Special Opportunity for Synergy Among Animal Agriculture, Human Health, and the Environment – a One Health Approach

Introduction

Disease models suggest that the next pandemic is likely to originate from animals. More specifically, experts believe that "hot spots" can be identified to receive priority attention and focus in implementing mitigation strategies. However, it is also feasible that the next pandemic could originate from food animals involving a highly virulent influenza virus or even an antibiotic-resistant pathogen. This threat extends well beyond zoonotic spillover to humans; it has potential to profoundly impact the worldwide volume of food animal production.

It is estimated that almost 90% of the global population growth over the next few decades will occur in low-and-middle income countries (LMIC), particularly those in Africa and Southeast Asia. As populations in those regions make economic gains, they have traditionally demanded more protein in their diets from animal sources. Thus, the global population of food animals will need to increase by approximately 20 billion animals to meet this imminent demand, especially in regions experiencing the greatest human population growth.

In recent decades, the production of food animals has become significantly more efficient due to advances in genetics, nutrition, production practices, and disease prevention. Despite these positive developments, the public and policymakers have often focused on adverse effects of modern production systems. Adopting the holistic and integrated One Health framework could help to address the complex and socially vexing problems facing animal agriculture, because the approach recognizes that the health of people, animals, plants, and the environment are so closely related that improvements in any one of those domains can spur progress in the others.

Animal Agriculture: Transitions and New Challenges

Contemporary issues such as intensified production systems, use of antibiotics, animal welfare, globalization of trade and food systems, sustainability, food security, and impacts of climate change have coalesced to create flashpoints and a problematic business environment. In addition, these drivers have also generated conditions that are conducive to the occurrence and spread of zoonotic diseases, some with pandemic potential.

The need to produce greater volumes of food—and do so more cheaply—to serve rapidly expanding human populations has led to changing production practices across agriculture. This has resulted in trends toward larger farms and ranches, intensification, global trade, vertical integration, antibiotic use, and concerns about animal welfare, and environmental degradation. Consequently, tension has emerged between animal production practices and public health, resulting in greater scrutiny, criticism, and blame directed from consumers and policymakers toward the animal agriculture industry. Particularly contentious issues concern antibiotic use in animal production and the spillover of resistant organisms into human populations.

The next transition for food animal agriculture will inevitably be shaped by a broad range of unprecedented factors, including greater consumer demands and criticisms, the increasing influence of food retailers, changing global demands, and the industry's shift from a culture of fierce independence

to one of collaboration and recognition of its new interdependence. Animal agriculture should be part of a coalition and collaborative with integrated intersectoral teams that work together to help address their shared challenges. The next step is to join forces with other professions and experts toward collective action, a focus on mutual interests, and the design of new strategies to protect and promote human and environmental health while improving and ensuring greater animal health and welfare.

It is critical that this next transition be based on the essential tenets of One Health, because past solutions and thinking will no longer be effective in confronting today's challenges. Although the One Health framework to accomplish this is already available, it has not been fully embraced by agriculture: this has been a missed opportunity. This shift in thinking should be considered as just another transition, which has been a common denominator of past successes.

Benefits of Animal Health to Public Health: Envisioning a Health Continuum

Although not often fully appreciated, good animal health can also benefit the health of humans and our ecosystems. Therefore, the health of animals and health of people should be considered as a continuum, not as separate and disconnected entities. Good animal health is intertwined with good public health, as well as contributing to issues such as food safety and security. There are also specific mutual benefits and value-added dimensions in eliminating zoonotic pathogens. For instance, programs such as the successful eradication efforts to rid U.S. livestock of brucellosis and bovine tuberculosis have not only benefited the health and wellbeing of food animals but have also eliminated human exposures and infections from these zoonotic threats.

In considering the concept of this continuum, there is also an important group of biologic agents, termed select agents, that are relevant and could threaten human, animal, and plant health and be used as potential bioweapons by terrorists. In reviewing Select Agents, Category A or high-priority agents, 80% of these pathogens that could be used by bioterrorists are zoonotic (Ryan 2008). The Department of Health and Human Services and the United States Department of Agriculture are both responsible for regulating this group of pathogens and potential diseases. This reality reinforces the need for agriculture to be closely aligned with One Health activities and the need for integrated surveillance efforts and the coordination and collaboration of diagnostic systems, research and disease prevention, detection and response. An additional benefit is that animals can provide an early warning to people if clinical signs are detected in animals before the emergence of human illness.

The growing global problem of food security also highlights the relevance of the animal-human health continuum. The same drivers and factors underlying our new era of emerging zoonotic threats to humans have also increased the vulnerability of animals and plants to multiple disease outbreaks. For instance, China recently lost half of its hog population due to an outbreak of African Swine Fever. Food animal epidemics and pandemics can cause starvation, loss of valuable nutrients, and create major public health crises. Even animal diseases that are not zoonotic can have a profound impact on public health, further highlighting the importance of the animal and human health continuum. A current and relevant example is the impact of poultry losses due to HPAI. The poultry industry experienced serious financial losses to production and poultry populations. Such losses from this outbreak due to the disease and/or culling practices can lead to a lack of animal-based protein and other nutrients in the diet of young children in LMIC.

The transition of animal agriculture to embrace food safety also demonstrates the value of considering public and animal health as a continuum. Producers and farmers learned that their responsibility for food safety did not end at the farm gate, but rather it carried over throughout the entire food chain. Reducing antimicrobial resistance, improving environmental health, ensuring conservation, and implementing biosecurity—including protection from zoonotic diseases—are all tied to animal agriculture. New production systems informed by the One Health framework could incorporate changes to improve human and environmental health, such as adopting and responding to life cycle assessments (LCA) and climate-smart agriculture systems, that would extend production systems beyond farms and add special value to food animal products.

Building on Recent Success

Recent successes in policy and practice across the agricultural industry can serve as a platform to catalyze further progress. For instance, there have been notable advances in efforts to control antimicrobial resistance (AMR) in recent years. In 2015, the FDA issued new guidance to eliminate the use of medically important antibiotics to promote growth and production efficiency. Subsequently, antibiotic use by animal agriculture in the U.S. was reduced by over 40%, an achievement that was lauded by public health. Simultaneously, the G-7, G-20 and United Nations have identified One Health as the cornerstone to address AMR in people, animals, and the environment. Thus, animal agriculture was incorporated into coherent and integrated national and international plans to improve health across all the domains of One Health. The U.S. National Action Plan to Combat AMR Bacteria acknowledges the importance of agriculture and envisions it as part of a guiding coalition in helping to address the difficult and complex issue of AMR.

The agriculture industry has always been innovative and early adopters of technology, as demonstrated by research and development in genetics, nutrition, precision agriculture, vaccines, diagnostics, and animal health management. Recent adoption of climate-smart production systems is proactively helping farmers and producers to address the impacts of climate change by adopting new practices and interventions to prepare for major disruptions in production. This type of One Health strategy could promote environmental and human health as well as the health of our crops, plants, and food animals. However, effective implementation of One Health, particularly in LMICs, depends on having adequate numbers of highly trained food animal veterinarians, both in government agencies and to serve the needs of producers. More broadly, the One Health approach—if widely adopted—would change the narrative about the role of agriculture in disease control and emphasize the positive societal contributions of agriculture beyond food.

A New Era for Zoonoses and Animal Agriculture: The Path Forward

Today's fast-growing and increasingly mobile human and animal populations, coupled with the huge, interconnected global food system, has created an unparalleled 21st century mixing bowl—that is, a novel disease ecology where pathogen exposure and transmission across species is almost guaranteed. There is nowhere in the world from which we are remote and no one from whom we are disconnected. Numerous animal microbes are only a few mutations away from initiating new spillovers and outbreaks infecting humans.

This new era of zoonoses and elevated risks demands new thinking and approaches. Rather than arguing about responsibility and assigning blame, now is the time to bring domestic and global animal

agriculture into the fold of the holistic and integrated One Health approach. Strategies implemented within this approach should focus on building effective surveillance systems, developing early detection and response systems, engaging in new dialogues and collaborations across the health and environmental sectors, garnering greater investment in R&D and animal health infrastructures, and enhancing preparedness and response activities. Specifically, animal production should adopt effective biosecurity strategies, promote vaccines, and readily share information. Such new strategies must be compatible and supportive of an appropriate business model that is fair and profitable for producers but not inwardly focused.

The escalating scale and scope of the risks associated with zoonoses has created an urgent need for systems thinking, in which human health and environmental health are situated on a continuum with animal health. Therefore, the animal agriculture industry should commit to take part in a new community health effort under the common principles and practices of a One Health approach, including engagement with intersectoral One Health partners and involvement in the development of national plans to improve human, animal, and environmental health. Without this critical transition, it is likely that old tensions will persist and worsen, and an opportunity to create broad societal benefits will be squandered to the detriment of all, including the food animal industry.

Dr. Lonnie King, dean emeritus, College of Veterinary Medicine, The Ohio State University

Dr. James A. Roth, distinguished professor and director, Center for Food Security & Public Health, College of Veterinary Medicine, Iowa State University