

# Flexibility in disease outbreak management could save lives and money

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A new approach for responding to and managing disease outbreaks -- such as foot-and-mouth disease, measles, and viruses -- is being proposed by a team of epidemiologists led by two Penn State University researchers. The team's

flexible approach could save many lives and millions of dollars. The approach, called 'adaptive management,' allows decision-makers to use knowledge they gain during an outbreak to update ongoing interventions with the goal of containing outbreaks more quickly and efficiently. Current efforts to prevent or stem such outbreaks may fall short because of uncertainty and limited information about the real-time dynamics of the specific disease outbreak. The researchers' scientific paper describing this adaptive management approach is published in the Oct. 21, 2014 issue of the open-access journal *PLOS Biology*. This image shows a group of cows -- a species that is susceptible to the contagious foot-and-mouth disease. Credit: Shmuel Rozenblatt, Tel-Aviv University

Research by a team of epidemiologists from the UK and the USA has proposed a new approach for responding to and managing disease outbreaks. They say lives and money could be saved if decisions are adapted to relevant information about the dynamics of the current crisis and not based on retrospective analyses of prior crises, trials and interventions.

Dr Michael Tildesley, a lecturer in infectious [disease](#) modelling in the School of Veterinary Medicine and Science at The University of Nottingham and co-author of the paper, said: "Organisations involved in the outbreak of disease should be able to change approaches as new information becomes available. In the early stages of a new disease outbreak there is often insufficient information to make a decision regarding the best control policy. At the same time policy makers cannot afford to delay until that uncertainty is resolved before introducing interventions. Adaptive management provides a mechanism for introducing control at the onset and then using information gained during the outbreak to determine the most effective long term management action."

The research, carried out by experts at The University of Nottingham and Pennsylvania State University, is published on Tuesday 21 October 2014, in the academic journal *PLOS Biology*.

The study suggests current efforts to prevent or stem the spread of disease fall short because of confusion and limited information about disease dynamics. It shows adaptive management would allow researchers to use the knowledge gained during an outbreak to update ongoing interventions with the goal of containing outbreaks more quickly and efficiently.

## **The Benefits of Adaptive Management**

The research was carried out in collaboration with Dr Katriona Shea, Professor of Biology and Matthew Ferrari, Assistant Professor of Biology and Statistics at Pennsylvania State University; Michael C Runge, from the United States Geological Survey at Patuxent Wildlife Research Center and Christopher J Fonnesebeck, from the Department of Biostatistics at Vanderbilt University School of Medicine. It presents two scenarios in which adaptive management would be likely to improve outcomes.

The team explored the implications of adaptive management on the 2001 foot and mouth outbreak in the UK and measles vaccinations strategies in the USA as examples of how a more flexible approach would be less draconian, could save lives and money.

Dr Tildesley said: "We demonstrate expected savings of up to £20 million in terms of lower livestock losses to culling in a foot-and-mouth outbreak. Similarly, up to 10,000 cases could have been averted in a [measles outbreak](#) like the one observed in Malawi in 2010. Adaptive management allows real-time improvement of our understanding, and hence of management efforts, with potentially significant positive

financial and health benefits."

Professor Shea said: "Culling decisions during the outbreak of foot and mouth were contentious as there was so much uncertainty about the spatial scale of transmission. Many farmers felt that they were being penalised for being in the vicinity of infected farms when they believed that they were not at risk. Adaptive management in the case of foot and mouth disease would initially employ a less severe approach. This would reduce the number of cattle culled and rely on real-time updates to modify responses—more severe culling would only be recommended if justified by the spread of the outbreak."

Dr Ferrari, who consults with organisations such as the Centres for Disease Control and Prevention, the World Health Organisation and Doctors Without Borders on disease outbreak prevention and response, said: "In measles outbreaks responders need to make decisions and act quickly based on the information available. An outbreak contained to young children would call for a fast and nimble response, moving from town to town very quickly and vaccinating only young children. Conversely, an outbreak affecting a broader age range requires a slower, broader, more methodical response.

There are trade-offs to taking the wrong approach. If you did the fast, nimble child vaccination but the outbreak had a broader risk, you would miss a lot of people. If you did the slower, broader, more methodical response, you'd protect lots of people but the response may not be fast enough."

## **A More Nuanced, Context-Specific Approach**

Dr Ferrari said: "The new approach would mean that when you find yourself on the ground, responding to an [outbreak](#), and you have evidence that a change will result in improvement, you can make that

change without having to provide post-hoc justification because you have incorporated that potential into the plan.

"Historically the argument has been for a very static policy to manage infectious [disease outbreaks](#) because it's clean and easy to understand. We recognise that a more nuanced, context-specific approach could be better. We need to put the possibility of changing midstream into our toolbox, integrating scientific discovery with policy making to improve intervention efforts."

**More information:** Shea K, Tildesley MJ, Runge MC, Fonnesebeck CJ, Ferrari MJ (2014) Adaptive Management and the Value of Information: Learning Via Intervention in Epidemiology. *PLoS Biol* 12(10): e1001970. doi:10.1371/journal.pbio.1001970, [www.plosbiology.org/article/in ... journal.pbio.1001970](http://www.plosbiology.org/article/in...journal.pbio.1001970)

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