as a unifying approach to medical, veterinary and other sciences. [22]

**Discussion:**

**Communicable diseases**

**Zoonotic diseases**
Pathogenic viruses and bacteria are not only detected in humans - but they also circulate and cause infections within animals. While such pathogens typically circulate and cause disease in their host species, there are instances when pathogens are introduced to the human population and
transmission ensues. Zoonotic diseases are infections that originated from animals and have subsequently established human-to-human transmission within the population. [23] More than 60% of human infectious diseases can be assigned as zoonoses, and such conditions cross the socio-economic and political boundaries. [24] Animals that are natural hosts to certain pathogens act as their reservoirs. Identification and knowledge of each of those reservoirs are crucial as they allow for proper surveillance and early warning of the possible emergence of zoonotic disease. A proper comprehension of the range of natural hosts and their ecology is also important to help understand the threats posed by zoonotic diseases to human populations. Numerous diseases are known to be of zoonotic origin. While these pathogens can be bacteria or fungi, the most recent and infamous outbreaks caused by zoonotic diseases involve viruses.

The Severe Acute Respiratory Syndrome (SARS), the Middle East Respiratory Syndrome (MERS) and the recent Coronavirus Disease 2019 (COVID-19) pandemic are caused by zoonotic pathogens. Being members of the coronaviridae family, they mainly cause respiratory pathology in humans and are suspected or confirmed to have been split over from bats and dromedary camels through an intermediate host. For example, the SARS outbreak in Southern China in the early 2000s was caused by spillover from palm civets [26], an intermediate host, kept in markets, and ultimately from bats, its natural reservoir. [27]

Nipah virus, which is part of the Henipavirus genus, was first detected in Malaysia. It is known to cause respiratory and neurological disease in humans, yet these viruses are attributed to having originated from bats before they came into contact with our species. In an outbreak in the early 2000s, bats were identified to play a key role in the Nipah Virus outbreak in Bangladesh. In one of those events, bats were found to be feeding on date palm sap – a source of food – and this was found to be the primary source of the epidemic. [28]

Ebola virus disease is yet another example of a zoonotic disease. First identified in Sub-Saharan Africa, Ebola causes haemorrhagic disease with a very high mortality rate. Bats were found to be the most likely natural reservoir for Ebola, which is believed to be able to infect humans through direct contact with bats carrying the virus, or through intermediate hosts such as non-human primates or duikers. [29] As shown in the examples of the coronaviruses, henipaviruses and the Ebola virus, animals are a key component of the emergence of zoonotic diseases. Animal health and wellbeing, addressed in the One Health concept, are crucial to mitigate the risks posed by these zoonotic conditions. [30]

**Pandemic risk and preparedness**

One Health plays an important role in pandemic preparedness. As the majority of the novel pandemics are caused by zoonotic infections, understanding the dynamics and the ecology of viruses in their natural reservoir as well as the scope of possible intermediate and human hosts is imperative to the science-based efforts to avoid disease outbreaks. [31] In a highly globalized world where communicable diseases spread in no time, more emphasis is being put not merely on early detection and isolation of infected people, but also on pathogen detection even before there is any proof of human-to-human transmission. The warning system alternatives include random testing of all animal populations that constitute significant disease risk. [32]
One of the most notable causes of pandemic concern is influenza. It has previously caused major pandemics, the most recent one having been recorded in 2009. One Health is applied when animal and human health professionals are on the constant lookout for novel strains of influenza in avian hosts and in humans. Surveillance becomes an important tool for pandemic preparedness – where highly pathogenic strains are tested for and reported – and action can be taken by health authorities to mitigate the risk of further spread. [33]

One of the major tasks of the World Health Organization is to navigate and inform about global efforts aiming at mitigating the spread of communicable disease outbreaks. In 2016, the Research & Development (R&D) Blueprint was published - it calls upon all involved parties to work towards shortening the time between disease spread detection and the development of targeted measures to avoid a public health crisis. [34]

**Vaccination of humans and animals**

One of the most important tools in the armamentarium against infectious diseases and pandemics is having vaccines applied to both human and animal populations. Vaccines against rabies and the Hendra virus provide a useful example of how animal versions of vaccines help indirectly in reducing the risk of human disease. [35] Rabies, a lyssavirus, is a zoonotic disease that causes encephalitis in its host. Typically transmitted from domestic dogs, rabies causes mortality in humans once symptoms appear, but such an outcome can be prevented by vaccination or prophylaxis in animals and/or humans. The One Health approach applied in rabies control is deemed important and vaccination is deemed to be a “cornerstone” of rabies prevention efforts. [36] By vaccinating susceptible at-risk animals against rabies, the risk of humans contracting rabies from animal bites is significantly reduced. [37]

Another example of animal vaccination to protect the health of both humans and animals is the Hendra virus vaccine. Hendra virus is a henipavirus (like Nipah virus) affecting horses and humans. Prior outbreaks in Australia led to both animal and human mortality. While a horse vaccine was developed and is currently available, a human Hendra vaccine is not yet available. Hence, the use of the animal vaccine in horses not only protects horses from the virus but also indirectly protects humans from acquiring it. [38]

**AMR prevention**

Antimicrobial Resistance (AMR) is the ability of microorganisms, such as bacteria, fungi, viruses and parasites to become increasingly resistant to a given antimicrobial to which they were previously susceptible. Since AMR arises through overuse and misuse in both human and animal sectors, a One Health approach to tackle this issue is required, as no single action will, in isolation, provide an adequate solution. [39]

Healthcare providers play an essential role in preventing infections and stopping the spread of germs. Following infection prevention and control guidelines, ensuring that patients receive recommended vaccines, staying informed of current outbreaks and educating patients on ways to prevent the spread of germs and infections are some of the actions that need to be taken. [40]
Veterinary practice is a focal point for the implementation of disease prevention strategies since the sustained education of individuals who come in frequent contact with animals, including livestock. Disease avoidance practices, including adherence to basic rules of hygiene before and after human-to-animal contact and proper clothing, disinfection of equipment as well as physical spaces are crucial to limiting the spread of pathogens. [40]

The CDC’s National Action Plan for Combating Antibiotic-Resistant Bacteria, 2020-2025 has set as its goals to:
- **Goal 1:** Slow the Emergence of Resistant Bacteria and Prevent the Spread of Resistant Infections
- **Goal 2:** Strengthen National One Health Surveillance Efforts to Combat Resistance
- **Goal 3:** Advance Development and Use of Rapid and Innovative Diagnostic Tests for Identification and Characterization of Resistant Bacteria
- **Goal 4:** Accelerate Basic and Applied Research and Development for New Antibiotics, Other Therapeutics, and Vaccines
- **Goal 5:** Improve International Collaboration and Capacities for Antibiotic-Resistance Prevention, Surveillance, Control and Antibiotic Research and Development. [41]

Modern surveillance is crucial to the provision of coherent data that will drive forward the improvement in disease outbreak preparedness and infection control measures, including vaccination programmes that will work to reduce the overall need of antimicrobials application upon curbed spread and lower health impact of many pathogens. Antimicrobial stewardship, based on limiting antimicrobial use to science-informed and necessary cases only, is not yet fully developed in all the relevant sectors. [42]

**AMR surveillance**
Surveillance is the process of tracking changes and collecting data regarding microbial populations that enables microbiologists to ensure early detection of AMR organisms of public health importance. Furthermore, outbreak investigation relies heavily on prompt and targeted notification systems. Surveillance findings are needed to inform clinical therapy decisions, guide policy recommendations, and assess the impact of resistance containment interventions. [43]

In 2015, the WHO developed the Global Antimicrobial Resistance Surveillance System (GLASS). Its purpose is to collect AMR rate data and provide nation-wide reports on the local emergence. Through proper analysis reporting, the national policy making is better informed and driven by evidence-based, validated data. [44]

In Europe, surveillance systems include EARS-Net, which is coordinated by the European Centre for Disease Prevention and Control (ECDC) and CAESAR. EARS-Net is the continuation of the European Antimicrobial Resistance Surveillance System (EARSS), which was established in 1998. In 2020, all EU Member States and two EEA countries (Iceland and Norway) participated in EARS-Net. The CAESAR network was founded in 2012 as a collaborative effort by the WHO Regional Office for Europe, and the WHO Collaborating Centre for AMR Epidemiology and Surveillance. As of 2021, 20 countries are engaged in the CAESAR network. [45]
In accordance with the Global Action Plan and to meet needs specific to Africa, Africa CDC established the Antimicrobial Resistance Surveillance Network (AMRSNET). AMRSNET is a network of public health institutions and leaders from human and animal health sectors who collaborate to measure, prevent, and mitigate harm from AMR organisms. Among the goals set by the AMR 2018-2023 is the improved surveillance of AMR organisms across the species, delaying their emergence, limiting their transmission and mitigation of the harm that AMR-infected patients are at risk of. [46]

The U.S Government has set specific objectives in order to strengthen testing and training capacities and capabilities, expand the number of sources for and quantity of antibiotic resistance surveillance data from animals, farms, and production facilities and expand and improve access to specimen and data repositories for research and innovation, as part of its National Action Plan 2022-2025. [41]

Surveillance systems and protocols exist all around the world, regarding all different categories of communicable diseases. Different sampling methods and surveillance types are being used, in order to identify all key pathogens, collect data and develop actions and interventions in each country or region. [47] Moreover, a national monitoring system for AMR in bacterial pathogens of animals exists in some countries and experts of the European Union Joint Action on AMR and Healthcare-Associated Infections (EU-JAMRAI) recommended building the European Antimicrobial Resistance Surveillance Network in Veterinary medicine (EARS-Vet) [48].

**AMR Stewardship**
Antibiotic stewardship is defined by the US CDC as “the effort to measure and improve how antibiotics are prescribed by clinicians and used by patients. Improving antibiotic prescription and use is critical to effectively treat infections, protect patients from harms caused by unnecessary antibiotic use, and combat antibiotic resistance.” [49] It is strongly advised that hospitals and other medical institutions introduce their own AMR Stewardship programs, tailored to their individual needs, resources and epidemiological situation. [50] Beyond the local level, AMR Stewardship requires collaboration between professionals and institutions working on different territorial levels as well as in both governmental and non-governmental organizations to continually share the available data in order to be able to combat the current scope of AMR organisms in a given area. [51]

**Non-communicable diseases**

**One Health and NCDs**
Non-communicable diseases (NCDs) are responsible for more than 70% of global deaths, including disproportionately more in low- and middle-income countries (LMIC). Their incidence is caused by genetic, environmental and psychological factors. The highest death toll is ascribed to cancer, respiratory diseases (mainly chronic obstructive pulmonary disease - COPD) and diabetes. [52] To a certain extent, every individual is responsible for their lifestyle choices which in turn may lead to an increased or decreased risk of certain NCDs. In contrast, one is hardly in control of environmental factors like food safety and quality, water pollution and toxic chemicals present in everyday life. This is particularly true for less advantaged groups - people living in poverty, members of ethnic and national minorities and indigenous communities. [53-54] While the focus of One Health has so far
predominantly revolved around communicable diseases, including their prevention, surveillance and treatment, it is increasingly being pointed out in the academic discourse that non-communicable disease burden is equally to be addressed through health interventions reaching beyond the human-animal-plant divide. However, the scope of available research is not extensive, leaving considerable space for scientists to investigate links between the environment and NCDs [55]. Interestingly, the medical examination of animals living in the wild and those that are resident in human habitats can give significant comparative study material in terms of the NCDs risk factors that humans themselves are subjected to. [56] In addition, the One Health approach calls for a significant rethink of how animals themselves, including those living as companions to humans, should be protected from damaging external factors like tobacco smoke, air pollution and food contamination so that their health can be improved - something that would equally improve their owners’ mental and physical health as a consequence. [57]

One of the root causes of obesity, which is an underlying condition behind countless health challenges like type 2 diabetes, hypertension, cardiovascular disease and others, is a sedentary lifestyle with little to no regular physical exertion. There is a clearly established link between access to green spaces and average obesity rates in the neighboring populations. [58] It is, however, only safe as well as psychologically appealing to remain active in outside settings if the environmental degradation does not pose any major risk, both in terms of chemical pollution and communicable diseases with animals as vectors. [59]

Through environmental degradation and sustained pollution by industrial actors, humans and animals living in heavily industrialized areas are at a significantly greater risk of developing toxin-derived diseases, including lead poisoning. The exposure is either direct or indirect - when the toxic particles make it to the disease-stricken organism through consumed food (meat or plants) and water. [60]

**Cancer**

Cancer is one of the leading causes of death in every human population, and one of the two leading cause of death among non-communicable diseases. [61] It is also a major health problem in animals, including those accompanying humans. The epidemiological data suggest that the cancer incidence rate is over 10 times higher in dogs than it is in humans (5000 vs 500 per a population of 100,000). Worryingly, various human activities increase cancer rates among animals living in the wild as well. [62] Although exact causes and risk factors do differ (as does the average life expectancy between the species), certain factors can be easily identified as common carcinogens. Shorter lifespans may contribute to research through shorter generational turnover. A new branch of medical science - comparative oncology - was developed to measure and record similarities and differences in both the development of various tumours and risk factor groups. Animal cancer growth models may be useful when developing therapies for humans, yet the human therapy regimens do not always translate to positive health outcomes in animals. [63] Undeniably, comparative oncology will provide useful knowledge to both medical doctors and veterinarians as they manage the treatment of their respective patients. [62]

There are numerous chemicals whose occasional or sustained intake can increase the risk of cancerous growth. Air pollution has been classified as a non-communicable disease risk factor due
to its detrimental effect on respiratory diseases as well as the incidence of lung, tracheal and bladder cancer - among others. [64] Aflatoxins - toxins produced by Aspergillus - can cause cirrhosis and cancer of the liver. While it is unlikely to be present in food intended for humans, animal food and fodder are not always that rigorously monitored, which results in shorter average lifespans for many species. Dogs are particularly susceptible to the detrimental health effects of aflatoxin contamination. [65]

**Nutrition**

**Access to nutritious food**

According to the World Health Organization (WHO), nutrition represents the multilayered processes by which food intake affects bodily health. Good nutrition constitutes an important role in human health and development across the entire life span, particularly in child and maternal health, immune systems, pregnancy, and non-communicable diseases (including obesity, cancer, heart disease, stroke and diabetes) [66] Proper nutrition is dependent upon the efficacy of food systems, management of economic inequalities and, in emergency instances, humanitarian aid provision. [67] Acute food insecurity crises can be sparked by human-induced mechanisms, including heat waves and droughts (as a consequence of the climate crisis) or the destruction of ecosystems through deforestation. [68] In addition, zoonotic diseases spreading uncontrollably among animal populations (livestock) may lead to the health authorities ordering to cull them, leading to a decrease in meat and diary availability. This presents a particular danger for the low-and middle-income countries. [69]

Malnutrition is defined as the deficiency or excess in a person's consumption and/or energy intake or the qualitative or quantitative imbalance of essential nutrients. [66] Several conditions are included under this umbrella term:

- undernutrition (such as wasting, stunting, underweight or nutrients deficiencies);
- micronutrient-related malnutrition (such as inadequacies in vitamins and minerals intake, such as iodine, vitamin A and iron - all of these represent global public health issues);
- overweight, obesity and diet-related non-communicable diseases.[70]

Every country is affected by one or more forms of malnutrition. In 2019, it was estimated that two billion people globally (one in four) did not have access to affordable, healthy and nutritious food. The State of Food Security and Nutrition in the World Report (SOFI 2019) showed that both the number of the undernourished and the number of overweight and obese have been increasing in the past years. [71-72] One of the Sustainable Development Goals, set by the United Nations as part of the 2030 Agenda for Sustainable Development, is Zero Hunger, which aims to ensure access by all people to nutritious food and end all forms of malnutrition. [73] The WHO is working with the Member States toward a world without any forms of malnutrition, securing universal access to safe, nutritious and sufficient food derived from more sustainable food systems for maternal, infant and young child. [74]

**Health impact of food contamination**
Food safety is a crucial component of sustainable development. According to the WHO, access to safe and nutritious food is fundamental to sustaining life and promoting general well-being and a healthy lifestyle. It is estimated that every year 600 million people fall ill following consumption of contaminated food. [75] Foodborne illnesses are defined as such caused by harmful bacteria, viruses, parasites or chemical substances present in contaminated food or water, which enter the body and elicit a toxic or inflammatory reaction, thus manifesting as severe health threats. Diarrhoea is one of the most common clinical manifestations. [76] Nowadays, foodborne diseases still play a crucial role in public health, particularly in low- and middle-income countries, and can lead to increased suffering, disability or death. [77] The WHO has been working with FAO in order to ensure food safety and protect consumers' health by assessing chemicals, biological agents and methods used for the production. Moreover, FAO has developed diverse frameworks, key to an effective food control system. [78] Food safety should represent a public health priority, as it is crucial in developing policies and establishing effective and sustainable food safety systems for all people across income levels, age groups and regions. [75]

**Sustainable food systems**

Food systems constitute a link between production, processing, transport, consumption and food products. [79] A food system is in constant interaction with other systems, such as the production of energy, the global and local trade as well as the healthcare systems - therefore it is a vital part of a dynamic socio-economic structure. Throughout the years, these transformations have led to problems accumulating, with wide-reaching consequences for the state of food security, such as the emergence of highly processed food items and uncontrollable and unsustainable amounts of waste. In this day and age, food systems are responsible for environmental degradation, including deforestation and loss of biodiversity. Therefore, food systems require a more holistic approach, in which actions are taken at local, regional and national levels, aiming to improve food security and nutrition. [80]

A sustainable food system is defined as a process that enables access to food and proper nutrition in the present without jeopardizing the socio-economical and environmental factors, upon which the long-term ability to maintain food production and security rely. [81]

According to FAO, a food system is considered sustainable if it comprises the following three features:

- **Economic sustainability**, in which the activities should be commercially or fiscally viable for all stakeholders, in terms of food supply, profits and incomes;
- **Social sustainability**, when it has broad-based benefits for the population, taking into consideration vulnerable groups, cultural traditions, nutrition and health or workers' rights and safety;
- **Environmental sustainability**, if it has a positive or neutral impact on the environment, underlining the importance of biodiversity, carbon footprint, water health or toxicity. [82]

Across the world, multiple countries have planned strategies to make food systems resource-efficient and environmentally-friendly, in order to transition to more sustainable options which increase agricultural productivity, reduce greenhouse gas emissions for agriculture and improve climate resilience. Some policies have been suggested, such as reducing food loss and waste, enhancing diversification and highlighting the importance of dietary changes toward a
more sustainable and healthy diet. [82] Therefore, a multi-stakeholder dialogue is needed, with a focus on enabling policy conditions to support the transition to more sustainable food systems. [81]

Environment and Health

Climate change
Climate change is a phenomenon characterized by continuous shifts in global temperatures and weather patterns across the globe. [83] There are various factors contributing to these changes - astronomical - including solar activity variations and changes in the orbit of the Earth, the greenhouse effect (dependent upon the concentration of certain gases in the stratosphere) and volcanic activity. [84] Although climate change is partly caused by natural processes over which human civilization has little to no control, during the past two centuries the greenhouse gas (GHG) emission caused by human industries and the means of transportation has risen to be the dominant cause of climate change worldwide. [85] As a result, unprecedented weather pattern changes have been recorded across the planet, with countless communities threatened by rising sea levels and extreme weather events. [86] Various regional and global initiatives have been established to address this crisis through comprehensive climate action - which is included in the UN Agenda 2030 as the Sustainable Development Goal 13. [87]

One of the major human-caused GHG emission sources is livestock farming, which is linked to around 15% of the total amount through its massive production of methane. [88] In parallel, the increased demand for protein-rich food leads to large forested areas being turned into livestock farms, while an ever-increasing number of animals are living in enclosed spaces, without proper health conditions. Subsequently, AMR pathogens evolve and spread through the population and large-spectrum antibiotics are used. It is mainly through significantly limiting meat consumption (especially red meat) that significant outcomes for both climate equilibrium and animal health can be achieved. [89]

The widely mentioned topics of communicable diseases and antimicrobial resistance also stand to be influenced by the ecological consequences of climate change. Changing environmental factors are due to cause the emergence or re-emergence of tropical infectious diseases, some of them will include AMR pathogens. [90] Vector diseases, including malaria, will widen their territorial incidence as their vectors find comfortable living conditions in a wider scope of ecosystems. [91] The incidence and severity of communicable disease outbreaks will also be negatively impacted by climate-induced food insecurity which is going to lower the level of immunity among impacted populations, making them particularly vulnerable to novel strains of pathogens. [92-94]

Water, sanitation and hygiene (WASH)
In many parts of the world, proper water sanitation is universally taken for granted, yet for a large portion of the global population even basic sanitation services are not remotely available. [95] According to 2017 WHO/UNICEF data, cited by the CDC, more than 884 million people did not have access to safe sources of drinkable water. More than a quarter of the global population had considerable difficulty accessing basic sanitation services. [96] Whether drinkable water is retrieved directly from natural sources or passaged through rural or urban water systems, it can be contaminated by chemical particles or bacterial, viral and/or fungal pathogens. [97] The lack of
available water sanitation and impeded hygiene are likely to contribute to the spread of communicable diseases, including those classified as zoonoses. Past epidemics are often attributed to the lack of comprehensive One Health policies as was the case with a cholera epidemic in Yemen and E. coli contamination in low- and middle-income countries [98-99] When the basic sanitation systems are not implemented, the risk of animal pathogens contaminating the water drunk and otherwise utilized by humans increases manifold, which in turn makes it possible for the neglected zoonotic diseases (NZDs) to return in the form of novel outbreaks. [100] Continuous neglect of those diseases in terms of global health policy reinforces the health inequities as they impact mostly communities where a majority of people live in poverty and have limited or no access to basic healthcare services - this includes rural and indigenous populations. [101-102]

**Air pollution**

Air pollution consists of a mixture of hazardous particles and gases which are considered the end-products of human-caused industrial production. Its impact on health lies mainly in the inflammatory process and oxidative stress on human cells which cause serious medical conditions. [103] According to statistics gathered by the World Health Organization, about 4.2 million people annually die due to air pollution and 90% of people worldwide live in areas where air quality does not meet the WHO guidelines. [104]

The effect of air pollution on a human or animal body is multifaceted and involves well-known reactions as well as risk factors that have not yet been precisely identified:

- **Respiratory system:** through the inhalation of noxious gasses, such as nitric oxide (NOx) and sulfur oxide (SOx) or particulate matter, including carbon and mineral dust, normal lung development and function can be affected - among the possible disease burden there is asthma, emphysema or chronic obstructive pulmonary disease (COPD) [105]
- **Cardiovascular system:** Blood vessel function can be impaired, thus increasing the risk of hemorrhagic stroke, high-density lipoprotein levels being lowered and calcification of the arteries leading to major consequences for bodily homeostasis [106]
- **Cancer:** since many of the chemical substances identified in the polluted air are proven to act as carcinogens, the risk of non-communicable diseases is severely increased if the organism is subjected to long-term pollution exposure. Industrial end-products, including benzene and lead compounds, are likely to increase the individual risk for haematological diseases, including non-Hodgkin lymphomas. While charcoal leads to an increased risk of lung cancer, some airborne toxic substances are linked to cases of breast cancer. [103]

Designing and implementing policies and programs that reduce pollution and decrease the prevalence of diseases is a priority by monitoring the pollution and establishing policies with governments to decrease the waste products of companies to a limited extent. [107]

**Biodiversity loss**

The occurrence of spillover events is not randomly distributed across the world. On the contrary - they are predominantly located in areas where the fragile structure biodiversity is affected and where there is a high level of land-use change. [108] The loss of biodiversity and the change in land use has been identified as key factors for the emergence of infectious disease outbreaks, and they have also been linked to worsening inequities in health. [109] The most recent pandemic of
COVID-19 has also been linked by some authors to the worsening ecosystem health which bodes extremely negatively for the future of the global communicable disease situation. [110] Environmental degradation in one region can easily cause health events of a much more severe magnitude. The protection of environmental health – a component of the One Health approach – is imperative to ensure health security on both local and global levels. [111]

**Life below water**
According to Sustainable Development Goal (SDG) 14, which was settled by the United Nations General assembly in 2015, one of the cornerstones of sustainable development is to conserve and sustainably use the ocean, seas and marine resources. According to the available data, over 3 billion people are directly dependent on water ecosystems for their livelihoods, However, the issue of the so-called Dead Areas, defined as areas of water that lack oxygen for marine life is of an increasing magnitude, having risen from 400 in 2008 to 700 in 2019 according to the WHO. [112]

Earth relies on oceans to emit greenhouse gases because of its capability of reabsorbing them, which will have a harmful effect on the ocean by raising its temperature. The rise in the temperature will affect marine life by increasing the rate of deoxygenation and ecosystem and threaten food security, which will also increase the prevalence of diseases and loss of coastal protection. [113-114] Arctic sea ice is lost at a rate of 13% every decade. Even the thickest and oldest ice in the Arctic has declined by 95%. [115] The rise in sea levels increases the coastal erosion leading to declining of land on humanitarian life, which can also affect the green land and decline the food production leading to starvation and wide exposure to chronic diseases. [116]

**Life on land**
Sustainable Development Goal 15 - Life on Land - aims to protect biodiversity, regulate deforestation and restore the ecosystems that have already been destroyed to help the planet regenerate after centuries of mismanagement and overuse induced by the human species. [117] There are numerous issues that our economies contribute to when it comes to ecosystem management. One of the crucial aspects of this goal, inextricably linked to One Health is to promote access to genetic resources and fair sharing of the benefits. Genetic diversity and the implementation of science-based regulations in crop management are crucial to ensure human and animal health as any plant diseases can either contaminate food or spark a food insecurity crisis through decreased harvest. [118] Deforestation (as well as forest fragmentation) can directly cause land erosion and local changes in weather patterns, which in turn destroy natural animal and plant habitats, breaking the food chain at various levels. Indirectly, it can cause animal populations to move to different areas, at times those inhabited by humans. Through that phenomenon, cities and villages may be threatened by the presence of dangerous species of animals and many infectious disease outbreaks are likely to emerge. Furthermore, different pathogenic strains will cross between populations of the same or related species, which would not otherwise happen due to physical separation [119]

**One Health Policy**

**One Health and SDGs**
The Sustainable Development Goals consist of seventeen formulated by the United Nations General Assembly in 2015. [120] They constitute the Agenda 2030 which aims to reduce global inequalities, solve the most urgent crises and spark a more sustainable future for everyone. [3] Since their inception, the SDGs and attached indicators have served as a roadmap for the global community, including health professionals and medical students, in planning, executing and evaluating their activities and interventions. [121] Since One Health is tied to multiple scientific fields, most SDGs are related to this concept. However, taking into account so many challenges at hand simultaneously, the deadline of 2030 set by the UN entails that with passing years the indicators might not be fully met, especially in light of the COVID-19 pandemic negatively impacting the progress that had already been made. [122] Since the One Health concept is primarily targeting the environmental factors and the health-related interconnectedness between different species, the relation is most visibly identifiable for SDG 6 (Clean Water and Sanitation), SDG 13 (Climate Action), SDG 14 (Life below Water) and SDG 15 (Life on Land). The realization of the One Health objectives is also going to significantly impact the indicators of SDG 3 (Good Health and Well-Being) by contributing to limiting preventable deaths due to communicable and non-communicable diseases, lessening the burden on healthcare systems and strengthening the capacity of all countries and communities to manage health risks. [123]

Policy examples
One Health itself is an approach as well as a perspective applicable to general Public Health problems and challenges, including those whose scale is much smaller and limited to particular demographics or diseases. [124] Since it comprises many different sorts of interventions, the scope of policies is equally varied. In order to provide a comprehensive review of different individual activities, examples from different regions are presented.

- Historical perspective - the example from Brazil
The first specific models of One Health can be identified in Brazil in the 1960s as stated by Souza et al. [125] The roots lie in the joint efforts made by multiple disciplines within the National Rabies Program, in the case of which the Ministries of Health and Agriculture agreed on a joint strategy for data exchange in terms of human and animal treatments. Building on this framework, in the following decade more and more multidisciplinary projects emerged, including responses to brucellosis, salmonellosis and bovine tuberculosis. [126] This led to the creation of the Unified Brazilian Healthcare System in the 1990s, a State Policy encouraging different professionals to work alongside each other to tackle public health issues in Primary Health Care. Therefore, Brazil has potentially the policies and programs in place that would allow working in the One Health approach. [127]

- COVID-19 and One Health Policy
The ongoing COVID-19 pandemic is a paramount example of a One Health Policy and the importance of a One Health approach. SARS-CoV-2 is a zoonotic virus, meaning it can spread between humans and animals. [128] The consequences of the virus are multidimensionally ranging from individual health to health care systems, from social to cultural, and from educational to economic. The virus has infected people, wildlife, zoo and production animals and is found in soil and water; COVID-19 impacts multiple ecosystems worldwide. [129]
Joint policies and global efforts have been and are an essential part of fighting the COVID-19 pandemic and its effects. WHO calls for collective efforts in the prevention and abatement of transmission by developing strategies to effectively test, diagnose, shelter and (rapidly) treat those in need of it, by expanding public health capacities, engaging in collaborative research and knowledge sharing and decreasing vaccine inequalities. [130-131] As part of these policies “One Health investigation and animal surveillance are crucial in evaluating transmission, the risks of potential establishment of new hosts and reservoirs where the virus could hide, mutate, and potentially re-emerge as a new variant in the human population.” [128]

All in all, One Health perspectives were not only included in policies to take on the pandemic, but even more, this pandemic has emphasized the importance of One Health within healthcare strategy.

- The call for One Health Policy: Toxoplasmosis

Another specific example of One Health Policy is called upon in the research of toxoplasmosis, which is caused by an infection with Toxoplasma gondii. Toxoplasmosis is a public health hazard worldwide with “estimates of infection range from 30 to 90%” in Central America, South America and Europe. This parasite has significant consequences on the health of humans, domestic animals, wildlife, and ecosystems. Therefore, Aguirre et al. strongly urge decision-makers to create the policy for a multidisciplinary effort in developing control and prevention strategies to take on toxoplasmosis. [132]

The role of healthcare systems

One Health reaches from global collaborations and policies to national healthcare systems and local projects organized in a transdisciplinary way. Therefore, the role healthcare systems are taking within One Health Policy is a key role. Depending on its structure and flexibility, at the same time, it can be the gateway tool for implementation and its biggest obstacle.

To be able to follow a One Health approach human and veterinary healthcare systems must hold essential infrastructures. This is especially true in the context of containing neglected tropical diseases (NTD), many healthcare systems lack specialization, diagnostic capabilities, data research facilities and early warning systems to focus on disease prevention and provide basic healthcare in public health emergencies. Without being adequately equipped in terms of workforce, education and structure, a healthcare system is hardly able to prioritize the One Health approach nor is it able to accommodate the changes coming with it. [133]

On the other hand, healthcare systems and policies designed from the perspective of One Health can facilitate the change in mindset, multidisciplinary collaborations and the tackling of communicable diseases, non-communicable diseases and nutrition. It is important to mention here that this change can not only be within the healthcare system but that it has to be a global societal and especially intergovernmental approach. The healthcare system and healthcare professionals, however, are the place of its implementation. [126,134]

Interprofessional collaborations

Professional communities working on local, national and global levels to provide holistic health services to people as well as animals benefit greatly from the realization of the One Health approach. It is essential that different professions join forces and work to complement their narrow perspectives to create strong and sustainable interprofessional structures. [135] The terms
"multidisciplinary care" and "interdisciplinary care" have been replaced by the more contemporary term "interprofessional practise and education" (IPE). [136] It has been proposed as a framework to join together the historical ways of collaboration. Multiple gaps have been identified in the singular approaches of different professional groups - the purpose of this assessment is to introduce holistic education and practices within these groups. It is widely established that only a approach based on interprofessional collaboration is likely to bring the desired impact in an increasingly globalized world. [137]

No one is in possession of all perspectives, thus successful One Health change-making requires specialists from multiple areas of expertise to communicate and collaborate in order to reach the objectives. Although the joint efforts might be strong at the academic level, it is not equally reflected on a local scale in community centres due to a persistent lack of funding and the fact that the One Health objectives might not be clear to many healthcare professionals. [135] Among the possible ways of filling this knowledge and skill gap, experience with on-the-ground workshops is named in the available literature. Reducing the physical distance between veterinary and medical practices increases the likelihood of a successful collaboration. [138]

Economic benefit
The main focus on the One Health approach is evidently related to the health benefits and the mitigation of health risks on a smaller and larger scale. Since the healthcare system expenses constitute a large portion of every country’s GDP, any effort to reduce the need and scope of human and animal health interventions can help transfer funds into the less developed parts of healthcare. [139] Since the management of immediate crises leads to a wider societal acceptance of public investment than building the health capacity to mitigate future risks, the latter cause is often at risk of underinvestment which in turn leads to a general lack of preparedness to handle epidemics, AMR and zoonotic outbreaks. The general health of the population is a leading factor that determines productivity, and therefore economic growth - any threat to the epidemiological situation is likely to cause an economic downturn, putting the financial situation of countries and communities at risk. [140] Emerging infectious diseases (EIDs) threaten the ability to travel and conduct trade and thus contributing to the hospitality sector laying off staff and supply chains to be broken. [141] Through comprehensive action combating AMR, emerging and neglected infectious diseases and other One Health-related threats, WHO the Member States can avoid future expenses and economic losses through targeted investment in medical and veterinary care, research facilities as well as holistic education of all healthcare students to increase awareness of the interconnection of human and animal health, including other environmental factors. [142]

One Health Education

Rural Youth Education
Rural areas are more likely to suffer from the lack of available quality healthcare services than other communities due to their geographical remoteness and internal economic migrations within countries. Simultaneously, the education of young people living in these areas is not comprehensive in terms of the health impact of environmental factors. On top of that, the funding for research on animal health and diseases is lacking - in 2014 The World Health Organization (WHO)
identified very few laboratories and an absence of rapid response systems in some particular areas due to the lack of supply and unreliable systems. The main defect in the rural areas is identified to be the lack of surveillance of zoonotic diseases, even while the dependence on animal life and farming in those areas is overwhelming. Implementing programs to raise awareness in the youth and making the One Health approach understood and acceptable in the rural community will help to decrease the burden of future outbreaks through understanding the risk factors, and socioeconomic context and strengthening the reporting system.

**Awareness among professional farmers**

Farmers are the cornerstone of the food and nutritional industry. Their ecological awareness is increasing and more and more interest is being paid by this community as to the long-term sustainability of the farming industry. However, reports indicate that there are still significant gaps in terms of their capability to play a vital role in implementing the One Health approach in rural settings. This is an issue on a societal level, but also is clearly related to their own security as it is the rural workers who are most exposed to different types of diseases, including AMR pathogen infections, zoonoses as well as the health impact of environmental pollution, some of which is undeniably caused by the farming practices themselves. Similarly, it is in the vital economic interest of small and medium-size farm owners to learn about One Health and apply its content locally in order to make their industry sustainable in the long term. Policies and guidelines should be established to involve one health approach to promote prevention and awareness and also fund farmers with supplies, vaccines against zoonotic diseases and healthy fertilizers and pesticides for safer and healthier agriculture.

**Veterinary students**

The One Health approach includes the zoonotic origin of diseases and takes into account, among other factors, the life cycles of the pathogens which determine at what stage and to what extent they are transmittable to humans. Veterinarians stand at the forefront of the fight to improve animal health through organized and science-informed prevention of diseases (e.g. through vaccination regimens) and treatment.

In 2012, an outbreak of a novel strain of coronavirus affected several countries. Known as the Middle East Respiratory Syndrome Coronavirus (MERS-CoV), it’s a zoonotic pathogen which was transmitted from camels to humans, leading to severe acute respiratory distress. In spite of being a zoonotic disease, it went through mutations and was transmitted from one human to another whether direct or indirect. The outbreak was contained by a mass vaccination program to block viral transmission from camels to humans in major affected areas, so the major work to stop the outbreak was by veterinarians more than human doctors. The American Veterinary Medical Association (AVMR) and The Association for Prevention Teaching and Research (APTR) made many calls and policies to support the involvement of one health approach in the medical education of veterinary curricula.

**Medical students**

IFMSA International Secretariat, Nørre Allé 14, 2200 København N., Denmark

www.ifmsa.org  /ifmsa  @youifmsa  /ifmsa
On December 4th, 2019 in Warsaw, Poland, various Europe-wide organizations representing the medical community (including medical and veterinary students) made a call to implement One Health education in the medical curriculum by launching and supporting initiatives to encourage students of different backgrounds to share their experiences, provide learning spaces for medical, veterinary and other students and strengthen the interprofessional collaboration from early career stages. [151] This approach has been supported by medical professionals as well as by numerous public health organizations. [152] Medical students are also contributing to the inclusion of One Health in their educational cycles through The International Federation of Medical Students’ Associations (IFMSA) published its first Policy Document on One Health in 2019, while International Veterinary Students’ Association (IVSA) endorsed the FAO-OIE-WHO Tripartite [153]

According to a 2021 study, only 56% of medical schools offered courses on One Health within their medical curriculum. [154] Zoonotic diseases’ incidence has been on a rise lately leading to public health emergencies that affect all aspects of life such as animal, plant and humanitarian life. As SARS Covid-2 which started by a viral infection in a bat then made mutations in its gene through humans which were acting as an intermediate host. Due to the current and anticipated global health challenges, there is going to be a need for medical doctors to increasingly collaborate with veterinarians - not only in terms of medical sciences but also in clinical practice. [155] A multidisciplinary One Health approach plan can be established to prevent further emergencies and global pandemics, which can be done by implementing initiatives in the medical curricula for preparation against such conditions. [156]

One Health Advocacy

Role of youth in One Health advocacy

It is the youth that, to a great extent, constitute the strongest driving force behind the sustainable development agenda. It is through the youth-led structures that a great deal of social change and innovation is created.[157] Participation, in this particular context youth participation, is one of the guiding principles of Human Rights. Having the access and opportunities to actively engage in the development of their societies gives young people a position to express their opinions and values. By doing so, not only their priorities can shape their communities but also their own advancement, thereby creating actively participating citizens. [158] Youth forms 16% of the global population and youth is the population, which has to face most consequences related to the above-discussed topics such as AMR, zoonotic diseases and climate change. They are and have to be the key drivers for making the One Health approach a priority on the local, national and international levels. The COVID-19 pandemic and its consequences, in particular, worsened global inequalities and decreased focus on the Sustainable Development Goals, are calling more than ever for the advancement of One Health. [157,159] Furthermore, “young people need to be consistently in charge of fostering a lifestyle that is low-carbon and free of animal cruelty.” [159] Youth starts the change within their own population and lives what it advocates for. This leads to more motivation and initiative by others to do the same. Next to that, young people have been advocating and fighting for the One Health approach in the past by protesting on the streets and taking stances in high-level meetings. It has been proven that youth as a population are the most impactful when it
comes to advocating for policy change. In the future a focus must be on creating more structures that facilitate youth participation, forces need to be joint to reach the goals and youth needs to continue its efforts of making One Health a generally used perspective within science, society, governments and international collaborations. [158]

**Stakeholders in the field of One Health**

When considering One Health advocacy a very important factor in actually being able to make a change is stakeholders. Stakeholders are any parties or persons who have an interest in the topic. [160] In the context of One Health, they affect or are decision makers, policymakers or people in positions to guide structural change.

The following stakeholders are essential in making One Health a global approach:

- **World Health Organization (WHO)** agreed on One Health as a topic of importance for global health aspirations and has set programs and bodies (WHO One Health Initiative team) into place to support this approach. [2] The WHO is the most impactful institution in policy-making, proposing structural changes, in making strategies and guidelines to implement One Health, developing tool-kits, researching the subject and in distributing educational material. The WHO can make One Health a global priority for all its member states.

- **UNEP, FAO and other relevant UN agencies** support a joint definition of One Health and are working together to mainstream One Health so that they are better prepared to prevent, predict, detect, and respond to global health threats and promote sustainable development. [161] There are key players in policy-making, in prioritizing this approach, in search for funding and in advisory roles. They can lead and accelerate the structural and strategic changes, which have to be taken by governments and supranational unions.

- **Governments and supranational unions** are the places of implementation of One Health. Some countries for example Germany [162], the Netherlands [163] and Brazil [164] are already campaigning and/or implementing parts of the One Health approach within their (healthcare) systems. However, globally and especially supranationally there is a great need for more advances. Policies and programs have to be decided on by this stakeholder. Moreover, they can play a key role in the information and motivation of the population and thereby creating a multilateral and societal engagement in One Health. [165]

- **Food industry companies, farmers and food production specialists** should be focussing on creating a sustainable food industry. The necessary efforts should, among others, include changing the type of food produced, taking the living conditions of livestock into account and protecting biodiversity. [166]

- **Non-Governmental Organizations (NGOs)** are and can focus on One Health advocacy and all acts related to and necessary for it. They especially take a role in raising awareness for this topic and emphasizing its importance to policy- and decision-makers. Moreover, they can embody the idea themself and structure their organization by the principles of One Health. NGOs should make an effort to collaborate with each other and other stakeholders to form networks and alliances, which allow the interdisciplinary sharing of knowledge and resources. [165]
• Universities, including medical and veterinary schools and faculties, are responsible for including One Health in their curricula, faculties, research efforts and specializations. It should, furthermore, be part of each student’s competency development. [150,167]

• Research-funding bodies can make One Health a priority and fund research, especially on how to structurally integrate One Health within national and supranational structures and into the research itself. It can be stated that especially within the last two to five years the amount of research and publications about the topic have increased significantly. However, all subjects discussed above should be researched from the One Health approach, there is especially a need for research into sustainable healthcare systems and nutrition. [168]

• IFMSA National Member Organizations and medical students are especially important in meaningful youth participation regarding One Health; including this subject on their agendas, in their strategies and in projects. They are the key players of One Health advocacy on a local and national level. Each medical student can become a role model of change by trying to live and think within this approach, by actively engaging and by calling for structural change. [157]

References:


9. Sharun K, Tiwari R, Natesan S, Dhama K. SARS-CoV-2 infection in farmed minks, associated zoonotic concerns, and importance of the One Health approach during the ongoing


