



## ***Zoonotic Diseases in Animal Agriculture and Beyond: A One Health Perspective***

November 17, 2022 Webinar Questions and Answers

Panelists: Dr. Lonnie King, Dr. Bernadette Dunham, and Dr. Laura Kahn.

### **What is one over-arching take home message you would want the webinar audience to leave with today?**

**King:** The unique drivers that have created our perfect microbial storm are still in place and are mostly accelerating and intensifying and are predictive of more outbreaks and pandemics with greater consequence. We must break this cycle by rethinking and recreating the future by focusing on collaboration, forming multidisciplinary teams and engaging experts across society, investing in animal and public health infrastructures and surveillance systems, and forming effective community organizations capable of implementing One Health strategies.

**Kahn:** Agriculture is the foundation of civilization because of the food security that it provides. It comes with costs--zoonotic disease threats, greenhouse gas emissions, waste production. In this session, the focus was on zoonotic disease spillover threats.

**Dunham:** There really needs to be a paradigm shift towards prevention rather than a reaction, because that's far more costly.

### **What are the funding sources that could encourage integrated One Health approaches when we still have funding silos—NIH, USDA, etc.?**

**Dunham:** Education of the members of the Appropriations Committees (House and Senate) is needed to help them understand that funding One Health approaches is actually a cost savings because Agencies would be collaborating and sharing the costs rather than conducting studies in multiple silos. Encourage more public-private partnerships in funding programs to broaden funding resources that require a collaborative, multidisciplinary, One Health approach. The World Bank has established a Financial Intermediary Fund for Pandemic Preventions, Preparedness and Response and any activities related to One Health will be eligible for funding.

**King:** Agencies are slowly changing and promoting multi-trans-disciplinary teams; many funding opportunities will not have One Health in titles, but they are still based on the tenets of One Health. Watch for the National Science Foundation (NSF) who is promoting convergence science and funding new projects.



**What would you recommend as areas for research to Ph.D. students, and researchers interested in One Health, zoonotic diseases, and prevention?**

**Dunham:** Any of the areas listed (One Health, zoonotic diseases, prevention strategies, etc.) are in need of additional research, so a recommendation would be to seek a specific area or topic that appeals to the graduate student or researcher and then engage in a multidisciplinary approach. Embrace the concept of convergence science and merge your Research and Development agenda in support of emerging diseases and One Health.

**King:** Some productive areas are: dynamics of spillover diseases; quantifying and mitigating risk factors; measurements and impact of environmental exposures on human, plant and animal health; climate-smart strategies for ag producers; alternatives to antibiotics in animal agriculture; and behavioral aspects determining zoonoses and behavioral alterations to mitigate and prevent zoonoses.

**Many of us spent some of our time in the past 10-15 years on pandemic preparedness activities. Given all of that effort, did we respond to COVID-19 as we had planned? If not, what might we do to shore up our preparation for the next pandemic?**

**Dunham:** There are three primary targets for pandemic prevention and preparedness: surveillance coupled with epidemiological risk assessment across the One Health (e.g. wildlife–livestock–human) spillover interfaces; research to enhance pandemic preparedness and expedite development of vaccines and therapeutics; and strategies to reduce underlying drivers of spillover risk and spread and reduce the influence of misinformation. There needs to be critical scientific infrastructure for stakeholder coordination, and innovations that can facilitate rapid and effective responses to emerging infectious disease threats, along with continued efforts to improve and integrate biosafety and biosecurity with the implementation of a One Health approach.

**King:** We are still too siloed and continue our work with a strong biomedical bias rather than shifting upstream and addressing risks at the animal and environmental levels and interfaces.

**How do you think food systems, livestock production, and agriculture need to change to reduce risk of infectious disease emergence?**

**Dunham:** Taking a One Health approach to mitigate emerging zoonoses from food-, water-, and vector borne-diseases and antimicrobial resistant pathogens is essential. Building effective surveillance systems where data is shared, promoting vaccines, developing early detection and response systems, engaging in new dialogues and collaborations across the health and environmental sectors, and sustaining appropriate business models that embrace a One Health approach is the path forward: emphasizes the positive societal contributions of agriculture beyond food.

**King:** We need greater focus on prevention and non-pharmaceutical interventions; on-farms strategies are becoming more important with more options. The effective use of



vaccines, biosecurity practices, judicious use of antimicrobials; and more emphasis on environmental interventions like reducing exposures from run-off.

### **What is a next step CAST can take to contribute to One Health in Agriculture?**

**Dunham:** Building upon the *Zoonotic Diseases in Animal Agriculture and Beyond: A One Health Perspective* report, CAST can continue to engage with experts from agriculture by expanding the concept of climate-smart agriculture to include greater participation by producers (animal and plant) in a collaborative, proactive, strategic, One Health approach to help mitigate the impacts of climate change on zoonoses. Additional special publications and issue papers on One Health in Agriculture produced by CAST can then be communicated to policymakers, the media, the private sector, and the public to garner support and action on a variety of One Health issues.

**King:** A further exploration of agriculture and One Health that includes helping to resolve issues of understanding incentives, the positive influence of One Health when merged with agriculture strategies and proof of concept of the positive business aspects to producers by adopting One Health.

**Five public health advances brought us a 35+ year increase in life expectancy: vaccines, antibiotics, water sanitation, food security, and vector control. Pesticides are a cornerstone for preventing infectious diseases and food security. However, there is very big push to ban pesticides and romanticization of subsistence farming. How can the Ag sector better engage with the public health sector to make sure that we're making good policy decisions?**

**Dunham:** Engage in active communication with diverse stakeholders in order to keep abreast of current and emerging pest management issues. Bring all of the players to the table so their views and concerns can be heard and discussed. In 2021, the WHO and FAO released a guidance “Managing pesticides in agriculture and public health” <https://www.fao.org/3/cb3179en/cb3179en.pdf> that has some very helpful recommendations. This guidance advises governments on the development of policies that support pesticide risk reduction and sustainable agricultural production. The guidance places pesticide management in the broader context of pest management, it warns about the problems that result from overuse of pesticides, and it links sustainable pest management to environmental protection, human health, food safety and trade. The guidance encourages governments to analyze their pest and pesticide management situation, to identify areas for improvement, and to develop plans to realize these improvements. Special attention is given to integrated pest management, including biological control, as an approach to sustainable pest management and a means to reduce reliance on pesticides. An overview of policy tools that can play a role in such plans is provided.

See also: EPA - <https://www.epa.gov/pesticides/pesticides-disease-vectors-and-public-health>



See also: USDA - <https://www.usda.gov/oce/pest/about>

**King:** I am concerned that ag has become too defensive and isolated. Ag is a critical life science contributing to improved health. I would like to see a more positive and proactive approach demonstrating its huge benefits to society. Unfortunately, animal welfare, antimicrobial use and intensifying production practices may still be influencing public opinion and we need to launch a different communication campaign on the benefits of ag to our lives and their important roles in innovation, productivity, tech advancements including use of pesticides – perhaps a new pesticide stewardship program?

### **What are the implications, if any, of a One Health preventive approach on confinement livestock practices?**

**Dunham:** Since current trends towards intensive livestock production are unlikely to reverse, the research in food-producing animals will be an ongoing need. Confined animal feeding operations need to be very well managed and monitored to avoid rapid spread of infectious diseases. The global effort for AMR surveillance and research is quintessential and will be enhanced via a One Health approach. In addition to heightened surveillance, increasing the implementation of livestock vaccines is a vital tool against disease transmission.

### **Haven't human cases related to Avian Influenza have been seen in Europe and Asia already?**

**Dunham:** A total of three human cases of infection with influenza A (H5N1), one case from the United Kingdom in 2021 and two cases from Spain in 2022 have been reported in Europe to date. The USA has reported one case (symptoms only) on April 28, 2022 (confirmed May 5, 2022). <https://www.who.int/emergencies/disease-outbreak-news/item/2022-DON420#:~:text=A%20total%20of%20three%20human,reported%20in%20Europe%20to%20date> A bird flu virus (a Eurasian strain of H5N1) that has been spreading across the country infecting domestic and wild birds, has a low risk of infecting people. The current avian flu virus was first found in wild birds, commercial poultry and backyard flocks in late 2021 in the USA, when a highly pathogenic strain of flu known as Eurasian H5N1 was detected in birds in Eastern Canada. The virus made its way down the Atlantic coast to Florida and then exploded this spring, when migrating birds carried the pathogen north and west. Countries are increasing their biosafety measures to help curb the swiftly spreading disease in birds. <https://www.ecdc.europa.eu/en/news-events/2021-2022-data-show-largest-avian-flu-epidemic-europe-ever> and <https://www.cdc.gov/flu/avianflu/avian-flu-summary.htm> Avian influenza or bird flu refers to the disease caused by infection with avian influenza Type A viruses. These viruses naturally spread among wild aquatic birds worldwide and can infect domestic poultry and other bird and animal species. Influenza A viruses have



been detected and are known to circulate in seven different animal species or groups, including humans, wild water birds, domestic poultry, swine, horses, dogs, and bats. Bird flu viruses do not normally infect humans, however, sporadic human infections with bird flu viruses have occurred. Transmission from birds to humans is infrequent and no sustained human-to-human transmission has been observed, however it can cause severe disease in humans. Two strains that have most recently infected humans - H5N1 and H7N9.

WHO reports that as of 10 November 2022, a total of 239 cases of human infection with avian influenza A(H5N1) virus have been reported from four countries within the Western Pacific Region since January 2003 (Table 1). Of these cases, 134 were fatal, resulting in a case fatality rate (CFR) of 56%. The last case was reported from Lao PDR, with an onset date of 20 October 2020 (one case, no death). Globally, from January 2003 to October 2022, there have been 865 cases of human infection with avian influenza A(H5N1) virus reported from 21 countries. Of these 865 cases, 456 were fatal (CFR of 53%). A total of three human cases of infection with influenza A (H5N1), one case from the United Kingdom in 2021 and two cases from Spain in 2022 have been reported in Europe to date. The USA has reported one case (symptoms only) on April 28, 2022 (confirmed May 5, 2022). [https://www.who.int/publications/m/item/cumulative-number-of-confirmed-human-cases-for-avian-influenza-a\(h5n1\)-reported-to-who-2003-2022-5-oct-2022](https://www.who.int/publications/m/item/cumulative-number-of-confirmed-human-cases-for-avian-influenza-a(h5n1)-reported-to-who-2003-2022-5-oct-2022) and <https://www.who.int/emergencies/disease-outbreak-news/item/2022-DON420#:~:text=A%20total%20of%20three%20human,reported%20in%20Europe%20to%20date>

### **Are there efforts underway to integrate Colleges of Agriculture, Veterinary Medicine, and Human Medicine?**

**Dunham:** Lessons learned from infectious disease outbreaks in recent years have illustrated that training professionals, from multiple disciplines, in the One Health arena has the potential to improve epidemic and pandemic preparedness. Apply consistent One Health core competencies in education. See also: <https://nam.edu/core-competencies-in-one-health-education-what-are-we-missing/> e.g. The Center for One Health Illinois, established at the University of Illinois, received grants from the U.S. Department of Agriculture to pursue its mission of fostering collaborations and the free flow of information among those in the fields of medicine, public health, the environment and agriculture. See also: <https://u.osu.edu/onehealth/> The Ohio State University as an example where integration in education amongst colleges of agriculture, veterinary medicine and human medicine takes place.

**King:** In the past, graduates from these colleges have not been trained to work across professions. While this is changing, we have much more to accomplish. The use of Interprofessional Professional Education (IPE) is an existing program across the U.S.



with multiple training centers. Veterinary medicine has not been well integrated within this teaching/learning program but need to be and ag needs to be engaged as well. Medical colleges are migrating toward establishing competency-based curricula which will help. We can respect core education programs unique to individual professions yet still have time and courses dedicated to integrative education and system thinking – after all, our difficult societal problems like emerging zoonoses are societal issues and cannot be resolved by narrow views and past educational paradigms.

**What environmental factors could we monitor as part of One Health surveillance to address drivers of these diseases?**

**Dunham:** Disruptions in environmental conditions and habitats can provide new opportunities for diseases to pass to animals. The movement of people, animals, and animal products has increased from international travel and trade. As a result, diseases can spread quickly across borders and around the globe. Climate change, biodiversity loss, and emerging infectious diseases are the most significant environmental challenges we face. The principal drivers of global change that should be monitored are habitat transformation, pollution, over-exploitation of natural resources, and invasive species. Surveillance is the key to stopping spillover events from becoming pandemics, and surveillance happens when all levels of government collaborate. One Health aims to understand the mechanisms of spillover, as well as the origins, changes, and hotspots of pathogens.

**King:** I like the concept of “One Water” which is a philosophy emphasizing the interconnection of all water sources and focusing on monitoring (microbial populations and antimicrobials), understanding this connection and using these data to provide the best sites and intervention strategies to prevent and mitigate diseases.

**Financial investment in gene edited agricultural livestock, development and regulatory compliance, may point to reduced diversity in livestock genetics and increased risk for rapid disease spread. What would be a preventative measure?**

**Dunham:** Responsible and supportive regulation of genome editing technologies will enable animal breeders to develop enhanced breeds more rapidly and successfully with desirable traits; reduce impacts of pests and pathogens; adapt to environmental impacts of climate change; reduce costs and numbers of animals required for genetic improvement; improve animal well-being; maintain product quality; and foster food safety.

**What is the best way to change the paradigm of veterinary education to emphasize One Health for addressing animal and food systems?**

**Dunham:** The good news is that veterinary education is already doing this ... Veterinarians play an essential role in the animal-based food chain. They are professionally responsible for the health of farm animals to secure food safety and public



health. The concept of One Health has been broadly promoted within veterinary medicine and it embraces the fact that the health of humans, animals, plants, and the environment are inextricably linked and supports the related call for transdisciplinary collaboration. Moreover, having the leadership (*e.g.* Presidents, Chancellors, Faculty) of universities embed One Health in everything they do – teaching, research, and outreach – will go a long way to bringing about positive paradigm changes in education!

**King:** A shift to competency-based education and away from siloed and disconnected “ologies” One Health is not inconsistent with understanding the complexities and interconnectedness of animal and food systems. Adopting systems thinking is important and the ability to step back and comprehend how complex societal issues are best attacked. The idea that good animal health makes good human health has well known and that one Health, public health, ag health and food systems should be considered as a continuum will help create better collaboration and cooperation.

**Acknowledging the challenges with new technologies, what do the panelists think about new 'cellular agriculture' to reduce pressures on the multi-factorial problems related to zoonoses and environmental problems while simultaneously improving resource efficiency?**

**Dunham:** It is always exciting to see the development of new technologies and cellular agriculture (meat and fish) is just emerging, so at the moment, it is an expensive niche market. However, when we experience major disasters such as COVID-19 outbreaks in employees subsequently leading to meat processing plant shutdowns; or climate change events, or African Swine Fever decimating the world pig population by one quarter; or the global impacts of conflict such as is occurring in Ukraine, then cellular agriculture may hold greater promise as an alternative if it can be widely distributed and readily deployed.

**King:** Agriculture has always been improved through technology and innovations. Thus, new innovations are welcome but need to have strong consumer backing. These new technologies also need to explore scalability issues, cost-efficiency, sustainability and consumer support but new innovations are needed moving ahead even if only certain populations might have access to the products.

**How can we re-think the prevention of zoonosis and epidemics/pandemics in humans if we still can't prevent/contain new infections or introductions to domestic animals (for example avian influenza, African Swine Fever, porcine epidemic diarrhea and others).**

**Dunham:** It is encouraging to see the WHO, FAO, WOA, UN Program on the Environment form a quadripartite organization termed the One Health High-Level Expert Panel to help ensure a sustainable and healthy future for world. The health of all life on earth is connected more intensely and with greater consequence today. Fortunately, research and technology continue to provide new vaccines against many of the infectious diseases facing animals and humans, but there needs to be encouragement to use these



vaccines, and to make them available and affordable especially to LMIC. We need to stay committed to preventing and ameliorating zoonotic diseases through new epidemic/pandemic preparedness programs. We need global surveillance programs that share the data openly and quickly to enable informed decision-making, to forecast outbreaks, and to target high risk populations and ecological sites in disease control and treatment.

**King:** Transboundary diseases in livestock and poultry can also be important public health issues especially concerning food insecurity. The prevention and response activities for both transboundary and zoonotic diseases have similar strategies; thus, we know how to do this but often lack resources, expertise, and country incentives for reporting. Building effective surveillance systems, infrastructure, lab systems and capacity are similar strategies but unevenly implemented, supported and funded on the animal health side – we need to think about using limited resources to support similar and effective strategies and not try to create more expensive and more siloed systems separately.

**How do we convince faculties to embrace the “wicked problems” approach? Many are resistant to collaboration across silos?**

**Dunham:** Keep up a positive outreach and be a strong advocate for One Health by highlighting all of the benefits that will come both nationally and internationally, when we all embrace a One Health approach to these “wicked problems.” Researchers, scientists, and One Health practitioners will need to develop the professional and interpersonal skills to enable them to successfully collaborate, and work with diverse teams and stakeholders. Education is the linchpin to transdisciplinary competencies and thinking skills to address these “wicked problems.”

**King:** Try to spend time and energy on the doable and take small initial steps. Ohio State University now has a group of faculties termed “wicked scientists” – a like-minded group from across campus and across many departments and colleges; they self-formed and meet outside the old “walls of institutions” to share perspective and ideas. They just received NSF funding for developing a “wicked curriculum” for graduate students. I like the “rule of three” – 1. Identify and coalesce supporters, 2. Counter resisters but don’t waste a lot of time here; 3. Actively recruit the uncommitted.

**The effect of these zoonotic diseases is very high in Lower and Middle Income Countries (LMIC) but the attention given is lower and the application of One Health has paper value and is non-practical as compared to high income countries. My question is how can these huge gaps can be addressed?**

**Dunham:** The WHO released an excellent document to provide guidance on One Health actions needed to address the neglected tropical diseases in LMIC (<https://www.who.int/publications/i/item/9789240042414> ). The platforms facilitate a



One Health coordination structure at their national level that serves as the inter-ministerial contact point to coordinate efforts. However, funding mechanisms still need to be supported, which means establishing a global network for political and financial infrastructures such as those set up by the World Bank: One Health Operational Framework. Education of global leaders regarding the health and economic impact of transboundary diseases will be needed to encourage them to step up and collaborate under a One Health Approach... containing infections at their source is essential in our connected world. There needs to be dynamic changes in our policies, investments, preparedness, response, and collaborations across our public, animals and environmental sectors.

**King:** A very good question and I understand some of the frustration. However, I disagree with your conclusion that One Health is a paper value and unpractical. It is an especially valuable concept and contribution for LMIC. Some of these countries increase funds by pooling across ministries and it is critical to have Ministers of Finance involved and convinced – this can be the key. Also remember that a threat anywhere is a threat everywhere. These countries need permanent workforce and capacity to help prevent possible global pandemics and, more and more, are targets of international funds – World Bank, philanthropic (Gates), WHO and regional U.N programs. Now that the G7, G20, and U.N. have actively endorsed One Health and almost all national programs to reduce antimicrobial resistance use One Health as their programmatic approach, a greater awareness and application of One Health strategies are much more acceptable and possible.

### **Where or how do we bring consumers into the process and awareness of One Health?**

**Dunham:** The One Health approach helps protect the health of all living beings by bringing experts across fields together to solve problems threatening humans, animals, plants, and the environment. By working together, we can achieve the best health for everyone: communication, coordination and collaboration. Using a One Health lens that brings all relevant sectors together is critical to tackle global health threats, like monkey pox, COVID-19 and Ebola. One Health issues can affect everyone, from pet owners, travelers, and farmers to anyone who buys and eats food or drinks or swims in water.

**King:** Major outbreaks and pandemics have become as much of a social problem as biomedical. The impact of global pandemics (may have reached \$20 trillion with SARS-CoV-2) are changing mind sets – these enormous and complex societal problems are now national and global security issues – not one off. How we think about these, prevent them, fund preparedness and early detection and response can be critical. To change this thinking and the subsequent response, stakeholders must be included and more influential in their engagement.



**Is there a way to change the minds of those politicians, media outlets, and large segments of the population who refuse to even believe in the seriousness of climate change, COVID, etc., and make them understand the seriousness of this issue? Thank you!**

**Dunham:** Have patience and continue to remain positive throughout the many conversations that you may have with others as you help to change the narrative ... One Health needs to be central to the narratives and the discussions, not only of its disease prevention and financial benefits, but also its broader social, environmental and health benefits. Stay proactive and continue to network with diverse interest groups to help reinforce common goals and help develop innovative solutions and activities. Take small steps and work with your communities to highlight the larger societal benefits rather than self-interests.

**King:** Unfortunately, in the U.S. our political and legislative responses are based on reactions. When only 3% of U.S. healthcare funds are spent on prevention of disease, we have a major and self-serving problem. It will be important to turn to economists and the private sector to calculate the tremendous cost effectiveness of prevention – a supporting tenet of One Health. Scientists don't seem to have the influence on policy that we have had in the past; thus, we need to turn to others as messengers and supporters as well.

**Captive mink raised for fur have spawned five variants transmitted to people. No other species has demonstrated this ability for viral crossover. Many European nations have been active in shutting them down. But the USDA and CDC have said nothing about the problem, even though this is a commercially insignificant industry producing a non-essential product, exclusively for export.**

**King:** I am not an expert in mink and their diseases; however, what we have seen has been typical of many pathogens – they rather easily cross species lines. For example, COVID has been found now in over 25 species beyond humans. The virus moves across species and ecosystems, constantly evolving and posing further transmission and threats. A worry is that a new species may emerge that could become a maintenance host making future control strategies much more difficult.