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31 Livestock Epidemic

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INTRODUCTION

Since the widespread domestication of animals in the Neolithic era, 10,000-15,000 years before the Common Era (CE), human livelihoods have been inextricably linked with the livestock they keep. Domesticated animals must have been among the most valued assets of ancient humans: walking factories that provided food, fertiliser, power, clothing, building materials, tools and utensils, fuel, power and adornments. Inevitably, the innovations of crop cultivation and food storage that allowed people to settle and live in high numbers and densities also increased the number of animals kept, density of livestock population and the intimacy of human-animal interactions. Pathogens responded, undergoing intense genomic change to seize these dramatically expanded opportunities. Epidemics of highly contagious and lethal disease emerged, as livestock and people reached the critical population sizes needed for acute infections to persist. Diseases also jumped species from animal to humans: the lethal gift of livestock.

This chapter discusses which livestock epidemics are likely to constitute a disaster and why.

LIVESTOCK EPIDEMICS AS DISASTERS

When Animal Epidemics Constitute Disasters: Livestock Plagues

Epidemics are usually defined as occurrence of a certain disease above expected levels in a population. A few cases of a rare disease may constitute an epidemic, as may the gradual increase of chronic or benign disease; epidemics may also be non-contagious (e.g. bovine spongiform encephalopathy commonly known as 'mad cow disease'). Increasingly the term may be used when the aetiology is non-biologic (for example, an epidemic of lameness associated with concrete flooring). But the word 'disaster' likely refers to those epidemics caused by rapidly transmitting pathogens that produce acute and serious disease in large numbers of hosts. In livestock, rinderpest (cattle plague), Newcastle disease (fowl pest), and classical swine fever (hog cholera) are archetypal examples.

Historically these lethal, highly contagious diseases were known as murrains, pestilences and plagues; words still evocative of disaster. The former List A of the World Animal Health Organisation (which retains its historical acronym of OIE) comprised 16 of the most important livestock epidemics, chosen because of their potential to spread rapidly, to cause large socio-economic losses and to interrupt trade. The current OIE list is longer and the criteria for inclusion have been expanded to include animal diseases that can affect people (zoonoses) or that are emerging. In rich countries, the most serious livestock epidemics have been controlled and as a result, many highly contagious and serious epidemics are labelled ‘exotic’ or ‘foreign’ diseases. Global organisations prefer the term transboundary animal disease (TAD) as ‘foreign’ is a matter of perspective and most diseases are ‘at home’ somewhere in the globe Generally, these diseases are notifiable; that is, there is a legal requirement of reporting to veterinary authorities (or, curiously, to a police constable in the United Kingdom).

Many serious livestock epidemics also fit into the category of Diseases with High Externalities (DHE), a term used by the European Union to indicate they pose a large threat to the wider economy and hence their control justifies public intervention. What these definitions have in common is recognition of high infectiousness and potential for major negative impact. This chapter refers to these as livestock plagues, to distinguish them from non-contagious, slowly spreading, chronic or benign livestock epidemics that are less likely to constitute disasters, and the zoonotic diseases which constitute disasters but for different reasons. Table 31.1 provides a rapid profiling of some important livestock plagues based on the former OIE list A.

Insert Table 31.1

These diseases are absent from, or controllable in, rich livestock-keeping countries. This is sensible given that if a country has eradicated a disease it will not wish to re-import it and is entitled to put it on its notifiable diseases list. However, once on the ‘scare list’, a disease becomes guilty by association and more feared than it might be on its own merits. This has implications for poor countries whose role still too often is accepting standards rather than setting them. For example, lumpy skin disease is arguably neither more deadly nor less manageable than orf, a similar disease causing skin lesions in sheep (and a zoonosis to boot). However, orf is present in the major livestock exporting countries of the developed world that built the international system of disease control on the model of their own systems. Could this partly explain why orf is less likely to appear on global disease lists of major epidemics than its exotic counterpart lumpy skin disease?

Impacts of Livestock Plagues

The epidemics described in Table 31.1 are among the most likely to constitute disasters. They have multiple and severe socio-economic, health and ecosystem impacts, including loss of animal assets through death, sickness or culling; increased cost of production, resulting in increased cost of livestock products and potentially compromised food security; loss of livestock genetic resources, some irreplaceable; restriction of livestock and livestock products export; loss to other agricultural sectors (e.g. feeds); in some cases threats to human health (zoonoses); in some cases spill over to wildlife; disruption of other economic sectors (tourism); and, loss of ecosystem services provided by livestock and wildlife victims. In richer countries for which agriculture is usually small percentage of the GDP the costs to other sectors may be greater than the costs to the livestock sector: for example, in the United Kingdom 2001 foot and mouth disease outbreak losses to tourism were actually greater than the losses to the agriculture sectors (Royal Society of Edinburgh 2002).

One of the most powerful drivers of human interest in livestock disease and epidemics is enlightened self-interest. Many human epidemics of Eurasia (e.g. measles, small-pox, influenza) originated when pathogens of domestic animals evolved to become human specific (Wolfe *et al.* 2007). In recognition of their ancient animal origin, these are sometimes called the old zoonoses. Other pathogens remained adapted to domestic animals but took the opportunity to infect the humans who exposed themselves to infection by consumption of livestock products or contacting animals (e.g. the pathogens responsible for tuberculosis, brucellosis, rabies). These are called classical or established zoonoses. For another group of diseases, the sporadic or emerging zoonoses, human infection is rare, either because the pathogen is poorly adapted to humans (e.g. Ebola, avian influenza) or occasions of transmission are infrequent. As these pathogens evolve, they may become better adapted to humans, and this concerns underlies the efforts to control avian influenza in birds before it gets the chance to evolve into a Spanish Flu type strain capable of killing tens of millions of people as happened in 1918. Hence, understanding livestock epidemics is important not only because of their impact on livestock population and production but because of their role in disease emergence. However, zoonoses are an area in their own right and this chapter concentrates on diseases of importance to livestock.

While few argue that disease control is a bad thing, recent experiences remind that, if livestock epidemics have negative impacts, so too can the action taken to control or prevent them. During the avian influenza pandemic, which started in 1997 and as of 2010 is still continuing, there have been several calls to ‘restructure’ the poultry industry, which in effect meant getting rid of the backyard sector which included most of the poorest producers, many of whom are women with limited other options for other income-generating activities.

The pandemic of H1N1 influenza declared in 2009, which originated in pigs but has escaped its swine host and is now maintained entirely by human to human transmission, gives another example. In response to the pandemic, the government of Egypt ordered all of the country's pigs to be slaughtered in a costly and, (because humans can only get the new flu from other humans), epidemiologically pointless move. This had far-reaching and unintended consequences. Cairo's 30,000 garbage collectors used to feed the city's organic waste to pigs and so their livelihood became endangered while the streets of the capital filled up with trash (ABC 2009).

PLAGUE EPIDEMIOLOGY

The epidemiology of livestock plagues has important implications for their behaviour that are unfortunately not always understood. Three are highlighted: the requirement for crowds, the illusion of epidemic control, and the (partial) bonus of herd immunity.

The Requirement for Crowds

Many livestock plagues, as for their human equivalents, require large animal populations (and are therefore sometimes called 'crowd diseases'). Without a constant supply of fresh victims, or if too many hosts die or become immune, plagues burn out rather than propagate because hosts are too few and contacts too sparse. The actual threshold population needed to maintain an epidemic depends on pathogen factors (e.g. ease of transmission, survival in the environment) as well as host factors (e.g. susceptibility and contact rates), but historical records suggest human habitations of about 250,000 are needed for major epidemics. (Given that livestock-dependent households typically require several animals for each household member it is possible that livestock epidemics pre-date human ones.) Where crowds are absent, so are epidemics. For example, arguably, in the many African countries with low densities of chickens and few ducks, even if avian influenza is introduced it will not become established. Hence, the large amounts of money spent on preparedness in these countries may not have been the most efficient use of scarce disease control resources.

The Illusion of Epidemic Control

Plagues that result in immunity and/or widespread death are frequently cyclical in nature. When first introduced to a naïve population not previously exposed, called a ‘virgin soil epidemic’ in a ‘naïve community’, mortality is very high. As hosts are removed through death or the development of immunity, the rate of infection slows until it is no longer at epidemic proportions. After new susceptibles are added by birth or in-migration, another outbreak occurs. Even in the poorest countries, the introduction of a novel plague is followed by control efforts. And, even if completely ineffectual, control efforts are often accompanied by a natural decline in cases. Politicians and technicians with what psychologists term an internal locus of control (i.e. a tendency to attribute success to their own efforts rather than good luck) may attribute declines in disease to their actions rather than the natural history of plagues. Arguably, the recent decreases in avian influenza owe more to natural decline than to the huge but often not very well thought out global and national responses to the pandemic.

The (Partial) Bonus of Herd Immunity

Herd immunity is an epidemiological phenomenon first described in livestock populations that proved sufficiently useful to be transferred without name-change to the epidemiology of humans (Coleman *et al.* 2001). Herd immunity refers to the resistance of a group to disease attack to which a large proportion of the group is immune. This underpins population vaccination campaigns: not all individuals need be vaccinated to ensure protection of the group, and those who are vaccinated protect those free-riders who are not.

Herd immunity has a dark side: if generated to a level that is below the level needed to eliminate a disease, it can paradoxically perpetuate disease by creating a partially immune population in which either the disease persists at a low and difficult to detect level or is sufficiently suppressed for its effects are tolerable. The widespread private use of vaccination probably allowed rinderpest to maintain itself for 30 years in India and for avian influenza to remain endemic to this day in Pakistan (Roeder and Taylor 2007).

Major Livestock Plagues and the Lessons From Them

History has been partly shaped by livestock epidemics, as it has by human epidemics (many of which originated in livestock). Chinese, Egyptian and Indian texts describe animal epidemics millennia ago and classical authors wrote of plagues leaving not a single ox in the land (Blancou 2003). Retrospective diagnosis of plagues is a popular pastime of medical historians. Some of the plausibly, if not always definitively, identified livestock epidemic disasters of the past include:

- Cattle plague (rinderpest) entered Europe with the Hun invasions of the sixth century and followed every major war until the last century (Barrett *et al.* 2006).
- Sheep murrain (probably sheep pox or mange) is reported to have killed sheep on every farm in England in the 13^{th} century (Fleming 1871).
- Black bane (anthrax) epidemics resulted in massive animal mortalities throughout history and concept of cursed earths or 'terres maudites'.
- Lung plague (contagious bovine pleuropneumonia) was first described in Germany in the seventeenth century and spread round the world in the globalisation of the steam age with disastrous effects. The USA was infected twice in the 19^{th} century, and the post of Secretary of State for Agriculture was created specifically for the control of this disease (Blancou 2003)
- Glanders (farcy) is one of the first diseases to be fully described reflecting the importance of horses as the mainstay of transport, tillage and war. Surprisingly, its zoonotic potential was often not realised, for example, Vial de Saint Bel, the first

principal of England’s first veterinary college, maintained glanders was not contagious right up until his death from it in 1793 (Wilkinson 1992).

In the roll call of historic animal diseases, pigs and poultry are not salient. In the past as with the present, these were often the less-favoured species and so kept by women and the poor. In the past as in the present, their owners’ voices are hardly heard. While large-scale die-offs have been reported from antiquity and historical times, the detailed description of symptoms and course of disease that would allow tentative identification is rarely present.

While less is known about historical livestock epidemics in other regions of the world, especially those without a written literature, it is plausible that livestock epidemics have been one factor in the vulnerability of American and African cultures to European colonisation. For example, in Africa the Great Cattle Death of the 1860s (contagious bovine pleuropnemonia) was followed by the African Cattle Plague of the 1890s (rinderpest) which killed 80-90 per cent of cattle and susceptible wild ruminants; the result was famine, smallpox and unprecedented predation of carnivores on people. This overthrew the pastoralist hegemony in much of Africa: it has not recovered to this day (Tiki and Oba 2009). Box 31.1 looks more closely at some important epidemics to draw lessons on the drivers, impacts and control of animal plagues.

Box 31.1 starts

Box 31.1 The Emergence of Epidemics: A Hotter, Wetter, Sicker World?

Bluetongue is an evocatively named disease of ruminants resulting in severe disease in naive sheep not previously exposed to the disease. Caused by a virus from the family that includes African Horse Sickness, it is widespread in the tropics and subtropics, and is spread by biting midges. For the last century, Europe was mostly bluetongue-free and brief incursions of the disease did not establish it. But since 1998, there has been at least one serotype of bluetongue virus (BTV) active in Europe every year with serious impacts. For example, two epidemic waves in Italy at the start of this century resulted in the death of around 100,000 sheep and an outbreak in Holland a few years later had net costs of 200 million Euros (Vetlthuis *et al.* 2010).

There is a substantial body of evidence linking this emergence to climate change and bluetongue is often taken as the harbinger of the exotic diseases set to invade Europe as climate change creates new niches for nasty diseases. This may be alarmist; bluetongue differs from most of the other livestock plagues discussed in this chapter in important ways: it is not contagious; it is not highly-lethal; it is not easily detected; it has a wide range of hosts (including wildlife); and the midge vector is highly abundant. All these factors make bluetongue a worse candidate for control than other plagues long eliminated from richer countries (rinderpest, CBPP, sheep and goat pox, classical swine fever).

While climate change will undoubtedly bring changes in disease distribution, as the world gets warmer it also gets richer. From a centuries long perspective, the overall trend is the world is becoming richer and disease control better (albeit with local and temporary setbacks). Most diseases occur in areas which are hot, wet, and poor. If they are not comparatively poor, then they tend to have disease levels comparable to non-tropical rich countries (e.g. Singapore and Hong Kong). Malaria, an old zoonosis, is also the most important climate-sensitive disease. However, studies show that while Malaysia became steadily warmer over the last 50 years, malaria has dramatically declined (Sian 2000). Development explains the difference.

A series of malaria control programmes along with better diagnosis and treatment, changing environments, and increasing wealth has led to a dramatic decline in cases. Of course, the helpful assurance that being richer in the future and hence healthier is little consolation for climate change affected people today. The poorest countries, which have contributed least to the phenomenon of climate change, are most likely suffer from climate-mediated change in disease distribution.

Box 31.1 ends

MANAGING LIVESTOCK PLAGUES

Past Livestock Plague Management

The essentials of livestock plague control have been known for centuries. Quarantine, import bans, identification of suspicious animals and premises, duty of reporting (and punishment, sometimes capital, for failure to do so), isolation, compulsory slaughter, disinfection and compensation can be traced back to mediaeval times and before (Blancou 2003). But, as for the human epidemics, control attempts of the past were often ineffective in the face of ignorance and panic responses from frightened populaces. There are some exceptions that teach the important lesson that controlling livestock epidemics does not require modern technology or 21st century institutions. For example, rinderpest was successfully controlled in the Papal States (1712–1715) by movement controls and quarantine rigorously applied (Barrett *et al.* 2006).

Developments and events of the nineteenth century improved the prospects for eradicating livestock plagues. Germ theory provided a scientific rationale for unpopular quarantine and culling, the emergence of a veterinary profession supplied human resources for the war against disease, the formation of state veterinary services allowed centralised and organised controls, widespread public concern over livestock plagues, and increasingly interventionist governments were all factors. Technological advance in the age of empire created a lot of the problem as massive numbers of animals moved by ship and rail around the world were responsible for a huge upsurge in livestock plagues.

In a nice example of finally getting rid of a disease long prone to troubling incursions, cattle plague was eliminated from Britain in 1898 after an 8 year long extensive, centrally directed campaigning, involving ruthless tracing and destruction of infected cattle. The US declared freedom of infection from contagious bovine pleuropneumonia in 1892, foot-and-mouth disease in 1929, babesiosis in 1943, screwworm in 1959, and classical swine fever in 1978, while similar successes were achieved in Australia, New Zealand, Canada, parts of Europe and parts of Latin America.

The achievements in the eradication of livestock plagues from more developed countries in the last centuries shows that top-down, hierarchies, operating military style campaigns with minimal stakeholder consultation and lots of resources can be quite effective at controlling disease. Fortunately (or not) veterinary services in rich countries no longer have the liberty of ignoring considerations of animal welfare, environmental impacts and society approval in their zeal to control livestock plagues.

Present Day Livestock Plague Management

Plagues know no boundaries and modern management is increasingly transnational. At the global level, three organisations have mandates that cover livestock epidemics. The World Organization for Animal Health (OIE) has a global mandate to set standards for trade in animals and animal products (see also Box 31.2). More recently, it has expanded its mission to cover food safety, animal welfare, veterinary services and support to animal disease control. The Food and Agriculture Organization of the United Nations (FAO) has had a long involvement in livestock epidemics. Its programme Emergency Prevention System (EMPRES) for Transboundary Animal and Plant Pests and Diseases aims to minimise the risk of emergencies developing and focuses on five livestock plagues (indicated in Table 31.1). The World Health Organization (WHO) is concerned with livestock plagues that are also zoonoses or have potential to evolve into human pandemics. Together, the so-called 'three sisters' of WHO, FAO and OIE operate the Global Early Warning and Response System (GLEWS) which has the objective of improving coordination for identification and management of major animal diseases and zoonoses (25 in total, see Table 31.1 for livestock plagues).

Box 31.2 starts

Box 31.2 The Impacts of Epidemics: Trading Our Way Out of Poverty with Livestock. Or Not?

Many livestock-rich African countries are excited about the prospects of export to the high-value meat markets of rich countries. The Sanitary and Phytosanitary (SPS) regulations that govern international trade are seen at best as a barrier to be scaled and at worst as protectionism through the back-door. The fear is that countries which are members of the World Trade Organization can no longer exclude imports simply to protect their own producers and so have created the fear of livestock plagues to ban livestock and livestock products from poor countries.

More recent research suggests that while some developing countries are hugely successful exporters (e.g. Brazil), most have little competitive or comparative advantage. In particular, most African countries have little competitive advantage in production for high-end markets. It appears that meeting SPS requirements is not the major roadblock, but rather costs of production and ongoing quality assurance. Indeed, some southern African countries including Botswana, Zimbabwe and Namibia export, or have previously exported beef to the EU under a highly favourable trade agreement for developing countries. But despite favourable conditions – relatively good veterinary services, many cattle and few people, a high price and a sure market – none was able to produce enough meat to fill the quota.

A sectoral approach to livestock export has also left unanswered questions about its equity and environmental implications. An economic assessment in Zimbabwe showed the direct impacts foot and mouth disease (FMD) had on the poor and the measures for controlling it are very limited. Although most of the direct costs of FMD control are met by the public sector, the greater part (84 per cent) of benefits is captured by the non-poor commercial sector. Many of the rural poor keep cattle but these are mainly used for asset accumulation and only 2 per cent are traded (Perry *et al.* 2003). A study from neighbouring Botswana found that the veterinary fences that criss-cross the country to control livestock diseases block the migratory pathways of wildlife and contribute to their decline in Botswana (where tourism now contributes more to the economy than beef export) (Mbaiwa 2006).

More encouragingly, recent studies have also underlined the large potential of the domestic, and to a lesser extent regional, markets. In Kenya, for example, domestic beef prices approach the world price and demand is so great that a third of beef consumed comes on the hoof from Tanzania and Ethiopia (Aklilu 2008).

Box 31.2 ends

These global organisations are supported by reporting and/or information systems. OIE maintains the World Animal Health Information Database (WAHID) which covers just seven species (including bees) and 117 infectious livestock diseases many of which are livestock plagues. These are notifiable; that is, there is an obligation for Chief Veterinary Officers of member countries to report to OIE. FAO has developed the Transboundary Animal Disease Information System (TAD-Info) which covers seven important livestock epidemics.

Most regions have a specialised organisation for animal health, for example InterAfrican Bureau for Animal Resources of the African Union, while at national level public veterinary services have the responsibility for the management of animal plagues.

At the national level, veterinary services have traditionally been responsible for livestock plague management. A useful distinction is between preparedness, prevention, surveillance, and response. Table 31.2 summarises some of the activities under these rubrics. In the case of notifiable livestock plagues the initial response is usually to it stamp out. The rationale is that vaccination may not completely effective but will keep disease at such a low rate that it can spread widely and establish in a country. Moreover, because vaccination and disease both lead to an immunological response it is not always possible to differentiate between vaccinated and infected animals and this can interfere with trade. Recently, the veterinary dogma of stamping out has been challenged but it remains the preferred option as a first approach to small outbreaks of exotic disease. Stamping-out involves quarantine of affected farms or areas and the destruction of infected and in-contact animals. Because contacts can be difficult to determine, a cull zone (of up to several kilometres) around the index case is usually recommended. If this proves ineffective then milder control means, such as vaccination may be considered.

Insert Table 31.2

Indigenous Knowledge and Community-based Animal Health Care

While only a few decades ago many scientists and administrators in developing countries thought of farmers as ignorant and erroneous, now there is general acceptance that livestock-keepers can possess a vast storehouse of detailed knowledge about health and indeed every aspect of the animals they depend on (Wanzala *et al.* 2005). Numerous examples exist of farmers' ability to identify and diagnose disease, often recognising signs such as the taste of milk or the smell of an animal that may be missed by western diagnosticians. Livestock-keepers also have a wealth of traditional treatments, mainly plant-based, some of which have been shown to be effective in clinical trials (Mathias 2007).

However, there were no effective remedies against most major epizootics in the pre-modern era. Trypanosomosis was managed by keeping out of the tsetse-infested regions and rinderpest could only be combated by taking the entire herd into a remote area. Livestock keepers managed risk of herd wipe-out by developing elaborate systems of loans, gifts and animal exchange (Blench 2001). An interesting exception is preventive inoculation against CBPP a traditional practice in west and southern Africa. Diseased lung tissue is inserted subcutaneously on the bridge of the nose resulting in a keratinous nasal excrescence. Ignorance of this advanced indigenous technique led a French physician in the late nineteenth century to incur the ridicule of anatomists by reporting that he discovered a new breed of three-horned cattle (Blancou 2003). Treatments for CBPP are of more dubious value: for example, Fulani pastoralists burn cattle over the ribs thinking this may ease breathing and on the nose to prevent foot and mouth disease: painful and useless treatments (Grace 2003).

Most African countries, following the guidelines of the World Animal Health Organisation, require animal treatments to be under veterinary supervision. These countries have typically a few hundred veterinarians, millions of livestock keepers and tens of millions of animals. Consequently, most diagnoses and treatments are made by non-veterinarians, as shown by field studies (Grace *et al.* 2009), so community animal health has been promoted since the 1970s. Experts in livestock are selected by their communities and given from a few days to a few months skills-oriented training in diagnosis and drug use. Evaluations have repeatedly shown the effectiveness and positive impact of this approach. Grace (2001) collates some examples: in conflictridden south Sudan community animal health workers (CAHWs) vaccinated more than 1 million animals a year; in Cambodia five years after training 95 per cent of CAHWs are successfully treating animals; in Indonesia training one CAHW cost 15 US Dollars and the benefits from improved animal productivity were 170 US Dollars per farmer reached. Community animal health programmes have fulfilled only a fraction of their potential, as public veterinary services lack resources and interest in supporting them and private veterinarians oppose them as actual or potential competitors (IDL 2003).

Future Livestock Plague Management

Extrapolating the trends of the past can give insights into the future (at the risk of missing the major discontinuities more likely to shape it). A key trend of recent decades has been the greater integration of human and veterinary medicine. One Health One World (OHOW) is a growing movement built around the premise that the health of humans, animals and the environment are inextricably interlinked and that disease is best managed in broad and inter-disciplinary collaborations. An obvious positive development from the 1997 avian influenza pandemic has been a visible need for better coordination between livestock, wildlife and human health services, and more support to the OWOH concept. Ecohealth is another integrative framework covering human, animal and ecosystem health and with a strong emphasis on links between scientists, communities and policy makers.

Another noteworthy trend is the democratisation of disease control. Increasing participation from a wider range of people has led to novel perspectives being introduced to livestock plague control such as the need to ensure animal welfare and to consider impacts on women and poor farmers. For example, over the last decade, hundreds of thousands of dogs in Chinese cities have been clubbed to death in attempts to control of rabies. But this traditional and very ineffective way of rabies control, is now evoking non-traditional responses: in Beijing, over 500 people protested on the city's streets, and a petition of over 60,000 signatures was presented to the government and the draft of China's first animal welfare legislation received over 80 per cent online approval when it was released in September 2009 (China.org.cn 2010).

There has also been a surge in novel surveillance and reporting tools which draw on a far wider range of field reports, that the traditional state veterinary officers, for example the Program for Monitoring Emerging Diseases (ProMed) (http://www.promedmail.org), GeoChat (http://instedd.org/geochat) and HealthMap (http://www.healthmap.org). But old diseases continue to thrive in the face of new technologies. The resurgence of CBPP, peste des petits ruminants and African swine fever in and out of Africa, the breakdown of livestock plague control in Zimbabwe, the failure to control to avian influenza in poor countries where circumstances are propitious to its endemicity, the spread of climate sensitive diseases such as Rift Valley fever and bluetongue -- all these should prompt a rethink of animal disease control. Bottom-up approaches such as community-based animal health have been highly successful in getting animal health services to poor farmers at prices they can afford. Yet global as well as national veterinary policy still too often discourages these appropriate and inexpensive alternatives to scarce and expensive veterinarians.

CONCLUSION

The struggle with epizootics continues and has even intensified in recent times. Population-decimating animal plagues, such as contagious bovine pleuropneumonia, peste des petits ruminants, swine fever, Newcastle disease and avian influenza, continue to have lethal and devastating impacts on livestock and livelihoods. Livestock plagues are also shifting and emerging while climate change, urbanisation, migrations, genetically modified crops and rapid land use changes are examples of wild cards which could alter the present distribution for the disease dramatically for the worse. The declaration of an era of epidemics, though, might be premature. In richer countries, dependence on livestock is low, resources exist to effectively control disease and non-communicable diseases associated with modern farming systems (such as lameness and reproductive problems) production pose the greatest problem to animal health.

In the developing world, the situation is different. Many people depend on animal agriculture: 700 million people keep livestock and up to 40 per cent of household income depends on livestock. Animal and human disease outbreaks are far more frequent, both for infections well controlled elsewhere and for emerging diseases. In the poorest countries in Africa, livestock plagues that were better controlled in the past are regaining ground. Paradoxically, the fear of epizootics is much higher among the worried well in rich countries, who are highly concerned about the diseases they are very unlikely to fall sick or die of. Thankfully this enlightened self-interest is providing more support for control of epizootics in poor countries. But it appears that while the centralised control of livestock plagues is effective (albeit, at high-cost) in richer countries, it struggles in the poorest. New approaches are not only needed but need to be rapidly tested and made available. What is required now is the vision and courage to transcend sectoral and conventional veterinary approaches and apply innovations to these urgent problems.