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To Succeed, One Health Must Win Animal Agriculture's Stronger Collaboration

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The One Health approach has received widespread international endorsements from professional, academic, and governmental organizations as the way forward in tackling complex interdisciplinary problems, such as emerging zoonotic diseases, antimicrobial resistance, and food safety. Yet conspicuously absent from US One Health training or research activities are the animal agricultural industries. Their absence is likely due to multiple factors, including the lack of appreciation for their potential problem-solving roles, as well as the industries' business-oriented fears that such engagement could cause them to suffer economic damage. As demands on the swine, poultry, egg, beef, and dairy production industries are closely linked to the above-mentioned complex problems, we must find new, nonthreatening ways to better engage and win animal agriculture's collaboration into One Health training and research partnerships for successful health problem solving. Without animal agricultural industries' improved cooperation, One Health's efforts to control these complex problems are not likely to succeed.

Keywords. biosecurity; One Health; zoonotic diseases; antimicrobial resistance, animal agriculture.

The One Health approach [1], a strategy where professionals from multiple and often disparate disciplines work together to solve complex health problems, has gained much notoriety in recent years. It has been endorsed by many professional organizations [2, 3], academia [4], governments [5, 6], and multinational institutions [7] as the best way forward in responding to the very complex issues, such as antimicrobial resistance (AMR) [3], emerging pathogens [8], and food safety [9]. Each of these complex problems requires and has the enthusiastic engagement of professionals from human health, animal health, and environmental health [10]. However, despite improvements in agricultural industries' engagement in One Health policy in recent years, applied consortia that target these complex problems through training and research frequently lack the enthusiastic participation of modern animal agriculture industries, without which they are not likely to succeed. For instance, how can we know which AMR genes or emerging pathogens are circulating in modern farms and design effective interventions to counteract them unless we aggressively surveil and share the data with collaborating problem-solving stakeholders? Despite observations that large pig farms were involved in the evolution of the 2009 pandemic influenza A virus [11, 12], routine

surveillance data for the next pandemic influenza A virus circulating among pigs are remarkably sparse [13]. Unfortunately, AMR and emerging pathogen research efforts in academia are often not inclusive of animal agriculture industries. This omission could be due to a lack of established and ongoing collaborations—and, thus, professional trust—across these sectors, as well as other practical challenges, especially with data sharing. Although there have been great strides in addressing AMR in animal agriculture, some industries may still not wish to engage in AMR and emerging pathogens research, as it is reasonable to perceive that the work could be a threat to industries' profit generation if not closely managed. Unfortunately, the limited surveillance that is openly reported is most often released in response to overt animal illnesses or to concerns raised by others about human health issues, such as food contamination [14]. While proactive assessments and interventions for AMR and emerging pathogens may be occurring, only limited AMR and emerging pathogens surveillance data that animal agriculture industries collect are released for broad-scale analyses, unlike the commitment seen to open data sharing in other realms.

While international and national organizations are engaging animal agriculture in One Health discussions, animal industries' sparse engagement in One Health (ie, collaborative) research becomes very apparent when attending national or international One Health conferences, reading the One Health scientific literature, or discussing human health biosecurity. Industries are not commonly invited to the table and, therefore, may be blamed in absentia, often inappropriately, for abetting the complex problems. Animal agriculture's absence is not from a lack of awareness, as evidenced by separate,

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siloed animal biosecurity meetings that are sophisticated and well attended [15]. Animal agriculture is also quick to dispel misconceptions regarding the contribution of the industries to the large-scale health issues of our time. Unfortunately, exemplifying the problem, the identification of environmental or animal reservoir risk factors for AMR or emerging pathogens have impacted animal agriculture, resulting in public relations problems [16–18]. In addition, calls for expensive mitigation strategies, developed without balancing input from the industry, are likely discouraging animal agriculture participation, in that industry does not wish to bear such costs [19, 20]. Thus, in addition to a lack of enthusiastic encouragement of participation by the One Health community, concerns about full engagement, when openly stated, seem instead to be somewhat appropriately protective of the industry. However, we believe these concerns may be short-sighted if they assume that engagement with professionals in other disciplines might lead to an amplification of misinformation or negative business outcomes. Instead, we call upon the academic One Health community to make participation for animal agriculture industries attractive enough on a broad scale for these concerns to be allayed.

Animal agriculture’s limited engagement in observable, multi-sector, One Health activities aimed at complex problem solving is unfortunate, as the worldwide projections for beef, pork, and poultry suggest continued production growth (Figure 1) [21]. Among the world’s largest meat producers, industries in China and the United States are not strongly engaged in One Health collaborations. It seems logical that, as modern producers increase the sizes and numbers of their commercial farms [19, 20, 22], the potential for novel pathogen generation and sustainment will also rise [23]. This risk is supported by research findings documenting higher prevalences of influenza

A viruses in large, densely populated swine farms [24, 25]. Hence, these complex problems that merit a One Health approach are likely to increase over time [20].

We call upon the academic One Health community to better engage and find ways to collaborate with animal agriculture. We posit that animal agriculture’s sparse engagement in One Health training and research is limiting successful intervention development, and that active participation, and even the industry’s leadership in One Health, should be encouraged by the community to build trust in the process. Despite perhaps the best biosecurity in history, modern agriculture facilities have often been identified as reservoirs for AMR bacteria, origins of and mixing vessels for emerging zoonotic pathogen threats, and sites of food contamination. As human antimicrobial use is contributing to the selection of AMR genes and incursions of human pathogens are contributing to livestock morbidity [26], and since human behaviors are contributing to food safety problems, we would expect large benefits from modern agriculture engagement. We therefore call upon One Health–engaged stakeholders to encourage animal agriculture industries to play a foundational role in collaborative efforts to mitigate these complex problems. Animal agriculture industries may even want to lead some complex problem-solving collaborative efforts. As animal agriculture industries’ current engagement in One Health approaches are currently perceived as minimal, partnerships beyond the select group of agricultural-friendly academic institutions and regulators are highly encouraged.

Were the livestock and food production industries to be welcomed into an business-aware and friendly One Health space and to then more openly engage with human medicine, public health, and environmental health institutions, the businesses could also benefit from well-funded collaborative partnerships, broader scientific resources, and the innovation that new partnerships can bring to bear. For example, when considering the US federal health security budget and the funding that federal and academic institutions receive for human health research, it is hard to ignore that such levels are many times greater than those often secured by academic institutions primarily working in animal agricultural, and that such budgets could be leveraged for a common agenda, seeking solutions for the complex problems at hand [27, 28]. Additionally, leading academic centers are generating many breakthroughs in applying novel scientific approaches to human population health and environmental health, from which the agriculture industries could more fully and directly benefit. Examples include novel aerosol, water, and other environmental sampling technologies; rapid and cost-efficient next-generation sequencing pathogen detection systems and bioinformatic pipelines; and clinical trials of therapies to alter host microbiomes. Finally, political leaders in the United States and abroad are increasingly employing legislative efforts to push government institutions to adopt One Health approaches in complex problem solving, such as in

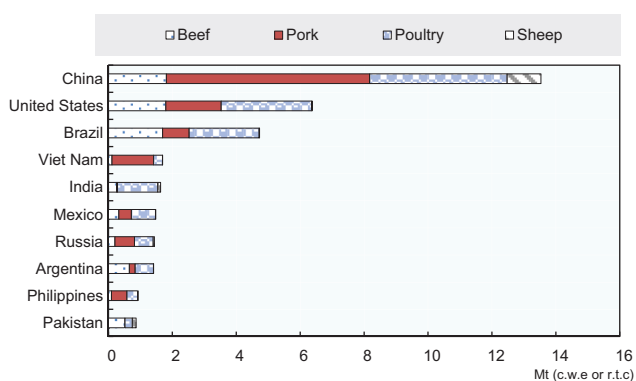


Figure 1. Countries with the greatest share of additional meat production, by meat type, from average production counts during 2015–17 to projections for 2027 [21]. China, the United States, and Brazil will remain the greatest meat producers. Much of the production growth will be due to human population growth and increases in per capita income for the middle classes. Image is adapted from Organisation for Economic Co-operation and Development/Food and Agriculture Organization of the United Nations [21]. Abbreviations: c.w.e, carcass weight equivalent; r.t.c, ready to cook equivalent.

AMR, emerging pathogens, and food safety [29, 30]. We believe that animal agriculture will want to be engaged in and even lead such approaches to problem solving, and it would seem strategic to jointly work with One Health partners in demonstration pilot projects that would identify best practices, develop solutions, and influence further legislation and regulations.

In summary, it now seems imperative that the One Health community come together to embrace and include animal agriculture industries in order to identify and apply One Health solutions to complex problems. Governments and scientists from human and environmental sectors need to find ways to encourage and engage animal agriculture, such that collaborative training and research will enhance and not threaten the industry and food sector productivity. Without modern agricultural industry help, global health security efforts are likely to remain more reactive than proactive. If animal agriculture is encouraged and more openly embraces One Health approaches, human health and food security, animal health, and environmental health will all likely benefit.

Notes

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