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Dirk Pfeiffer graduated in Veterinary Medicine in Germany in 1984. He obtained his PhD in Veterinary Epidemiology from Massey University, Palmerston North, New Zealand in 1994.

He worked as an academic in New Zealand for 9 years and has been holding the Chair in Veterinary Epidemiology at the Royal Veterinary College (RVC) since 1999. Dirk has been involved in epidemiological research since 1985 and worked on animal health issues in developing as well as developed countries. He has published 175 peer-reviewed publications, and currently holds research grants as principal investigator with a total value of about £5Mill. He currently is the Head of Veterinary Epidemiology & Public Health Group within RVC comprising 11 academic staff and about 35 PhD students and research assistants.

Dirk is also Head of the newly designated FAO Reference Centre for Veterinary Epidemiology at the RVC. He teaches epidemiology at undergraduate and postgraduate levels and has designed and taught international training courses in veterinary epidemiology, risk analysis and spatial analysis in Europe, North America, Australasia and Africa. At RVC, he co-directs an MSc in Veterinary Epidemiology as well as one in Veterinary Epidemiology & Public Health by Distance Learning.

He is the lead author of a textbook on spatial epidemiology, author of the chapter on spatial analysis in the key veterinary epidemiology textbook 'Veterinary Epidemiologic Research' and the author of a new textbook 'Introduction to Veterinary Epidemiology'. His particular interest is the epidemiology and control of infectious diseases, and the science-policy interface.

His technical expertise includes field epidemiological and ecological research methods, advanced epidemiological analysis, spatial and temporal analysis of epidemiological data, risk analysis, computer modelling of animal disease and development of animal health surveillance systems. Dirk provides scientific expertise to various national and international organizations including the European Food Safety Authority, the European Commission, the UK Department of Environment, Food and Rural Affairs, the Food and Agriculture Organization of the United Nations, the World Organisation of Animal Health, as well as various national governments.

RISK ASSESSMENT FRAMEWORK FOR H5N1 AVIAN INFLUENZA

in South-East Asia, with Special Reference to the Human-Livestock-Wildlife Interface

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SUMMARY

Risk assessment has been widely used in South-East Asian countries to inform the development of control policies for highly pathogenic avian influenza (HPAI) H5N1. The understanding of the disease's epidemiological parameters can probably now be considered adequate, and broadly effective diagnostics and vaccines have been developed. But the inability to eradicate the infection from the region has led to the realization that the occurrence of HPAI H5N1 is influenced by a complex interaction of environmental, epidemiological and social factors that are spatially heterogeneous and interconnected across the region and beyond. Sustainable and effective control will need to take account of the holistic nature of the system. A major challenge will be to understand the influence of human behaviour and to develop effective mechanisms leading to appropriate behaviour change where necessary.

CONTEXT

Initially large and now small-scale outbreaks of highly pathogenic avian influenza (HPAI) H5N1 have occurred in South-East Asia since late 2003. While some countries, e.g. Thailand, have been able to eradicate it, others, e.g. Viet Nam, still experience outbreaks on a regular basis. The threat of a global pandemic which justified the major multi-national efforts towards control of HPAI H5N1 in the region is still just as relevant, given the continuing virus spread and the associated risk of genetic change [1]. The current situation is dangerous, in that most stakeholders have become less aware of this still present risk. In addition, the widespread use of vaccination in Viet Nam (and in China) without being able to eradicate the virus due to insufficient vaccination coverage may accelerate the emergence of resistant virus mutations.

RISK MANAGEMENT OF HPAI H5N1

Risk management of infectious diseases such as HPAI H5N1 is ultimately aimed at elimination of infection from a population sub-nationally, nationally, regionally or even globally. Given the presence of the virus in wild waterbird species and domestic poultry in South-East Asia and neighbouring countries which are connected through wild bird migration and poultry-associated trade, elimination from South-East Asia will not be feasible for the foreseeable future with the currently available disease control tools. This reality needs to be recognised and the objectives of risk

management within the region may have to be re-defined in some countries. One objective should be to minimise the risk of genetic change in the virus and if it does indeed occur to detect such changes early. A second objective will be to minimise the risk of human exposure since infection can be fatal. The third objective is to eliminate the virus from defined populations for trade purposes. The fourth objective is to minimise infection risk for domestic poultry to reduce mortality.

The resulting risk management policy needs to be part of an integrated risk governance (or analysis) framework that includes risk assessment, risk communication and surveillance [2, 3]. Given the transboundary nature of the system within which the virus is transmitted, long-term effectiveness of risk management requires a regional approach to the problem. It is also important that the risk management policies are informed by integrated risk assessment taking account of the holistic nature of the underlying system.

RISK ASSESSMENT OF HPAI H5N1

The understanding of the ecological, epidemiological and sociological system within which HPAI H5N1 exists is one of the factors influencing the development of risk management policies. Scientific risk assessments are now widely accepted as the most appropriate tool for synthesizing knowledge about risks such as infectious diseases in a structured way. They also allow expressing the absolute risk in quantitative or qualitative terms and to prioritise different risk pathways which in turn provides guidance for risk mitigation strategies [3].

For HPAI virus (HPAIV) H5N1 in South-East Asia, structured scientific risk assessments based on the OIE risk analysis framework [3] were conducted in support of national policies, for example in Thailand and Viet Nam. The process was facilitated by a project funded by the UK Department for International Development (DfID) and led to a series of reports tailored to the needs of national policy makers [4, 5]. The risk assessments included a variety of information sources and analytical tools. Data- as well as knowledge-driven modelling approaches were used [6]. The data-driven approaches were based on existing surveillance data, and resulted in identification of many specific but also large numbers of proxy variables for environmental, epidemiological and sociological risk factors [7]. Key outcome of this research was the identification of the importance of rice-paddy production systems with their mix of poultry and ducks connected through live bird markets and free grazing ducks for local maintenance of HPAIV H5N1 [8-11]. Furthermore, cross-border trade played an important role as a source for continued introduction into the region and between countries within the region [1]. Knowledge-based approaches were applied to produce maps of suitability for HPAIV in Asia [12] and to model the infection dynamics [13-15]. The risk assessments were complemented by socio-economic studies which emphasized the importance of economic drivers influencing the occurrence of HPAI H5N1 [16-19].

LESSONS LEARNED

The complexity of systems associated with disease emergence has been recognised for some time now [20-22]. The inability to regionally control HPAI H5N1 in South-East Asia and elsewhere has demonstrated the need for

an interdisciplinary approach towards dealing with infectious disease challenges [23]. Most of the research conducted so far uses a single or multidisciplinary approach, primarily involving the bioscientific disciplines. The resulting very resource-intensive risk management policies have led to a major reduction in HPAI H5N1 outbreak occurrence in SE-Asia control without being able to eradicate HPAIV H5N1 from the region [18, 24-27]. The challenge for now and the future will be to establish more effective and sustainable processes and practices for participatory and cross-sectoral approaches embedded within a sound risk governance framework in SE- Asian countries, and elsewhere [28, 29].

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