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Controlling Avian Flu and Protecting People's Livelihoods in the Mekong Region

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Industrial Livestock Production and Global Health Risks

J. Otte, D. Roland-Holst, D. Pfeiffer, R. Soares-Magalhaes, J. Rushton, J. Graham and E. Silbergeld

Key Findings

- Recent emergence of contagious human diseases from animals has heightened public awareness of linkages between livestock production and global public health.
- Government control measures appear to reflect a belief that large-scale industrial animal farms are safer than smallholder operations, but there is little scientific suppot for this.
- Only a comprehensive, evidence-based approach to risk management on industrial and backyard farms can sustain a safe and affordable food supply.

Recent emergence of contagious human diseases from animals, such as Nipah in 1999, SARS in 2002 and the current epidemic of Highly Pathogenic Avian Influenza (HPAI), which has so far caused the death of nearly 200 people, have heightened public awareness of linkages between wild animals, livestock production and global public health. The risk of disease transmission from animals to humans will increase in future, due to human and livestock population growth, dramatic changes in livestock production, the emergence of worldwide agro-food networks, and a significant increase in mobility of people and goods.

The case of HPAI highlights how a new viral challenge can emerge from wildlife, by first adapting and then circulating within domestic poultry populations with subsequent risks for humans and other animal species. HPAI also clearly illustrates that through extending livestock supply chains, local conditions of animal production have repercussions on global human health risks.

Changes in Food Animal Production

The demand for meat and other livestock products has substantially increased as human population has grown and countries have become more affluent. In response, there have been significant increases in livestock populations and densities, at times close to urban centres. Concentrated industrial food animal production has increased, using fewer but more productive livestock breeds and lines, with a specialization in and vertical integration of stages of production (e.g. breeding, raising, finishing), and major changes in the design and size of animal housing facilities. These developments have potentially serious consequences for local and global disease risks, which, so far, have not been widely recognized.

Globally, pig and poultry production are the fastest growing and industrializing livestock sub-sectors with annual production growth rates of 2.6 and 3.7 percent over the past decade. In industrialized countries, the vast majority of chickens and turkeys are now produced in houses in which between 15,000 and 50,000 birds are kept throughout their lifespan. Increasingly, quail, pigs and cattle are also raised under similar conditions of high density. This trend towards industrialization of livestock production is also occurring in developing countries, where intensive production is rapidly replacing traditional systems, most notably in Asia, South America and North Africa.

Keeping thousands of animals in industrial production units, which are often geographically concentrated, coupled to rapid and repeated movement of animals between units in the course of the production process increases the probability of transferring pathogens within and between livestock populations. The frequency of exposure of susceptible animal populations to pathogens in turn affects the rates of and selection criteria for pathogen evolution, and could thereby facilitate the emergence of pathogens.

Emergence of Influenza Viruses

Wild aquatic birds are the reservoir of influenza A viruses (IAVs) and probably all IAVs of mammals have ancestral links to avian lineages. IAVs are capable to undergo molecular transformation and to adapt to new host populations and thereby acquire the potential to cause major disease outbreaks in both avians and humans.

Current evidence suggests that HPAI viruses are not endemic in wild bird populations and only arise in domestic poultry as a result of molecular changes from IAVs of low pathogenicity (LPAI).

Introduction of LPAI viruses into domestic poultry populations, industrial as well as backyard, appears to occur as a result of direct or indirect contact with wild waterfowl. Various incursions of LPAI virus into domestic poultry have been recorded over the past decade, mostly in North America and Europe, but also in Mexico, Chile and Pakistan. In both the 2003 HPAI epidemic in the Netherlands and the 2004 HPAI epidemic in British Columbia, Canada, which severely affected the industrial sector, LPAI outbreaks seem to have preceded the emergence of HPAI virus on the same farms. In Italy, the 1999/2000 HPAI epidemic was preceded by outbreaks of LPAI in the same region.

The high production efficiency of industrial poultry production systems thus seems to come at the cost of the necessity of increased biosecurity and improved surveillance to reduce risks to global public health. However, it has been shown that some pathogens readily move in and out of standard industrial poultry houses. The extensive spread of HPAI not only in backyard systems but also in the industrial poultry sector as well as observed biosecurity practices suggest that biosecurity of industrial production units is not always sufficient to protect against HPAI incursion.

Reports of HPAI epidemics have increased over the past 10 years, with nearly as many minor and major epidemics having been recorded worldwide since 1997 as over the preceding 40

years. Moreover, the extent of the more recent epidemics has dramatically increased. The HPAI epidemics in Italy, the Netherlands and Canada have shown that in densely populated poultry production zones the control of HPAI poses a substantial challenge, even for high quality animal health services.

The Animal-Human Interface

In the past 100 years, the sudden emergence of anti-genetically different strains of IAVs transmissible among humans leading to human influenza pandemics has occurred in 1918, 1957, and 1968. Molecular analyses of these pandemic viruses have shown that they all contained an avian component.

A number of studies have demonstrated that IAVs from animals can move across the animal-human interface in the context of livestock production. Thus, livestock keepers and people otherwise in close contact with live animals are the most likely group to act as 'bridge' for IAVs between livestock and human communities at large.

Fortunately, current HPAI viruses circulating in poultry do not easily infect humans, have so far not acquired sustainable human-to-human transmissibility, and only the Asian HPAI H5N1 apparently has a high case fatality in infected humans. However, increased human exposure to avian IAVs also increases the likelihood that avian and human influenza viruses infect the same individual with the potential for development of enhanced human to human transmissibility.

Conclusions

Concentration of livestock production in circumscribed areas generates significant animal and public health risks. An unrecognized aspect of industrial food animal production concerns worker exposures to zoonotic diseases. While HPAI H5N1 virus is currently of major global concern, IAVs in general in poultry and swine should also be closely monitored internationally. Human exposure to 'silently' circulating IAV is just as likely (or unlikely) to lead to emergence of a potentially pandemic strain as exposure to HPAI.

Policy makers in both developing and developed countries appear to accept that large-scale industrial farms have higher standards and self-discipline in biosecurity, while smallholders need more rigorous public oversight. But the realities of animal health, economic incentives, and the public interest in disease prevention are far too complex for simple rules of thumb like this to be optimal for society. Only a comprehensive, evidence-based approach to risk management on industrial and backyard farms can sustain a safe and affordable food supply.