Title: Issues and strategies in *ex-post* evaluation of intervention against animal disease outbreaks and spreads

Authors: Mohamadou L. Fadiga[1] and Hikuepi B. Katjiuongua[2]

ABSTRACT

Animal disease outbreaks pose significant threat in terms of potential economic losses, reduced productivity, and negative impacts on public health, food security and nutrition, and livelihoods. Reported outbreaks of foot and mouth disease in Botswana in 2009 resulted in temporary ban to its prime export destination, the European Union for three years, resulting in estimated losses of $33 million (USD) from 2009-2011 at the processing level alone. The outbreak of highly pathogenic avian influenza (HPAI) in Nigeria would have caused economic losses amounting to 145 million (USD) had no intervention been taken against the disease (Fadiga et al., 2012). These potential economic losses necessitate timely interventions to limit the spread or better eradicate these diseases. However, the costs of an intervention can be considerable.

As such, policy makers seek an accurate assessment of potential losses and cost savings to formulate (ex ante) or evaluate (ex post) an intervention against animal disease outbreak. Both ex ante and ex post assessments require integrating epidemic and economic models for accurate economic assessments of animal diseases (Paarlberg, Seitzinger, and Lee, 2005; Pritchett and Johnson, 2005). A considerable number of research, including (Rich and Winter-Nelson, 2007; Bennett, 2003; Gueye, 2007; McLeod *et* al, 2001; Rushton, 2009; Perry *et al*, 2009; Randolph *et al*, 2002) have addressed economic assessment of various animal diseases and mitigation strategies. But there is a dearth of research addressing issues in *ex post* evaluation of an intervention against an animal disease outbreak. Yet, *ex post* evaluation of intervention against animal disease outbreak and disease spread is important in that it can inform future intervention and control strategies, both in terms effectiveness and cost. There are many issues in *ex post* evaluation against animal disease outbreak requiring various strategies for an accurate economic assessment of given intervention.

This paper considers the key issues that arise in *ex post* evaluation and outlines key strategies to deal with them. We address four key issues and related methods: firstly, the integrated model involves a composite risk estimate that is difficult to capture in *ex post* analysis, as it requires answering the question about the disease trajectory in the absence of intervention. So the definition of the counterfactual scenarios remains a key challenge as the same disease could flare up and die down quickly or become endemic, depending on circumstances including the timing of initial actions, ecological and environmental factors, manner in which biosecurity measures was applied. Secondly, in the absence of an adequate design of a control and treatment groups, how can the social planner attribute the noted impact to the intervention? The question of attribution of the impact of a chosen intervention in response to an animal disease outbreak is challenging, yet it is important as this can inform future intervention strategies. Thirdly, how do we accurately assess cost savings through the intervention? It is customary in many studies that the focus is on total losses while focusing on avoidable losses would be more realistic. Focusing on total cost will overstate cost savings (net benefits) as a result of the intervention. Fourthly, given the underlying uncertainty in the data related to disease epidemiology, production parameters, market, and inter-sector linkages, would a deterministic solution for the key output variables make sense? A stochastic simulation to solve for the key output variables and a probabilistic sensitivity analysis to capture the underlying uncertainty in the data would be a more robust approach as the key output variables derived are stochastic averages unlike their deterministic counterparts. As we address the above issues in this paper, we will synthesize the implications and recommendations for decision makers at the policy level to help evaluate more accurately the impact of interventions in response to an animal disease outbreak.

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[1]Senior Agricultural Economist, International Livestock Research Institute.

[2]Agricultural Economist, International Livestock Research Institute.

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