EDITORIAL

Mass culling for avian influenza: rational strategy or needless destruction?

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Infection by the Highly Pathogenic Avian Influenza (HPAI) virus strain H5N1 has wrought periodic havoc in several pockets in the country in the last two years, most recently in West Bengal (1, 2). Millions of domestic fowl potentially infected with the virus have been slaughtered, affecting the livelihood and nutrition of people in thousands of villages and towns, with the intention of saving the rest of the poultry and preventing human infection. No human infection has yet been discovered in India, and this appears to justify the mass culling. But does it, really? How rational is the strategy? Can there be a more humane, less destructive approach which is no less likely to be effective?

There are good reasons to fear the H5N1. It kills about 90 per cent of the birds it infects and the surviving ones are sources of infection for other healthy birds. It rarely affects humans but when it does, it is almost as lethal: of the 300-odd people confirmed to have acquired the infection globally in the last four years since the first human case was reported, more than half have succumbed to severe respiratory illness. An antiviral drug, oseltamivir, can alleviate the seriousness of illness in humans but it is expensive, as is the intensive supportive care needed to salvage the lives of those infected. What makes avian influenza truly frightening is that the virus has been jumping species and hence presents the tantalising probability that it will any day mutate to a form that is highly infectious to humans and transmit rapidly from person to person in a pandemic crossing national boundaries at a scorching pace, before effective vaccines can be developed and used, leaving behind human mortality of a scale unthinkable in the modern age.

There appears to be sufficient evidence that some of the devastating influenza epidemics that killed millions of people in the recent past (in 1918, 1957 and 1968, with about 50 million, two million and one million human deaths respectively) might have been initiated by a similar mutation. (To place this in perspective, every year an estimated 250,000 to 500,000 deaths occur due to human influenza globally.) There is also evidence that the question is no longer whether such a mutation will occur in the H5N1, but *when* and *where*. In effect, one viral particle in one bird (or other suitable host), somewhere on earth, will acquire by random chance the ability to easily infect human cells and set the disaster rolling. Theoretically, this can happen in more than one unrelated location, and thus there could be epidemics beginning from more than one focus or country and at different points of time.

Guidelines for action

For this reason, since 2003, global public health attention has been increasingly directed to finding means of preventing or, at least, delaying the disaster. Besides the animal husbandry and health ministries of national governments in the affected countries, organisations such as the Food and Agricultural Organization of the UN, the World Organization for Animal Health, the World Health Organization and the Centers for Disease Control and Prevention have been at the forefront of the battle. Guidelines and manuals have been issued prescribing steps that countries and their provinces can take to contain bird-to-bird and bird-to-human transmission and prepare for the eventuality that the dreaded mutation and human epidemic will occur. In India, the central and state health authorities, in close collaboration with the department of animal husbandry, are using these guidelines to plan and act.

At the heart of the action are the following actions: early detection of unusual bird illness and death, testing sick or dead birds to confirm the diagnosis of H5N1 infection, the careful destruction of potentially infected birds and their products, their disposal, disinfection of premises as well as measures such as bans on the movement, sale and consumption of such birds. Parallel measures place the human population in the vicinity under surveillance for symptoms of flu and, potentially, for isolation, diagnosis and treatment. All this is accompanied by the provision of adequate information to the people in the affected area. In principle, all this is unexceptionable.

Two approaches to culling

The devil, as is its wont, lies in the detail. How does one identify "potentially infected" birds, especially since testing every bird is practically impossible? Thus, how many birds need be culled? The FAO manual on HPAI (3) recommends a "zoning strategy" for

containment. This begins with the identification of the "Infected Area" (IA) where the sick or dead birds tested positive, such as the poultry farm or the village. All poultry in this zone are to be considered potentially infected and culled, and movement of people out of this IA is to be prohibited or severely restricted for an extended period. Further, an area roughly one to five km from the outer boundary of the IA is to be considered a "Restricted Area" (RA), to be placed under strict intensive surveillance to detect early any case of bird illness. Residents are not permitted to move out of the RA. Around the RA, a "Control Area" (CA) is to be identified, extending two to 10 km beyond the boundary of the RA, to be placed under lesser oversight, mainly to provide a buffer zone in case of spread.

No culling is recommended beyond the IA (the original village or farm) unless there is evidence of spread. Further, the "RA [or CA] does not need to be circular but can have an irregular perimeter depending on known physical and geographical barriers, markets, poultry density and farming systems." (3) Finally, the manual emphatically notes, *"When declaring RAs and CAs, the areas must not be larger than necessary, thus restricting the number of properties to be quarantined to only those deemed prudent..."* (emphasis original). Even the quarantine must be restricted to what is prudent, let alone the culling.

The manual then provides an example of how control was carried out in China, presumably in 2004, where, for unspecified reasons, the method followed was to define a *circular* area of three km radius around the "infected point", labelled "infected zone", where "all poultry should be stamped out", surrounded by a concentric "threatened zone" of a further five km radial distance where all fowl were vaccinated. Since the example predates the manual's recommendations, the latter may be assumed to be more current; indeed one may assume that in recommending differently from the example provided, the manual implies that the example was in some way inadequate.

The difference in the two approaches, in terms of numbers of birds culled, is obviously enormous. For example, about 25 villages could be counted in the three km radius meticulously marked on a planning map in West Bengal, the central village of which had the infected birds. The difference in the two approaches in this case would be the equivalent of culling all birds in one village versus culling all birds in 25 villages.

In India, the department of animal husbandry has issued guidelines (4), last updated in November 2006, to be followed by state authorities. All birds within three km of the village or farm where birds tested positive are culled. In West Bengal, recently, this was extended to five km for some of the districts. In earlier epidemics in other states, even wider areas were reportedly included in the culling. In all, over 4 million birds were reportedly lost to the West Bengal epidemic, a very large bulk of them from culling. It is not clear why the circular area approach is being followed, and it will be important to understand the rationale from the experts.

Given the fact that the transmission of infection from bird to bird (or to human) is primarily by direct contact with infected droppings or secretions (much like the transmission of common cold), or secondarily from fomites (objects that have come in contact with infectious material, including human hands and the ubiquitous dust), it is unlikely the virus would spread "as the crow flies", however counterintuitive this may appear. In fact, in most documented outbreaks so far, the commonest mode of spread has been through movement of commercial poultry to and from markets. Wild birds, particularly water fowl, have been implicated, but their consistent role is far from established.

The effectiveness of the "three km" strategy is unclear also in the face of the fact that a large proportion of the poultry consists of numerous relatively small backyard flocks, rather than large commercial poultry farms. It is difficult to imagine how these birds, which scavenge through the day within short distances of the backyard to which they return at night, could carry infection to adjacent villages without human effort, or why such birds or their infected products may be moved from village to village by their owners and let loose there. Unless we have good evidence that this does happen, there does not appear to be sufficient ground for the assumption that all small flocks in a radius of three km are infected. It is not clear what has been hypothesised to be the mode of spread over three km. The outbreaks in multiple districts in West Bengal were certainly not contiguous and could well have been caused by movements of infected birds by their owners to far places in panic induced by the realisation that their flocks would soon be lost to culling. The probability of wild waterfowl carrying the infection from a shared pond at the epicentre and seeding faraway locations to cause "fresh" outbreaks is also significant, but it is not clear if this can explain the "three km" limit. The application of the "three km" strategy to an area dominated by backyard poultry may not be easy to justify. In fact, a similar argument can be made for large poultry farms as well.

A preventable economic disaster?

This also brings into question the validity of the economic argument for the mass culling of this kind. The generally understood and primary rationale for culling is that you cull some of the fowl in the vicinity of the proven infection, which are usually recognised from sudden mass deaths of fowl, in order to save the rest. When we consider that far lesser culling, such as that recommended in the FAO manual, might have been as effective, we are faced with the uncomfortable probability that this has been a preventable economic disaster. The alternative strategy in fact seems to make far more economic sense: cull in one village and cull more if and when there is evidence of infection elsewhere. This should allow the payment of higher compensation for

culling, encourage the reporting of bird deaths early, discourage false reporting, reduce the panic and thus the wild spread, and save hugely on the mobilisation of resources for culling and disinfection. Simultaneously, exhorting people to keep their poultry confined to the backyards until the danger has passed may find more takers than mass culling does. Such an approach may appear to prolong the epidemic but could considerably reduce net losses of all kinds.

Finally, the impression given is that mass culling will minimise the risk of human infection, such as by saying that this is being done to protect the people. Careful, early culling of infected birds certainly will protect humans but in a mass campaign such as this, there is a greater likelihood of people coming into closer contact with fowl when they are catching and handing them over, when they crowd to watch the culling, as has been reported in the press (5), or when they gather their infected flock and flee. Also, mass culling does not significantly diminish the likelihood of the dreaded mutation to human influenza.

Actions for the good of the poor

If culling is largely an economic intervention, it is worth considering whether the poor, who own much of the poultry being destroyed, might make somewhat different decisions if they had the choice. They may be ready to take the very slightly greater risk of infecting themselves by choosing to live on with birds having a marginally greater likelihood of being infected. For instance, imagine what decision a poor household in the "three km" zone may make when presented the following choice: *either* give up your bird for two thirds of its market price and enjoy a probable reduction in risk of your becoming infected from three per 1,000 to 1 per 1,000, or live with the bird who has a 90 per cent chance of not being infected but with a three in 1,000 chance of your becoming infected, if the bird turns out to be infected. These numbers are of course as hypothetical as the question itself, but may not be far from the truth. The poor take far greater risks in their daily lives. When we take such decisions on their behalf, how do we judge if we are really acting for their good? From whose perspective? At whose cost? To save whose costs?

A lot of this may of course be retrospective wisdom, and it must be acknowledged that the authorities exerted tremendous effort and resources to check the epidemic. It was the first experience for the state and there was considerable public pressure, fed by media reports, to "do something" in the face of the epidemic. The early reports of bird death were apparently long delayed and mishandled, not entirely due to the fault of decision makers, leading to the situation getting out of hand. At the end of it all, it must surely be galling for the authorities to be accused of not having done enough.

At the same time, it is important to learn from this experience. For instance, testing a sample of birds culled at varying distances from the epicentre should help provide concrete evidence about their being infected. The alternative strategy recommended by FAO can be tested in the next outbreak, with more lucrative incentives offered for culling. Local wisdom can be tapped to devise potential ways of minimising transmission of infection. Ways can be devised to offer the people informed choice. In short, until we know of more certain ways to stamp out what seems an elusive enemy at the moment, we would be wiser devising ways to live with avian influenza rather than resorting to desperate measures.

This commentary is partly based on a discussion on the email forum of Medico Friends Circle at the height of the recent outbreak of avian influenza in West Bengal in January and February 2008. This article predates outbreaks occurring after February 2008.

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