Emerging Diseases of Africa and the Middle East

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ABSTRACT: The term "emerging diseases" has been used recently to refer to different scenarios, all of which indicate changes in the dynamics of disease in the population. Of the OIE List A diseases, major changes have been experienced with rinderpest, peste des petit ruminants (PPR), contagious bovine pleuropneumonia (CBPP), foot-and-mouth disease, African swine fever, lumpy skin disease, and Rift Valley fever. Rinderpest represents a success story of the 1990s, thanks to the programs of the Pan African Rinderpest Campaign (PARC). The situation has changed from that of the 1980s when rinderpest was widespread throughout most of Tropical Africa and the Middle East. PPR is a disease that has become of increasing importance throughout Tropical Africa and the Middle East. CBPP, which had previously been reduced to sporadic incidence within endemic areas, invaded new areas, causing heavy mortality. African swine fever has extended to West Africa and to Madagascar, in both regions resulting in heavy losses. Climatic changes in both East and West Africa were associated with an upsurge of Rift Valley fever. Deficiencies in national veterinary services have contributed to failures in early detection and response; in many regions investigation and diagnosis services have deteriorated. The continuing structural adjustment program for national veterinary services will need to take into account their transformation from providers of services (e.g., vaccinations, medicines) to inspection and quality assurance services. Surveillance, early warning, and disease emergency preparedness will need to be pursued more vigorously in Africa and the Middle East as vital components of national veterinary services.

INTRODUCTION

The term "emerging diseases" has been used in recent times to refer to different scenarios all of which have a component of changes in the dynamics of disease in the population. This presentation will concentrate mainly on such changes in major transboundary epidemic diseases as have manifested themselves in recent times in Africa and the Middle East. Where possible, some of the major factors that might have contributed to such changes will be cited.

Diseases that have exhibited changes in dynamics in recent years have been rinderpest, peste des petits ruminants (PPR), contagious bovine pleuropneumonia

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(CBPP), foot-and-mouth disease (FMD), African swine fever (ASF), Lumpy Skin Disease (LSD) and Rift Valley fever (RVF). These will each be discussed in turn.

RINDERPEST

Two known foci of rinderpest persistence are present in eastern Africa, involving genetically distinct viruses—African Lineages 1 and 2. The ancestral Asian virus—Asian lineage—is known to be persisting in the Arabian Peninsula. There is some uncertainty over a small area covering eastern Turkey and northern Iran/Iraq.

After the second African pandemic of the late 1970s and early 1980s, rinderpest has been pushed back to eastern Africa where its range has resolved essentially into two independent foci of endemic persistence.

African Lineage 1 Rinderpest Virus

This virus lineage is usually characterized by high virulence in cattle. Identification of two foci of virus persistence in northern Ethiopia in the early 1990s enabled focused eradication efforts to be implemented, resulting in their elimination by the end of 1995. The last incursion of rinderpest into Ethiopia from southern Sudan occurred into south-west Ethiopia also in late 1995. Currently the main focus of persistence of African lineage 1 is believed to be the south of Sudan, with a risk of spread to contiguous parts of north-eastern Uganda and north-western Kenya. Ethiopia, Kenya and Uganda have declared the remaining parts as provisionally free from rinderpest. Sudan is also planning to declare the northern parts free.

African Lineage 2 Rinderpest Virus

Lineage 2 rinderpest virus reappeared as a cause of wildlife mortality in south-east Kenya in 1995. The virus is related to others which were circulating in Kenya and Tanzania in the early 1960s. Further incidents of wildlife rinderpest caused by this lineage of virus were detected in 1996, with related disease present in cattle in southern Kenya and northern Tanzania in 1996 to 1997. It is believed that the site of persistence of this lineage of virus is the Somali pastoral herds west of the Juba River. Recently encountered strains belonging to this lineage, and some earlier representatives, exhibit a reduced virulence for cattle whilst retaining full virulence for wildlife, especially African buffaloes and eland.

The Middle East (Asian Lineage)

The Asian lineage continues to be found in several countries of the Arabian Peninsula as a result of either endemic persistence or repeated introductions through trade in livestock from South Asia. Another enigmatic situation is that of sporadic outbreaks reported from Turkey— in 1991, 1994 and 1996. Rinderpest was eradicated from most of the Middle East during the late 1980s and early 1990s. However, the disease persisted in Iraq, up to 1996 in the north, from where it spread to Iran in 1994 and it could have been spread to Turkey from there. Currently, Jordan and Turkey have declared themselves to be provisionally free from rinderpest and most countries in the region are in a position to make similar declarations. The only areas of uncertainty where there might still be infection are the Yemen/Saudi Arabia and the border between Iraq and Turkey.

PESTE DE PETITS RUMINANTS (PPR)

PPR was until relatively recently considered to be limited in distribution to West Africa. However, it is now known to extend throughout most of tropical Africa from Mauritania to Somalia and southwards to Gabon in the west and Sudan/Ethiopia in the east. There is serological evidence that infection may have gained access to northern Kenya and Uganda. In 1998, Tanzania tested 3000 serum samples from small ruminants and found them negative for PPR. At the moment it appears that the SADC countries and north Africa are the only regions still free from PPR. It is prevalent in the Near East and extends in Asia as far eastwards as Bangladesh. It appears that there has been an actual extension of its range as well as increasing etiological differentiation between PPR and other causes of pneumonic disease in sheep and goats.

In the last decade the impact of PPR has been particularly severe in the countries of the Near East and Arabian Peninsula. For example, an extended epidemic in Jordan in the early 1990s occasioned very high morbidity and mortality in sheep and since that time the disease has prevented development of intensive sheep production and fattening schemes intended to improve self-sufficiency and rural income generation. Reports have also been received of widespread PPR in northern Iraq.

Throughout extensive areas of sub-Saharan Africa endemic PPR causes a constant attrition of small ruminants. Superimposed on the endemic pattern have been several more localized, albeit widespread, epidemics as the disease apparently entered populations of livestock which had previously been free. For example, in Ethiopia the disease was first identified in 1991 apparently emanating from the extreme south-west of the country. Spread throughout the low altitude pastoral areas, with the appearance of a virgin-soil epidemic, resulted in major losses of goats which continue. At the same time losses have been high in Eritrea and are suspected to be occurring in Somalia.

CONTAGIOUS BOVINE PLEUROPNEUMONIA (CBPP)

CBPP is present in about 27 African countries—mainly in western, central and eastern Africa. While the disease is endemic in many parts of the continent, it is in eastern and southern Africa that its pattern has changed drastically in recent years.

CBPP has been endemic within the pastoral cattle herds of sub-Saharan Africa for many years. Its control was a key subject of attention for veterinary services this century. Since the inception of internationally co-ordinated rinderpest control programs in the 1960s the routine use of vaccine in mass immunization campaigns may have suppressed, but not eliminated, the incidence of clinical CBPP even where the disease was not itself a specific target for control by other means. In east Africa, CBPP was eradicated in the 1960s from Tanzania and most of southern Uganda and southern Kenya through vaccination and quarantine. Recrudescence of CBPP is now being experienced in all sub-regions of sub-Saharan Africa.

CBBP in Eastern and Central Africa

During the late 1980s and into the 1990s CBPP, aided by civil strife and the breakdown of veterinary infrastructure, spread out from the Karamoja Region of Uganda to reinvade the whole country and spread to neighboring countries. Cattle in Zaire were recognized to be infected in 1989. Tanzania became re-infected after 25 years of freedom from infection in 1990; the disease first appeared in the Loliondo district of Arusha, then it was recorded in 1991 in Kagera and subsequently, from 1993, its geographical distribution became almost countrywide (even to parts of the country where the disease had not occurred for over 50 years). Rwanda recorded infection in 1994 and Burundi was infected in 1997. In 1989/90 CBPP spread from the endemic area into north-east Kenya also invading northern Tanzania through cattle movement. This illustrates the very insidious nature of the disease and the determinant role played by animal movements in its spread. The situation in northern Tanzania was relatively stable for a time despite some local spread, being suppressed by vaccination, until 1993 which saw a dramatic dissemination of the disease throughout Tanzania and back into Kenya. Despite attempts at control the disease is now endemic throughout the country and is still spreading. Infected cattle were detected in northern Zambia in 1998, but the incursion was effectively eliminated.

CBPP in Southern Africa

A geographically distinct focus of CBPP endemicity has been present in Angola for a long time. The endemic area continues into Namibia down to the sanitary cordon fence which protects the south. Infected cattle from this focus introduced CBPP into the west of Zambia in the 1970s, and again in 1997; both introductions were effectively controlled. An introduction into Botswana in 1994 spread rapidly, but was successfully eliminated, albeit at major expense—some 300,000 cattle were slaughtered.

CBPP in West Africa

A different pattern of recrudescence of the disease is taking place is the endemic zones of West Africa. As mentioned earlier, the low coverage with bivalent rinderpest/CBPP vaccine in recent years is one of the major factors having contributed to this recrudescence. Since the demise of rinderpest, CBPP has become the major infectious disease constraint to livestock production. Mauritania was reinvaded in 1995 after some 30 years of apparent freedom. Mali, Burkina Faso, Niger, Côte d'Ivoire, Guinea, Guinea Bissau, Ghana, Nigeria, Togo and Benin have recently experienced numerous outbreaks, which, unlike the previous ones, occurred with high morbidity and case fatality rates. Only Senegal and the Gambia appear to remain free from the disease. Endemicity characterizes the situation in west-central Africa (Cameroon, Chad and Central African Republic).

FOOT-AND-MOUTH DISEASE (FMD)

Foot-and-mouth disease is generally thought of as being endemic throughout most of sub-saharan Africa (where sero-types O, A, C, SAT1 and SAT 2 are predominant) with a zonal freedom having been declared (or to be declared) in some countries of southern Africa. In North Africa, some major changes have occurred in the past few months. An outbreak of foot-and-mouth disease (FMD), type O, has been developing in North Africa since 20 February 1999. The disease was first reported in Algeria where it spread quickly from the east to the west of the country. Isolated outbreaks of the disease have also occurred in Tunisia and Morocco. Until now, the disease has only affected cattle (more particularly beef cattle) and vaccination campaigns organized within the three countries should prevent its spread. The exact origin of the disease is unknown, but nucleotide sequence data showed the causal virus to be similar to strains that have been circulating in West Africa in recent years and to be different from the type O virus in the Middle East.

In the Middle East there have been two notable FMD episodes. The most dramatic recent FMD event in the Middle East is the detection of a new variant of type A virus, initially in 1996 in Iran and since March 1997 in the Asiatic part of Turkey from the provinces of Malatya in Eastern Anatolia and Kutayha in Western Anatolia. Both sets of virus have been found to be almost identical in the 1D (VP1) gene-coding region (nucleotide sequence 475–639) and to be genetically different by about 20% from any other type A isolates in the WRL database. This virus has also been shown to be antigenically distinct and outside the immune cover provided by existing vaccine strains.

An episode, which has attracted relatively little consistent attention, has been the spread of type O virus throughout the Middle East with incursions into European part of Turkey and Greece in 1996. The analysis by the FAO/OIE World Reference Laboratory has shown that a virus strain that was probable introduced in 1994 into Saudi Arabia through trade commodities from South Asia has now become the dominant strain throughout the Middle East. It is believed to have been responsible for outbreaks in Jordan, Syria, Turkey, Iraq, Saudi Arabia and most recently Yemen. Recent epidemics in Iraq, Syria and Yemen have been associated with heavy mortality in lambs.

AFRICAN SWINE FEVER (ASF)

ASF was first described in Kenya in 1921 and later in southern Africa and other central and eastern African countries. In 1973 ASF was reported to have occurred in Nigeria then in 1978 it occurred in Sénégal and later spread to The Gambia where it is suspected that it is endemically present. It is also reported to be endemic in Cameroon, where it was reported in 1982. In 1994, ASF occurred in Mozambique and Kenya. It is thought to be endemic in Mozambique and in parts of other southern African countries, where Argasid ticks serve as vectors.

The situation remained more or less stable throughout the 1980s until an epidemic of ASF moved through western Africa. In April 1996, Côte d'Ivoire reported an outbreak which was eradicated within one year at a cost of about 25% of the pig population. Benin is believed to have become infected in August 1996 and Togo became infected in October 1997. Several outbreaks occurred in the coastal areas where pig farming is important. Nigeria was infected through the areas on the Benin border in October 1997, and the disease continues to move through the country. Cape Verde reported outbreaks in December1997. FAO assistance to the value of some US$2 million has been procured to help these countries.

In December 1998 ASF was reported for the first time in Madagascar. This is the first time that the disease has been reported to the east of continental Africa.

LUMPY SKIN DISEASE

Until the 1950s LSD was confined to southern Africa. It then spread to Madagascar, central and eastern Africa in the 1950s and subsequently to the whole of sub-Saharan Africa. In 1989 it occurred for the first time outside Africa in Israel. In the 1970s and 1980s the disease was relatively mild, but since then, pathogenicity has increased giving rise to extensive epidemics characterized by severe disease with sporadic cases being encountered during inter-epidemic years. In the last nine years, major epidemics have been experienced in Ethiopia, Rwanda, southern Africa, and West Africa. The disease has its major impact on exotic dairy cattle, but has caused significant losses to peri-urban dairy farming with indigenous cattle in West Africa. A pandemic of LSD affected Mali, Guinea, Burkina Faso, Côte d'Ivoire, and Sénégal during 1994/95.

RIFT VALLEY FEVER (RVF)

RVF appears to be restricted to Africa. It was recognized first in the Rift Valley of Kenya at the turn of this century, but the agent was not isolated until 1930. The disease was first observed in southern Africa in 1950. Recurrent viral activity occurs in localized areas in southern and eastern Africa where transmission of RVF virus to ruminants occurs during most years. Most epidemics have occurred in eastern and southern Africa and, until 1977, the furthest north that the disease was known to have occurred was the Sudan. During 1977 and 1978, a major epidemic occurred in the Nile delta and valley in Egypt. A severe epidemic affected the Sénégal river basin in Mauritania and Sénégal in 1987 and again in Egypt in 1993.

Within the Greater Horn of Africa, RVF epidemics have occurred in Rift Valley and Central Provinces of Kenya at prolonged intervals of 5 to 15 years or more over at least 70 years. Northern Tanzania forms part of this disease zone, but RVF occurrence in north-eastern Kenya has been a rare event in the past. Heavy and unseasonable rainfall at the end of 1997 and in early 1998 in eastern Africa, attributed to an El Niño event, provided ideal conditions for the breeding of insect vectors of animal and human diseases and, as a result, a catastrophic Rift Valley Fever (RVF) epidemic affected livestock and humans across at least southern Somalia, Kenya, and northern Tanzania. Abortion in small ruminants and camels was the main presenting feature in livestock. Unusually, a high incidence of a hemorrhagic syndrome was noted in humans occurring mainly in individuals in Somalia and north-east Kenya, although cases also occurred in southern Kenya and possibly northern Tanzania. Elsewhere in Kenya, human cases followed the normal pattern of a transient, relatively mild, influenza-like illness. This was probably the largest and most extensive epidemic of RVF ever experienced. Fear of the disease led to a trade ban imposed by Saudi Arabia on livestock from the affected countries.

In Mauritania, following heavy rains, an outbreak of Rift Valley fever was reported in September 1998. The epidemic peaked in late September/early October. Because climatic conditions favor the emergence of several vector-borne diseases at the same time, it remains difficult to assess the real impact of Rift Valley fever both on human and animal health. However, it seems that livestock was severely affected (storm of abortions in small ruminants and camels), which will have serious economic consequences for the population. At about the same time, RVF was reported in wildlife in a major game reserve in South Africa, and in domestic stock on neighboring farms.

The facts that epidemics of RVF occur at long, irregular intervals of many years and that outbreaks tend to occur simultaneously across an extensive area make it difficult to advocate, and justify the expense of, repeated prophylactic vaccination of susceptible livestock species during the long inter-epidemic periods. A promising approach to resolving this dilemma is the prediction of RVF epidemics. Monitoring of meteorological and remote sensing data, *inter alia*, Cold Cloud Duration (CCD)—a measure of rainfall and Normalized Difference Vegetation Index (NDVI)—a measure of vegetation density/soil moisture, within a geographic information system can indicate when conditions suitable for high vector multiplication are developing; sero-monitoring of livestock can indicate periods of increased viral activity. Prophylactic immunization of livestock combined with vector control could then, conceivably, be applied in time to avert the most serious consequences.

FACTORS INITIATING CHANGES IN DISEASE STATUS

The renewed spread of many major transboundary epidemic diseases in Africa and the Middle East cannot be attributed to biological factors alone. Almost without exception, the deteriorating animal health situation in Africa and the Middle East has gone hand-in-hand with a deterioration in the standards of national veterinary services. These factors can probably be attributed to (a) a change in government priorities with respect to the funding of veterinary services and (b) moves to privatize and restructure veterinary services under structural adjustment programs. While the drive to privatize the provision of animal health services is welcome in principle, it has often not discerned certain control functions as being public goods. Funding to veterinary services for many activities has thus been reduced in real terms in many instances. In addition, restructuring exercises have often disrupted vital chains of command, making veterinary services unable to respond to disease emergencies, even if the funding to do so had been available. Many restructuring systems have not sufficiently taken into account the regulatory and command functions of an effective veterinary service as being distinct from the provision of an extension or technical advisory service.

Conversely, where successes have been achieved in the fight against animal diseases, they have normally been achieved through well-run externally funded projects, or have been supported by properly resourced veterinary services. In addition, other conditions, such as civil strife also contribute to disease spread.

A few examples will serve to illustrate these points:

- *Contagious bovine pleuropneumonia* entered Tanzania, where it was not detected early enough to check its spread. Once it had been detected, the Tanzanian veterinary services, partly because of a lack of resources and partly because of fragmentation (post restructuring), were unable to control the problem. On the other hand, a government-funded eradication operation removed the disease from Botswana; prompt government action supported by the FAO and other donors succeeded in eliminating CBPP from Zambia.

  CBPP remains endemic and uncontrolled in southern Angola owing to an ongoing civil war in the area, from where it spills over into northern Namibia where it is checked by an efficient veterinary service.

  A further problem noted on the CBPP issue was that of vaccine: T1-SR was, until 1995, the vaccine of choice throughout Africa; regrettably it had not been subject to adequate quality control. The use of an ineffective vaccine, coupled with a decline in vaccination coverage against CBPP, almost certainly contributed to the spread of disease.

- *Rinderpest* is essentially a disease of strife-torn countries, and the most stubborn foci—those remaining in Somalia and southern Sudan—remain unconquered, courtesy of two civil wars. The increasing use of participatory epidemiology techniques by non-governmental organizations (NGOs) are proving to be the most effective way to control rinderpest and other epidemic disease in such areas. The success experienced in controlling the recent rinderpest outbreak in Tanzania was largely due to efforts made by external donors and a focused well co-ordinated control and surveillance program, which was controlled through a conventional chain of veterinary command. The great strides made in eradicating rinderpest from large parts of Africa over the past decade have been due to the implementation of the Pan-African Rinderpest Campaign (PARC), which has been highly focused through the technical co-ordination of the Organization of African Unity/Inter-African Bureau for Animal Resources (OAU/IBAR) with funding by the European Commission and the technical support of FAO.

- The spread of *pestes des petit ruminants* and *foot-and-mouth disease* in Iraq has been aided and abetted by a dramatic deterioration in the national veterinary services for many reasons.

It also needs to be said that for all of the diseases mentioned above, the ability of national veterinary services to satisfactorily make and confirm diagnoses is limited. There are severe constraints, both in terms of staff training and resources needed to acquire equipment and reagents.

CONCLUSION

National governments will need to make a clear commitment to adequately financing and properly managing their veterinary services if tangible success is to be achieved with progressive control and eventual eradication of most of the major livestock epidemics from Africa and the Middle East in the years to come. While the technical means to deal with many of these diseases exist, the resources to apply these means, and the veterinary command structure, are often lacking.

Disease surveillance and early warning need to be seen as a function of national veterinary services. Surveillance activities need not impose a drain on resources provided that, in addition to government field staff, other sources of manpower are also harnessed. There are a variety of NGO workers who could be tapped as a source of information, and innovative surveillance methods making use of volunteer community animal health workers could be explored. Farmers themselves should become involved in the process, and adequate sensitization of livestock owners could go a long way to providing valuable surveillance data.

The drawing-up, implementation and management of a national disease surveillance system is clearly a government responsibility and will not be sustained without continuous government involvement.

One of the lessons learned from many recent experiences of disease outbreaks relates not only to a lack of early warning mechanisms, but also to a lack of preparedness. While early warning is essential if a disease is to be checked before it reaches disastrous proportions, no amount of surveillance will suffice, if clear plans to deal with emergencies are not in place. Contingency planning, together with adequate and secure emergency funding, is vital to any early response to a disease report. As with surveillance, it is clear that the drawing-up of contingency plans is the responsibility of national governments, no matter what other role-players may be involved.

Apart from the correct prioritization, funding, and management of animal health programs by national governments, there is also the responsibility of the international community. With visibly effective surveillance and control systems becoming imperative due to the regulations of the World Trade Organisation, it is also essential that the correct climate be created and maintained wherein governments and their veterinary services can operate effectively.

As a first priority, there needs to be a revisiting of structural adjustment programs, and a critical evaluation of their effects on animal health services. A clear distinction needs to be made between production diseases (whose effect is mainly local) and transboundary epidemics (whose effect is international and economically disruptive). Services directed at production diseases can be privatized while those aimed at keeping transboundary diseases in check cannot. The reorganization of veterinary services that takes place under structural adjustment programs does not only lead to a decrease in funding, but often disrupts and fragments veterinary services, turning them into agricultural support mechanisms akin to extension services. Strong chains of command with decisive powers vested in a central veterinary authority are essential to the management of animal health services for transboundary disease control and eradication.

FAO has taken the lead in establishing EMPRES (Emergency Prevention System for transboundary animal and plant diseases and pests), which has, in the past few years, given a great deal of support to FAO member governments in terms of:

- emergency interventions,
- drawing-up of contingency plans,
- the publication of manuals on disease recognition and contingency planning,
- compilation of manuals on surveillance, and
- creation of specialized computer software for disease surveillance (Transboundary Animal Disease information system, or TAD*info*).

The overwhelming response of member countries to the EMPRES program has underlined the need for such a program, and there is no doubt that FAO will remain committed to the direction that it has taken.

However, coping with, controlling and eventually eradicating these transboundary diseases remains a team effort that will involve the livestock owner, governments, NGOs, donor organizations, and the international community.