Improved animal health for poverty reduction and sustainable livelihoods

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EMERGENCY PREVENTION SYSTEM

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Acronyms

AGA	Animal Production and Health Division, FAO
AHS	African horse sickness
ASF	African swine fever
BSE	Bovine spongiform encephalopathy
BT	Bluetongue
CBPP	Contagious bovine pleuropneumonia
CSF	Classical swine fever
DFID	Department for International Development
EMPRES	Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases
ENSO	El Niño southern oscillation
FAO	Food and Agriculture Organization of the United Nations
FMD	Foot-and-mouth disease
GREP	Global Rinderpest Eradication Programme
HACCP	Hazard analysis critical control point
IBD(V)	Infectious bursal disease (virus)
ILRI	International Livestock Research Institute
LDC	Less-developed country
LID	Livestock in Development
ND	Newcastle disease
NGO	Non-governmental organization
OECD	Organisation for Economic Co-operation and Development
OIE	Office International des Epizooties
PIHAM	Integrated Livestock Programme
PPR	Peste des petits ruminants
RT/PCR	Reverse transcription polymerase chain reaction
RVF	Rift Valley fever
SPS	Sanitary and phytosanitary standards of the WTO
SPFS	Special Programme for Food Security
TAD	Transboundary animal disease
VBD	Vector-borne disease
VFU	Veterinary field unit
VPH	Veterinary public health
WRL	World Reference Laboratory
WHO	World Health Organization
WTO	World Trade Organization

Introduction

Animal diseases and veterinary public-health (VPH) problems constitute a major constraint to livestock production and safe utilization of animal products worldwide. This paper describes the serious socio-economic consequences, which include production losses, loss of livelihoods, poverty, food insecurity, restriction of marketing opportunities, disincentives to investment and public-health risks. The most vulnerable groups, for whom animal diseases are particularly devastating, are poor livestock farmers and farming communities.

There has been a resurgence of serious infectious livestock diseases and veterinary public-health problems throughout the world; this trend is likely to continue in the future. There is in addition the challenge of new diseases and new manifestations of existing diseases, the result of changing epidemiological circumstances and changing livestock husbandry and trading patterns. Whilst this is a major challenge for developed and developing countries alike, developing countries are particularly vulnerable. The livelihoods and health of poor livestock farmers and farming communities in such countries are under severe threat.

The 1996 World Food Summit in Rome, therefore, recognizing the need for sustained agricultural production and increased liberalized trade on the one hand and the threat of infectious animal disease epidemics on the other, committed world governments and civil society to:

Seek to ensure effective prevention and progressive control of plant and animal pests and diseases, including especially those which are of transboundary nature, such as rinderpest, cattle tick, foot-and-mouth disease and desert locust, where outbreaks can cause major food shortages, destabilize markets and trigger trade measures, and concurrently promote regional collaboration in plant-pest and animal-disease control and the widespread development and use of integrated pest-management practices.

Endemic, production-limiting diseases are continually present. They are less dramatic but tend nonetheless to make livestock farmers vulnerable to external shocks, which keep them in poverty. Diseases and conditions such as high neonatal mortality, suboptimal birth rates and mastitis reinforce the vicious circle of poverty, because livestock assets do not grow and products for home consumption or sale are not harvested. VPH programmes are often absent in rural areas. Rural dwellers are at high risk for zoonotic diseases because of their continual close contact with their livestock. In some rural populations, the occurrence of diseases such as brucellosis, hydatid disease and other intestinal parasitic diseases are higher than in any other population.

The situation is exacerbated because of declining institutional and other capabilities in many countries to meet increasing problems of animal health and VPH. The paper discusses how national animal-health services may be strengthened, with particular emphasis on policies and delivery systems that will give poor farmers better access to animal-health services, and how innovative tools and solutions may be developed to improve animal health and support poor livestock farmers.

Animal health is directly related to levels of production and safe trade. With demand for animal products set to increase dramatically over the next two decades, producers may benefit through increased trade opportunities. The extent to which producers in poor countries will share these benefits will depend on the production levels they are able to achieve and whether or not their products are accepted as tradable commodities. Animal diseases are important factors in this process.

The Animal Production and Health Division (AGA) of the Food and Agriculture Organization of the United Nations (FAO) has a leading role in driving change to support improved animal health and VPH for poverty reduction and sustainable livelihoods. Proposals are made whereby AGA resources may be used to carry out this vital function, fostering global improvement in animal health and public health.

Chapter 1

Socio-economic consequences for poor livestock farmers of animal diseases and VPH problems

LIVESTOCK, THE POOR AND THE VULNERABLE

Livestock are important in supporting the livelihoods of poor farmers, consumers, traders and labourers throughout the developing world. The greatest impact of livestock in sustainable development designed to help the poor is enhancement of livestock-production systems. Animal diseases are crucial constraints in this: the animals of poor people are particularly vulnerable to disease because of the expense, absence or unsuitability of animal-health and production inputs. The distribution of foot-and-mouth disease (FMD) in the world closely follows poverty indicators (see Box 7). Poor farmers have few animals and few reserves on which to survive during lean times and use for recovery, so the loss of individual animals has a proportionally greater impact.

On a global basis, precise estimates by region and system are being made of the numbers of poor livestock keepers, traders, labourers and consumers, or the livestock animals that contribute to their livelihoods. It is thus necessary to rely on crude aggregate estimates from summary reports, which provide a picture of the importance of livestock to poor people. To explore this with available information, a definition must be made of poor and vulnerable people and how they rely on livestock.

Because of the variety of ways in which human livelihoods are supported, human welfare and poverty have been measured by a number of indicators, none of which are universally satisfactory. Henninger (1998) proposes three groups of indicators: economic, social and enabling environment. Economic indicators include measures of current consumption expenditure, income and wealth. Social indicators include access to adequate nutrition, energy, education and health and sanitation services. Enabling environment considers important issues such as vulnerability and access to resources and markets.

Despite serious limitations, absolute economic indicators of income are the most widely used poverty indicators. An income of less than US$1 per day is the most common value for global analyses. People marginally above this threshold, at US$2 per day for example, clearly have little capacity to avoid becoming destitute should misfortune strike. The limitations of this monetary income indicator are that it fails to capture unmarketed and unpriced goods that sustain most rural people and it does not reflect differential prices of goods. To account for this latter constraint, some analysts have used a weighted measure of income as a function of average purchasing power, parity income and income inequality for a country to assess relative poverty. Countries with greater income inequality have lower-weighted average incomes.

Social indicators, although harder to measure, give a better description of the impacts of poverty. Nutritional indicators have been developed, such as caloric intake or chronic undernutrition (see World Food Summit report, 1996, country-level map; www.fao.org). These – birth weight, height and weight in relation to age – are frequently assessed in children. Other social indicators of critical goods and services of value to poor people are:

- health: infant, child and maternal mortality, life expectancy;
- education: literacy rate, primary school completion;
- sanitation: morbidity due to water-borne diseases.

There has been a much greater awareness and analysis of enabling environments, particularly risk and vulnerability, in recent years.

Two main approaches to assessing vulnerability are used:

- food-insecurity measures based on socio-economic and remotely-sensed vegetation data;
- key information interviews from relatively homogeneous livelihood systems.

As people's livelihoods depend on day-to-day availability of basic needs rather than average income, assessment of short- and longer-term risks and related coping mechanisms are crucial human-welfare issues. Components of risk that make people vulnerable include:

- environmental: droughts, flood, pests;
- market: price changes, loss of markets;
- political: civil strife, insecurity;
- social: marginalization of groups or individuals;
- health: diseases that prevent earning a livelihood.

Table 1. **Number of rural poor (1 000s) by region and livestock-production system** (Thornton *et al.*, 2000)**.**

	Number (proportion) of rural poor									Urban	Total
	LGT	LGH	LGA	MRT	MRH	MRA	MIT	MIH	MIA	Poor	
SSA	13 872	23 505	39 971	29 326	96 676	35 870	0	0	3 033	38 763	**280 927**
		(46)	(51)	(53)	(66)	(52)	(51)			(71)	
LAC	7 258	7 359	4 069	10 270	27 001	10 696	4 407	1 002	2 204	105 349	**179 615**
		(38)	(28)	(31)	(43)	(44)	(44)	(34)	(34)	(30)	
WANA	1 991	0	2 347	0	0	16 582	0	0	17 035	41 846	**79 800**
		(27)		(23)			(25)			(24)	
SA	0	2 117	0	0	40 526	88 922	0	120 768	156 352	104 793	**513 478**
			(40)			(40)	(40)		(61)	(37)	
SEA	0	0	0	0	34 568	0	0	82 953	1 176	26 949	**145 645**
						(34)			(30)	(30)	
EA	8 657	16 228	323	18 113	11 277	0	23 258	35 721	0	28 165	**141 802**
		(12)	(11)	(11)	(11)			(11)	(12)		
Sum	**31 778**	**49 269**	**46 710**	**57 710**	**210 048**	**152 069**	**27 665**	**240 444**	**179 800**	**345 774**	**1 341 267**

Regions:SSA – sub-Saharan Africa, LAC – Latin America and the Caribbean, WANA – West Asia and North Africa, SA – South Asia, SEA – Southeast Asia.
Livestock production systems: M – mixed, G – grassland-based, R – rainfed, I – irrigated, T – temperate and tropical highland, A – arid and semi-arid, H – humid and subhumid.
Note: Landless systems have not been included in this Table. The proportion of poor in each system is the number of poor people in proportion to the total population in each system.

Table 2. **Numbers (millions) of poor livestock keepers by livestock-production system** (LID, 1999)

Agro-ecological zone	Category of poor livestock-keepers		
	Extensive graziers	Poor rainfed mixed farmers	Landless livestock keepers
Arid or semi-arid	213		63
Temperate (including tropical highlands)		72	85
Humid, subhumid and subtropical		89	
Total	135	407	156*

* Largely in irrigated systems but also in other high population density livestock systems.

Aggregate estimates of correlations between poverty and livestock keeping have been based on the poverty definition of an income of less than US$1 per day. Thornton *et al.* (2000) at the International Livestock Research Institute (ILRI) estimated numbers of rural poor people for each region of the developing world by livestock production system (see Table 1). Livestock production-system categories, excluding landless systems, were defined and are divided into two main groupings: systems in which livestock predominate and mixed systems with livestock.

Livestock in Development (LID) (1999), using slightly different criteria, developed the global estimates of numbers of poor livestock keepers presented in Table 2. Their estimates, which include landless poor as opposed to landless industrial systems, show that livestock contribute to the livelihoods of at least 70 percent of the world's population of rural poor.

The major discrepancies between Thornton's and LID's estimates are that Thornton estimated approximately one-third fewer poor extensive graziers, 80 percent more poor rainfed mixed farmers and excluded landless livestock keepers. The total number of poor livestock keepers was estimated at approximately 800 million in the LID study and 1 billion in Thornton. Both the LID and ILRI estimates highlight the large numbers and proportion of the world's poor in livestock systems, the large numbers of poor livestock keepers in South Asia and sub-Saharan Africa and the significant number of poor livestock keepers in all regions of the developing world.

The type of livestock that supports the livelihoods of poor people varies according to agro-ecological zone, type of livestock system and region of the world. For extensive graziers, who are vulnerable to climate extremes, camels, cattle, small ruminants and yaks can be important. Poor smallholders in mixed farming areas depend mainly on

Table 3. **Village poultry throughout the developing world** (Sonaiya *et al.*, 1997)**.**

	Asset value to poor people of US$5.75 million represents on average 70% of poultry production (greater in poorer countries)
Africa	
Burkina Faso	25 million (majority guinea fowl); US$19.5 million export income
Nigeria	94% of total poultry; 83% of 82 million chickens
Asia	
Bangladesh	90% of total poultry; 74% of households keep poultry (22% landless)
Indonesia	Ducks provide 70% of income from 0.5 ha rice/crop/buffalo/duck
LAC	
Dominican Republic	13% of average animal production income (greater for poor)

poultry (see Table 3) and, when possible, small ruminants and pigs. Cattle and buffalo play a more important role for poor people in animal-traction systems, often as a shared or hired resource. Some livestock species, such as rabbits, pigeons and guinea pigs are not officially accounted for, nor are fish and bushmeat. These and other animal-source foods and products are used by the poor when possible.

ANIMAL DISEASES AND THEIR MULTIPLE IMPACTS ON THE POOR

The transmission, effects and control of animal diseases are manifested in a variety of ways. For the purpose of assessing the impacts of animal diseases on the poor, the following four-category classification captures the key disease groups. Some diseases occur in more than one category.

The categories are:

- Epidemic diseases such as rinderpest, FMD, peste des petits ruminants (PPR), Newcastle disease (ND) and the swine fevers threaten national livestock industries by direct effects. These include high levels of morbidity and mortality, control or eradication programme costs and restrictions to trade in livestock and livestock products. Livestock producers, workers in livestock industries and consumers are all affected.
- Zoonotic diseases such as Rift Valley fever (RVF), brucellosis, hydatid disease, bovine spongiform encephalopathy (BSE) and rabies may have impacts mainly on human health, mainly on animal health or on both. The effects of zoonotic infections on human health are usually greatest on livestock keepers who live in close proximity to their animals, butchers and other workers who handle livestock products.
- Food-borne infections and intoxications such as Escherichia coli 0157 and salmonellosis are a particular problem in more industrialized systems. Their incidence is thus likely to increase in developing countries as livestock production and processing systems become more intensive. Food-borne diseases affect consumers, food processing workers and livestock producers.
- Endemic diseases such as mastitis and pneumonia, and parasitic diseases such as trypanosomiasis and helminthosis, have impacts on livestock keepers and consumers because of productivity losses, control costs and indirect losses. For poor livestock keepers, the effects of endemic diseases, poor nutrition and other livestock-production constraints are intimately linked.

Animal diseases have multiple impacts, which have been highlighted from different perspectives. The impacts of endemic diseases are mainly felt at farm level, while broader economic impacts can occur with epidemic diseases that restrict trade in livestock and livestock products. The occurrence of such diseases impacts both poor and richer livestock producers by marginalizing them from higher-price livestock markets and restricting their capacity for value-added trade. The overall benefits of control of epidemic diseases are greater in rich countries; where resources are available for eradication, it is invariably carried out. Numerous recent examples, however, emphasize that maintenance of disease-free status when the disease occurs elsewhere is risky, for example FMD introductions worldwide and classical swine fever in the Netherlands. When considering pro-poor livestock development, it is necessary to highlight the impacts on the poor of epidemic diseases and their control, which include direct effects (highlighted below) and potential trade benefits. With regard to the latter, benefits and costs vary according to the different livestock sectors. For poor livestock keepers, who pays and who benefits is a crucial question when it comes to planning and targeting control and eradication efforts. How this might be achieved is discussed in Chapter 5.

Figure 1 summarizes the impacts of animal diseases in terms of effects on livestock and other effects within farming systems. Disease effects on livestock include direct effects on productivity, disease-control costs and constraints on

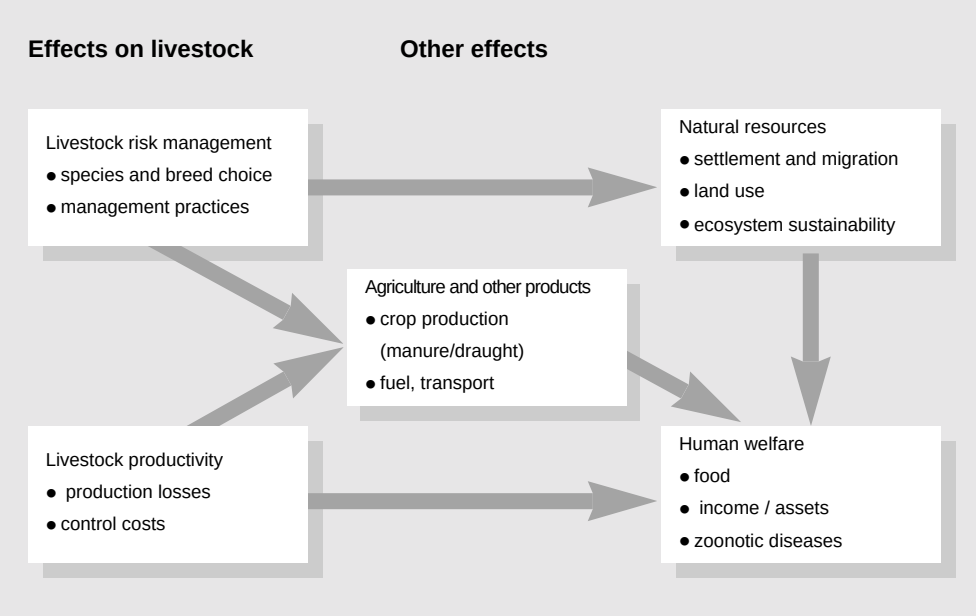


FIGURE 1
Multiple effects of animals disease on livestock, agricultural production, natural resources and human welfare in farming systems (Swallow, 2000).

livestock management including limitations on species and breed choices. Other effects have been divided into three categories: agricultural and other products, natural resources and human-welfare effects.

The direct effects of animal diseases on livestock productivity include reduced feed intake, changes in digestion and metabolism, increased morbidity and mortality and decreased rates of reproduction, weight gain and milk production. These have aggregate effects that limit economically important herd-management decisions regarding animal selection and optimal longevity. Examples are given in Box 8. The interactions between disease, nutrition and genetic selection emphasize the need to control the effects of epidemic and endemic diseases before enhanced nutrition and genetic programmes can make an impact. Substantial productivity and economic gains will not necessarily be achieved by disease control alone.

Considerable costs may be incurred in controlling animal diseases, though the control measures paid for may not always be effective. This is particularly true for smallholder farmers, who often lack information and have limited diagnostic data to make disease-control and treatment decisions. The overall impact of control measures may be constrained by non-compliance of a significant proportion of the community, which highlights the need for regulatory veterinary services supported by legislation and incentives to comply. It is an important principle that the total losses associated with diseases are less important than the cost benefits that can be obtained from different control options. An important loss associated with animal diseases is the cost of non-investment in production inputs and adoption of less profitable risk-management strategies to avoid disease impacts (Swallow, 2000). Such strategies may include reduction in livestock numbers, for example in tsetse-infested versus non-infested areas in sub-Saharan Africa, variations in grazing practices to avoid tsetse infestation and limitations in breed choices, as in the case of trypanotolerant breeds in West Africa.

The importance of livestock in mixed farming systems is indicated by the numerous indirect effects of animal diseases. These include impacts on crop production through decreased nutrient cycling and draught power and loss of products such as fuel and transport. Intensive smallholder farming systems in many regions of the developing world have integrated livestock into other agricultural practices to such an extent that livestock diseases, when they occur, have multiple impacts. Examples of such crop-livestock systems include the volume actually commercialized (VAC) system (integrating homestead, garden, livestock and fishpond) in Vietnam, the smallholder dairy system in the East African highlands (McDermott *et al.*, 1999) and the mixed-crop livestock systems in subhumid West Africa (McDermott *et al.*, 1999). The multiple impacts of trypanosomosis in this latter system are highlighted in Box 1. The integration of livestock into mixed-farming systems is now widely considered to be an essential component for sustainable agricultural development.

Another significant category of livestock-disease impacts is ecological, affecting utilization of natural resources. Livestock animals have been considered harmful to the environment and implicated in a host of environmental sins including desertification, deforestation, global warming and pollution. Control of livestock diseases, particularly large-scale programmes, has thus been the subject of much debate; environmental concerns have had a negative effect

BOX 1

Multiple impacts of trypanosomosis in crop/livestock systems in Africa (Swallow, 2000).

Direct impacts on livestock productivity

- reduced calving rates: 1-12 percent tolerant; 11-20 percent susceptible
- increased calf mortality: 0-10 percent tolerant; 10-20 percent susceptible
- small ruminants: lambing/kidding rates decreased by 4-28 percent/37 percent
- decreased milk production (cow): 10-26 percent tolerant; land-area: 83 percent
- decreased animal offtake (herd): 5-31 percent; land-area: 97 percent
- drug use (sub-Saharan Africa) US$35 million

Impacts on livestock risk management

- decreased cattle numbers: arid 14 percent; subhumid 27 percent; humid 77 percent
- grazing changes

Impacts on agricultural and other products

- decreased draught efficiency: 40 percent
- increased crop production: +25-45 percent per unit land; +140-143 percent per unit labour
- decrease in agricultural production in affected countries from 5-10 percent

Effects on natural resource use

- change in migration/settlement patterns; variable effects
- limited to moderate changes in biodiversity associated with tsetse control

Impacts on human welfare

- loss of income and assets related to impacts above
- livestock reservoir of sleeping sickness: eastern, western and southern Africa; limited importance in central Africa.

on investment in livestock-disease control. This has been especially true of tsetse and trypanosomosis control in Africa. Recent evidence, however, suggests that the environmental impacts of disease-control efforts are not invariably negative; they can be positive or neutral, depending largely on how people choose to manage their livestock in response to reduced disease risk. Considering such relationships is crucial in arid and semi-arid environments, where livestock are usually the main means of utilizing natural resources and where the risk of animal diseases (among other risks) complicates the process. This has important implications for poor livestock keepers, who rely almost exclusively on common natural resources. These resources are constantly declining. It has been estimated, for example, that such resources have declined by 30-50 percent in India from the 1950s to 1982. In temperate highlands, humid and subhumid zones, as described in the previous paragraph, livestock are recognized as playing a catalytic role in enhanced nutrient cycling.

Finally, animal diseases have significant and measurable effects on human welfare. Many of these have been described in considerable detail by Schwabe (1984), particularly the importance of animal products in human nutrition, the social benefits of livestock and the impact of food-borne infections and zoonotic diseases. Animal disease control and livestock products have been shown to have considerable impacts on improving child nutrition among poor people, particularly in pastoralist communities, in which 75 percent or more of general and child nutrition is based on milk and livestock products.

The intensification of livestock systems in many areas of the developing world is expected to increase the transmission and impacts of food-borne infections and intoxications (see Chapter 3). Because of poor surveillance and diagnostic facilities, however, the impacts on consumers, labourers and traders in livestock products are likely to be poorly understood and poorly controlled. Poor consumers currently have to face greater risks from food-borne infections such as anthrax and hydatid disease. Black markets of poorer-quality livestock products exist in many countries. In addition, there will be an increase of new risks of food-borne infections in more industrialized systems, for example by *Salmonella spp.*, *Camplyobacter spp.* and enterotoxigenic coliforms; these are currently seen in the developed world. Increasing levels of drug residues and antibiotic resistance will compound these infections. This will be a serious problem for poor consumers, as they will confront many of the multiple-antibiotic resistant infections seen in western countries

BOX 2

Multiple impacts of brucellosis and an ex-ante assessment of its control by vaccination in Mongolia.

Brucellosis is the second most important infectious disease in Mongolia, after viral hepatitis. Fifty percent of people are considered to be at high risk; infection prevalence in high-risk herders is 16 percent.

At present there are substantial impacts of brucellosis on livestock production, such as abortions and lost milk production, and human health. Brucellosis is a chronic and very debilitating disease in people if it is not treated.

During the 1980s, Mongolia had a mass vaccination programme for brucellosis in livestock that reduced human incidence to very low levels. Recent decline in public-resources, however, has led to a return to the pre-vaccination situation. The ex-ante benefits and costs of vaccination to the health and agricultural sectors were assessed using different scenarios and assumptions. Cost-benefit ratios in the order of ten for the livestock sector, and two for direct health costs were estimated. It was estimated that one year of human disability (disability adjusted life year – DALY) could be avoided for US$34.

This study highlights the importance and benefits of policy changes to enhance inter-sectoral assessment and action for controlling zoonotic diseases.

BOX 3

Assessing and managing milk-borne health risks for the benefit of consumers in Kenya (Omore *et al.*, 1999).

In Kenya, approximately 90 percent of milk is produced by smallholder farmers. Much of this is consumed locally but increasing amounts are being collected, transported and sold in towns and cities by small- and large-scale traders.

Omore *et al.* (1999) assessed a variety of risks associated with different milk-marketing systems. Overall, both raw and pasteurized milk rarely met accepted standards for bacterial counts. Ninety percent of milk reaching consumers was not pasteurized, but 96 percent was boiled before consumption. Worryingly, from 5-15 percent of milk sampled had antibacterial residues; Salmonella and E. coli O157 were only rarely detected, however. Zoonoses (brucellosis and bovine-source tuberculosis) were not detected in milk from smallholder farms but brucellosis antibodies in milk indicate that there is a risk, which increases as milk is collected and bulked from many sources.

This study highlights the trade-offs that will need to be considered, balancing public health and economic benefits to producers, traders and consumers. Two milk-marketing systems are emerging: a formal market for high quality milk and milk products that will require the highest milk-quality standards and an informal market involving small-scale producers and traders who sell unpasteurized milk at a cost one-third less to consumers. The informal sector provides employment to thousands of poor people. The authors recommend measures that will improve the quality and safety of milk from the informal sector through advice to consumers on boiling milk, training and improved handling for small-scale traders, and maintain economic benefits for poor farmers, traders and consumers.

but without the benefit of new-generation antibiotic treatments. The challenge (see Chapter 5) will be to develop risk-assessment and surveillance systems that strike a balance between consumer health protection and cost-effective and equitable marketing systems for livestock and livestock products. Box 3 illustrates the issues for poor milk producers, traders and consumers with respect to the marketing of raw and pasteurized milk in Kenya.

Zoonotic diseases, while not among the top impact human diseases, based on disability-adjusted life years lost, can have tremendous impacts among livestock keepers and workers handling livestock products. One example of many is brucellosis among livestock keepers in Mongolia (see Box 2 for socio-economic estimates of its impacts on human welfare and livestock production).

The benefits of livestock as a regular source of income, in terms of both cash and barter, have been detailed in numerous studies (see LID, 1999), which have shown that poor farmers (small land size or landless) are increasingly relying on livestock as their main source of income. In addition, livestock are often the main way in which poor farmers can acquire real assets, providing a safety factor when difficulties strike. The asset-acquisition pathway usually begins with poultry, followed by small ruminants and pigs, with larger stock such as equids, cattle and buffalo acquired at later stages. Animal diseases are a major constraint to income generation and asset acquisition by the poor, since poor people have limited cash to pay for animal health. The

BOX 4

The FAO/SPFS diversification component and animal disease.

The SPFS is a multidisciplinary programme that combines expertise and experience from a range of fields to promote an integrated, participatory approach to food security. The programme was launched by FAO in 1994 after unanimous approval by the FAO Council at its 106th session and was endorsed at the World Food Summit in 1996.

The SPFS concentrates on improving productivity, stability of production and farmers' incomes and access to food. Short-cycle livestock – poultry, swine and small ruminants – is included in the diversification component to increase the nutritional value and protein content of local diets and improve the household cash-flow situation to regular year-round income.

Diversification into livestock production is at risk from endemic and epidemic diseases of all types. Not least of these are the major transboundary diseases, including PPR, classical swine fever (CSF), African swine fever (ASF) and ND, whose potential for devastation of livestock development programmes has been amply demonstrated in the last decade. Safeguarding investments in livestock development is a challenge which must be taken up.

FAO Special Programme for Food Security (SPFS) recognizes in its diversification component the value of short-cycle livestock farming in alleviating poverty and promotes its development. Care will be needed to prevent the predation of disease from confounding this development (see Box 4).

In addition to improving the welfare of livestock keepers, enhancing livestock production through control of animal diseases can have multiple benefits for poor consumers, traders and labourers. This is particularly true if disease-control and livestock-development benefits are focused on poor livestock keepers such as smallholder mixed farmers and pastoralists. Enhanced livestock production on smallholder farms tends to be labour-intensive, using both surplus family labour and to a lesser extent non-family labour. Improved smallholder dairy production has been shown to increase labour opportunities for small-scale milk traders and to lower transaction costs, resulting in lower milk prices for poor consumers (Omore *et al.*, 2000).

IMPACTS OF ANIMAL DISEASES ON SUSTAINABLE LIVELIHOODS OF THE POOR

Animal diseases have multiple direct and indirect effects on human welfare. In order to achieve a better understanding of the importance of controlling animal diseases from the perspective of poor livestock keepers, however, a sustainable-livelihoods approach is valuable. A key consideration is that to improve livelihoods for poor people directly and effectively, approaches should focus on poor livestock keepers, traders, labourers and consumers. Figure 2 shows a framework developed by the United Kingdom Department for International Development (DFID) in 1999 for assessing sustainable livelihoods. It is particularly useful for understanding the effects of interventions on the poor, because it provides a checklist of important issues, highlights key influences and processes and emphasizes the interactions between factors and interventions that affect the livelihoods of poor people.

This framework for assessing the impact on poor people of animal-health services has been slightly simplified. The three left-hand components of Figure 2 are combined as the socio-political, environmental and institutional context under which individual and collective human, social, natural, physical and financial livelihood assets can be accessed and acquired to meet household and community needs. This allows consideration of individual and collective factors that households face in a range of environmental vulnerability and socio-political situations. Livelihoods are considered within specific contexts based on opportunities, strategies and outcomes (Figure 3).

A livelihood analysis in four steps has been recommended. First, the overall socio-political and environmental context is determined. Second, its ability to support enabling, disabling or neutral capital acquisition is assessed. Third, opportunity costs and option sets within a context are assessed. Fourth, potential livelihood strategies and outcomes based on identified opportunities are assessed. Based on this four-stage approach, impacts of animal diseases will be considered in two contexts: poor smallholder crop/livestock subsistence farmers and poor and vulnerable pastoralists.

In smallholder crop/livestock systems, poor farmers often rely on subsistence crops and smaller livestock species including poultry (chickens, ducks, guinea fowl), rabbits, guinea pigs, small ruminants (goats and sheep) and pigs. Village chickens are owned throughout the developing world by poor farmers, for whom ND is a major constraint. In Box 5, the livelihood issues associated with ND and its control are highlighted.

Other epidemic diseases in smallholder subsistence farming contexts will have similar impacts on the livelihoods of poor

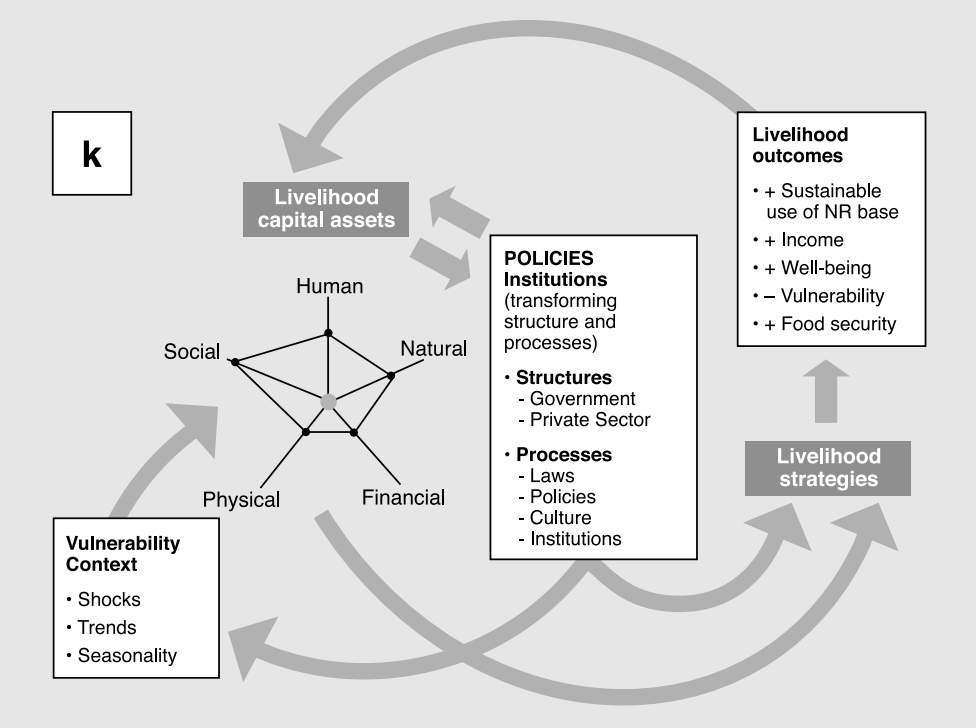


FIGURE 2
Sustainable livelihood framework (DFID, 1999).

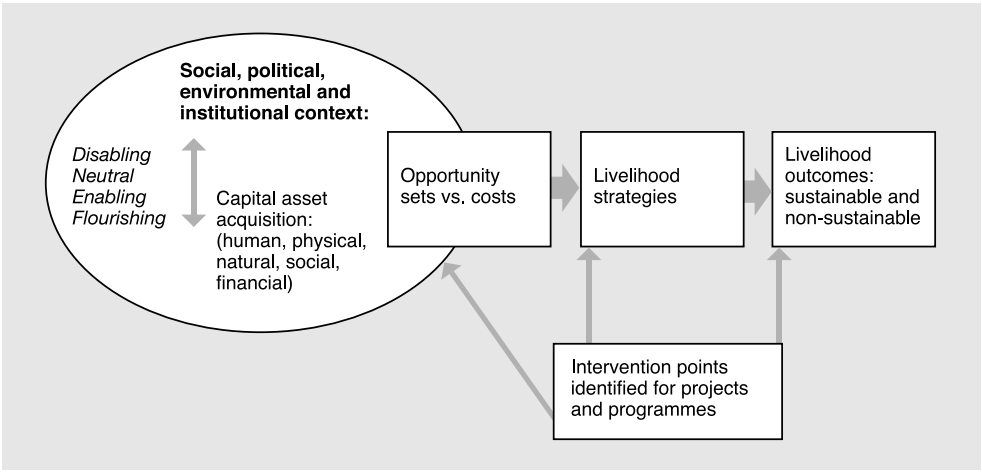


FIGURE 3
Simplified sustainable livelihood framework (Heffernan and Misturelli, 2000).

farmers. Examples of epidemic diseases affecting livestock assets, strategies and outcomes of poor smallholder livestock keepers include CSF in village pigs in Haiti, ASF in village pigs in Nigeria, and PPR in goats and sheep in West Africa. A key sustainable livelihood issue is that option sets are limited and option costs high where there are weak public-sector investment and capacity in disease diagnosis, surveillance and control. Options are also greatly influenced by the extent to which market access for inputs and outputs is constrained.

Pastoralists are another target group for pro-poor and vulnerable livestock developments. Epidemic diseases have had tremendous influences on pastoralists. The greatest of these was the introduction of rinderpest into Africa in the late 19th century, which wiped out 90 percent of the cattle population in most countries. It is hard to overemphasize the extent of the devastation that such epidemics have in pastoralist communities. The importance of cattle, camels and small ruminants for pastoralists is hard for non-pastoralists to appreciate. The statements below give some indication.

On the Dinka of Sudan:

"Cattle play an essential role in Dinka society, providing not only milk and dowry but performing important social functions and determining a man's position and influence in the community. A song bull, while not productive in the sense of providing milk and meat, is a source of great pride, prestige and possible influence. The value of a song bull is determined by an animal's size, colour and shape of the horns. To be Dinka you must own cattle. Cattle provide the means by which kinship ties are made and maintained, a process for ensuring the long term viability of the household and a means

BOX 5

Effects of ND and its control by vaccination on smallholder subsistence poultry farmers throughout the developing world.

Socio-political and environmental context

- Limited input/output systems
- Variety of social networks
- Relatively weak public support institutions for credit, animal health and production inputs
- Markets variable but some local demand

Acquisition of capital

- Village poultry accessible to poor and often provide an effective starting point for acquisition of additional livestock assets (pigs, small ruminants); livestock assets maintain their value in environments with weak banking systems and are crucial in times of crisis such as health emergencies, etc.
- Can be instrumental in providing funds for school fees (human capital); enhanced nutrition, particularly important for child development. Depending on scale, markets for village poultry are relatively robust (physical capital) but will require enhancement for larger-scale production.
- Importance of poultry as social capital; ability to fulfil social obligations. Evaluation of opportunity gives 50 percent mortality rate as main reason for low output; 50 percent of mortalities due to infectious diseases; ND most important and widespread infectious disease of poultry.

Potential options

- Distribution of thermostable ND vaccine in feed (southeast Asia) and by eye drop (Mozambique).
- Enhanced input-output systems including ND vaccination; vaccination, micro-credit, improved breeds and feeds.

Assessment of livelihood strategies and outcomes from opportunity sets

Option A:

- success depends on development of appropriate and very inexpensive vaccine production and distribution systems (being developed and assessed by the Australian Centre for Agricultural Research and partners);
- limited benefits can be captured by poor people in a variety of contexts;
- economic benefits (cost:benefit ratio 14:1) important but limited due to constraints from other limiting inputs and market potential depending on market access.

Option B:

- greater success possible but not everywhere; successfully applied in Bangladesh but needs assessment elsewhere;
- has potential for greatest increase in livelihood outcomes if input delivery and output markets can be developed.

of receiving support and animals in the event of disaster."

On the Karimojong of Uganda:

"The particular status that cattle have and the roles which they fulfil in the social and religious life of the Karimojong explain the psychological basis for the rapport which every herder has with his livestock. A foreigner can never understand why a Karimojong, for example, could commit suicide at the death of his ox. Among all the oxen in the herd there is one which exemplifies the uniqueness of this relationship. It can be recognised by the bell and leather collar on its neck. The herder received it as a gift from his father while it was a calf. He fed it the best he had, sometimes depriving himself of his own food. He sang to his ox in dances and contests with his friends. He defied death in going to rescue his ox from the kraals of the enemies who had raided it. How can such a relationship be defined? Certainly not as an economic relationship. He sees in the ox a friend, a confidant who embodies the pride of the owner, his poetic talents and his warrior ardour. It is thus evident that for the Karimojong, cattle are not a kind of capital from whose interests one can get a means of living. They are something far more important than this."

Livestock dominate the livelihood activities and strategies of pastoralists. In some pastoralist settings, livestock markets are not well developed. In others, livestock marketing is a crucial activity and epidemic diseases can make or break it. An example is the case of RVF affecting pastoralist livestock marketing in the Horn of Africa (see Map 1 and Box 6).

Analyses of livelihoods highlight the importance of livestock and control of livestock diseases as important

BOX 6

Impacts of RVF on livelihoods of livestock keepers and traders in the Horn of Africa.

Socio-political and environmental context

- Harsh natural environment in which livestock are the essential basis of livelihood.
- Complex social and economic networks for livestock production and marketing.
- Very weak public infrastructure for disease diaganosis, surveillance and control.

Acquisition of capital

- Livestock sales instrumental for all other expenditures such as school fees (human capital).
- Major source of regional, national, community and individual financial capital; major livelihood activity in the region (see Map 1).
- Sophisticated private marketing infrastructure (physical capital) susceptible to external disease control regulation.
- Crucial role of livestock as social capital (see above).

Evaluation of opportunity sets

- Disease surveillance.
- Export testing and quarantine.
- Information on risks: did the Near-East RVF outbreak originate from the Horn of Africa? (See Chapter 5)

All of the above will require sophisticated collective and public-sector information systems to mitigate negative effects and enhance livelihoods.

Assessment of livelihood strategies and outcomes from opportunity sets

- Given reliance on livestock export markets, financial and other assets, effects of export ban are devastating: exports decreased by 2 million head from Berbera in Somalia = approximately US$100 million to individuals and communities in the region (February 1998-May 1999).
- Negative impacts of the export ban on livelihood outcomes for the poor have been on livestock keepers, individuals and communities, particularly because of the complex social support network among Somali and other pastoralists (see Catley, 1999) and small-scale livestock traders.
- Effects on consumers were 30 percent lower prices in affected countries, but these did not persist.

BOX 7

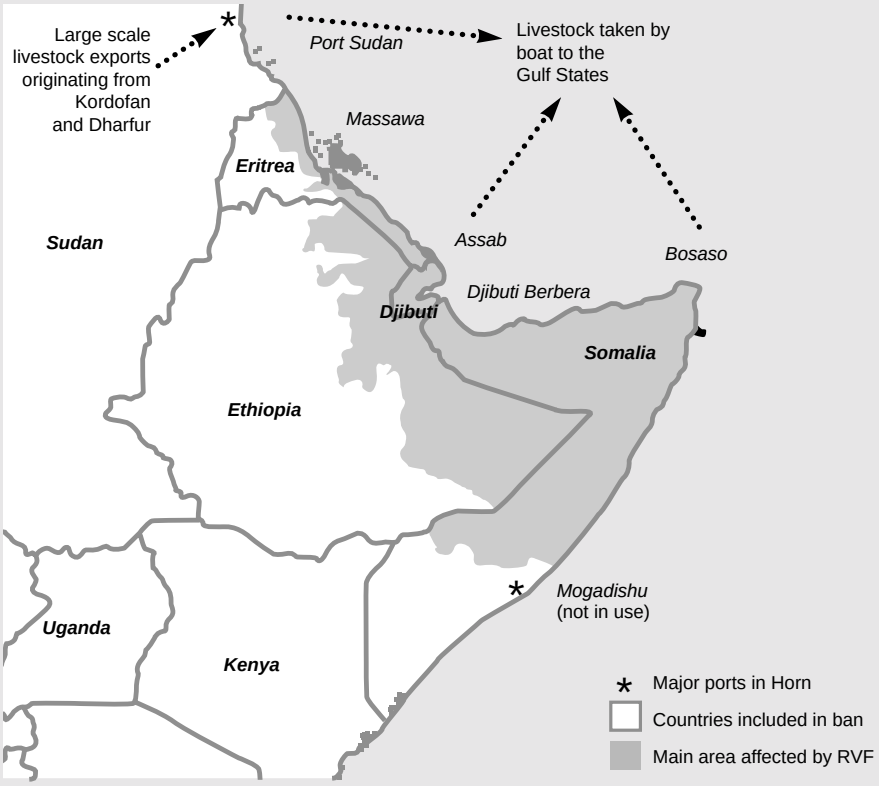
Distribution of FMD

It is probably no accident that the worldwide epidemiology of FMD is almost a mirror image of the global economic structure. The division is as follows:

- **FMD-free group**: equivalent to high-income, industrialized zones;
- **FMD control regions**: mainly middle-income, semi-industrialized countries characterized by medium to high FMD-control activity; South America is the most prominent of these regions;
- FMD endemic group: generally among the least-developed countries, some of which have a high livestock density.

The last group of countries is locked into a vicious cycle: being poor, they do not have the resources to control FMD and enter global trade, while having FMD and not entering trade contributes towards keeping them poor.

contributors to the social and economic wellbeing of the poor, which includes from 650 million (FAO, 2000) to 1 billion people in the developing world (LID, 1999). The control of livestock diseases can and will have measurable impacts on incomes, improved social and physical wellbeing, reduced vulnerability, increased food security and increased options for sustainable management of natural resources. Animal-disease control efforts, particularly those with donor and public support, must take account of the main impacts on the poor noted in this chapter, so that policies, institutions and processes can focus on delivery of services for the benefit of the poor and vulnerable.



MAP 1
Main livestock production areas in the Horn of Africa affected by the RVF export ban (FEWS NET/Greater Horn of Africa).

BOX 8

Examples of economic impact of disease and disease control.

A study of the Bolivian FMD situation in 1995 showed that a successful FMD eradication programme would have the benefit of addressing other livestock-related issues. This would include providing an infrastructure that would enable control of other production-limiting diseases, reducing risks associated with livestock farming and significantly reducing the risk of FMD spreading to neighbouring countries.

An FAO study in1997 showed the positive impact of FMD control at household level in Cambodia, Laos and Viet Nam. This demonstrated that if FMD outbreaks occurred during or immediately prior to land preparation for rice-planting, resulting additional ploughing costs could range from US$8.4 to US$2.8 for the farmers affected, whereas outbreaks outside this period would result in little or no extra ploughing cost. An analysis of peri-urban dairy farming in Vietnam showed that benefits gained from FMD prophylactic activities in areas at risk varied from US$9 to US$29 per cow – an increase of 7-24 percent per cow. The study showed that FMD prevention would improve the gross margin on pigs by a further 15 percent.

A request in April 2001 for emergency assistance by the Government of Bangladesh cites the severe damage done to the country's nascent goat industry by a recent epidemic of PPR.

"Total mortality during the epidemic from 1993 to 1998 is estimated at 7.5 million goats out of a total population of approximately 30 million. … In January 2001 a resurgence of PPR started. … In many villages it appears to be a virgin-soil epidemic; PPR is spreading rapidly, causing high morbidity and mortality rates approximating 50 percent. … In considering the likely impact of this epidemic, it must be stressed that goats are "the poor people's cattle", used for milk, meat and income generation; goat meat is more expensive by weight than beef. The losses impact very heavily on poorer families, for whose livelihoods the raising of goats and poultry is especially important. It is the women and their children who suffer most. Goat breeding and rearing has considerable potential to contribute to poverty alleviation in the diversification of the FAO/SPFS but it will not do so unless the problem of PPR can be overcome. In 1998, farmers refused microcredits from the Grameen Bank in Bangladesh because PPR made such investment a poor risk."

Chapter 2

Trends in animal health: problems and challenges

INTRODUCTION

This chapter describes a number of factors likely to have an impact in the future on the incidence and significance of animal diseases for all livestock farmers, particularly the poor, who are most vulnerable to the ravages of these diseases, and factors likely to impinge on communal and national abilities to counter livestock diseases.

During the 1970s there was hope that the major epidemic diseases of livestock and humans were being brought under control in many countries and practically eliminated from Organisation for Economic Co-operation and Development (OECD) countries. Most predictions emphasized the increasing importance of endemic and productivity-limiting non-infectious diseases with a concomitant reduction in the relevance of epidemic diseases to livestock production. With increasing intensive livestock farming in the industrialized world, it was believed that at worst infectious diseases could be confined to the least developed parts of the world and therefore would have little impact on development, food security and trade.

During the last 15 years, however, infectious and vector-borne animal diseases have become increasingly important worldwide and disease emergencies are occurring with increasing frequency. Even industrialized nations have been affected. In 1997, the World Health Organization (WHO) observed, of human health:

"Experience has shown that reducing resources to control infectious diseases in favour of other priorities leads to the resurgence of disease and can create problems more widespread and costly than before."

This is equally true of animal health, as is borne out by recent examples of outbreaks of old diseases, newly recognized diseases and re-emerging or evolving diseases. Some examples are summarized in Box 9.

IMPACT OF STRUCTURAL ADJUSTMENT PROGRAMMES

The collective geographical location of livestock diseases of major economic importance – FMD, rinderpest, Contagious bovine pleuropneumonia (CBPP), CSF, ASF, sheep and goat pox, trypanosomosis, tick-borne diseases, ND and probably Infectious bursal disease (IBD) – extends from Africa across the Near East and into Asia, encompassing many of the poorer countries of the world. Sustained control of these diseases requires:

- socio-political stability;
- access to all livestock by veterinary personnel;
- input of resources to supply and deliver vaccines;
- maintainance of effective surveillance systems to detect suspected cases at an early stage;
- provision of trained manpower and resources to implement disease-control strategies in the event of outbreaks.

Most countries across this sector of the globe do not have the resources to support all of those elements, so they resort to strategic approaches. The national veterinary services in developing countries have, like other departments, to compete for scarce resources; unfortunately they are often politically weak and fare badly when the cake is cut up. Furthermore, economic structural adjustment programmes have tended in several cases to weaken the administrative, legal and financial capacity for dealing with major animal diseases. Progress in the control of animal diseases in many developing countries has consequently become a tediously slow and unpredictable business.

In the immediate postcolonial period of the 1960s, the public-sector veterinary services of most developing countries were engaged in delivery of the full range of veterinary activities and services with little or no participation by the private sector. By the mid-1970s, many countries were experiencing serious economic difficulties and starting to seek financial remedial assistance. It was felt that the rescue lay in structural adjustment of their economies. Changes in fiscal, financial and pricing policy included elimination of subsidies and removal of tariffs; institutional reforms included privatization of government-owned enterprises and the introduction of cost recovery. It was argued that in seeking to move services from public to private sectors, in most domains any form of private enterprise is likely to outperform the public sector. This led to a drive for the privatization of veterinary services, with the aim of diminishing drastically the role of the state in these activities. Animal health was seen as a private good and veterinary

BOX 9

Examples of recent epidemics of transboundary animal diseases (TADs)

Rinderpest is perhaps the most serious cattle plague. The optimism of the 1970s was shattered when during the 1980s rinderpest spread throughout south Asia, the Near East and tropical Africa, affecting cattle, buffalo and wildlife. The disease has come under control again, thanks to an international partnership through the Global Rinderpest Eradication Programme (GREP). It is currently confined to three isolated ecosystems: southern Somalia, southern Sudan and parts of southern Pakistan. The success of GREP will depend on whether rinderpest can be eliminated from these foci before the end of 2003, otherwise there remains a risk that it could flare up again as it did in the 1980s.

FMD is a highly contagious virus disease of cloven-hoofed animals. There are seven distinct types of FMD virus. It is the animal disease with the greatest impact on international trade. The OECD countries are normally free from this disease, but it is endemic in less-developed countries (LDCs). The endemic distribution of the seven types of FMD is broadly as follows: Type O: Asia, Africa, the Near East and South America; Type A: Asia, Africa, the Near East and South America; Type C: Asia, Africa, South America (this type occurs rarely and tends to be sporadic); Type Asia 1: Asia; Types SAT 1, SAT 2 and SAT 3: Africa. In recent years, serious epidemics of FMD have occurred outside areas of endemicity, causing major economic losses. Examples are: Type O in Taiwan province of China in 1997 and again in 2000; Type O pan-Asian topotype, which over 10 years spread eastwards from south Asia to China, Japan, South Korea, Viet Nam, Cambodia and Taiwan Province of China and westwards to the Near East and south-east Europe; during 2000-2001, it leapt to South Africa, the United Kingdom, France, the Netherlands and Ireland. Type SAT 2 spread to Saudi Arabia in 2000, which is the first time this type has been recorded outside Africa.

PPR was until recently considered to be limited to West Africa. It is now, however, the most evolving epidemic of small ruminants. It has extended throughout sub-Saharan Africa from Mauritania to Somalia and southwards to the coastal belt of the Congo Republic in the west and Sudan, Ethiopia and Somalia in the east. In the Near East there have been serious epidemics in Jordan, Saudi Arabia and Iraq and now PPR has extended as far west as Turkey, which borders Europe; it now extends as far eastwards as Bangladesh. It appears that there has been an actual extension of its range as well as increasing aetiological differentiation between PPR and other causes of pneumonic disease in sheep and goats. In India, many cases in sheep formerly ascribed to rinderpest are now known to have been caused by PPR. It has been responsible for heavy losses in small ruminants in Nepal, Pakistan, India and Bangladesh.

CBPP is a serious mycoplasmal disease of cattle. There has been a catastrophic spread of CBPP over the last few years in Africa, where it now affects 27 countries and causes losses estimated at US$2 billion annually. In 1995, the disease was reintroduced to Botswana for the first time in 46 years. As part of the eradication campaign, all cattle (approximately 320 000) in an area of northern Botswana had to be slaughtered at a direct cost of US$100 million; indirect losses were over US$400 million.

CSF is a generalized virus disease affecting only pigs. It is endemic throughout many of the swine-rearing areas of the world. It is a major and constant constraint to swine production in the countries of eastern and southeast Asia. It has been endemic in some Latin American countries and Cuba since the 1980s. In 1996 it was introduced into Haiti, causing major losses, and is now endemic there. It has spread to the Dominican Republic. In 1998, outbreaks were reported in Costa Rica. CSF is a disease that poses a serious threat to the swine industry of the Americas. It is practically absent from the continental part of the Americas, so the recent epidemic in the Caribbean is seen as a serious threat to North America and South America as well as non-infected Caribbean countries. In Europe, the most serious recent epidemics have been in Germany, the Netherlands, Spain and the United Kingdom. Molecular genetic studies indicated that the causal virus strain was more related to those isolated from southeast Asia than those circulating in wild suidae in Europe.

ASF is another generalized virus disease affecting pigs. It is endemic in southern and eastern Africa, where it is maintained in an endemic cycle involving soft ticks (Ornthodorus moubata) and wild suidae (warthogs and bushpigs). Since the mid-1990s, there have been serious outbreaks in areas which either had never experienced ASF before or had not had outbreaks for a long time. In 1994, for example, ASF moved from the endemic area in northern Mozambique to Maputo and devastated the pig population, killing

80 per cent of the estimated 4 000 pigs in the area. In 1996 it occurred for the first time in Côte d'Ivoire, where it killed 25 percent of the pig population and, according to various estimates, cost the country between US$13 million and US$32 million in direct and indirect losses and eradication costs. There has since been serious spread of ASF to Togo, Benin, Gambia and Nigeria. In 1999 the disease spread to Ghana, where it has since been eradicated.

ND is one of the most important viral diseases of poultry. The history of ND is marked by at least three pandemics in domestic birds. The first began with the emergence of the disease in fowl in the middle of the 1920s and spread slowly from Asia throughout the world. The second outbreak appeared to emerge in fowl in the Near East in the late 1960s, reaching all continents by the mid-1970s. A third outbreak in the 1970s, also starting in the Near East, was associated with a mainly neurotropic and viscerotropic velogenic disease in pigeons. We are currently witnessing the fourth panzootic. Since 1991, there has been an increase in incidence with a series of related outbreaks affecting poultry in many European countries. Iran, India and southeast Asia were hit by the worst epidemic ever reported. In 1999, the panzootic reached the American continent and Australia. ND is regarded as endemic or epidemic almost all over the world.

IBD/Gumboro emerged in 1957 as a clinical entity responsible for acute morbidity and mortality in broilers in the United States of America. The disease has now been reported in most parts of the world and is widespread in commercial chickens as well as scavenging chickens. IBD is caused by infectious bursal disease virus (IBDV). Recently, IBDV isolates were described in the United States of America and Europe displaying an antigenic drift. These new "hot" isolates are very virulent for chickens. The disease has an acute stage followed by immunosuppression, resulting in lowered resistance to a variety of infectious agents and poor response to commonly used vaccines. The acute stage of the disease and the immunosuppression that follows are major factors contributing to its economic significance.

services were seen essentially as providing an animal healthcare delivery system. The sale of veterinary medicines and vaccines, provision of clinical services or vaccinations were thus uppermost in implementing the privatization programme. Surveillance, early warning, laboratory diagnostic services, planning, regulation and management of disease-control programmes and assurance of the quality and safety of animal products became secondary considerations. The concepts of control of epidemic and trade-related diseases and the international obligation to manage and report on these diseases were lost. As a result of restructuring and decentralization, government veterinary officers were often placed under the control of regional and local authorities within a general agricultural extension system. The chain of veterinary command requiring notification of disease outbreaks to respond to disease emergencies and manage national disease-control programmes was often effectively dismantled.

The combination of poor financial resources and an inadequately organized national veterinary service has often led to deterioration in animal-health services, with epidemic diseases frequently spreading unchecked. The resurgence and unchecked spread of CBPP in many parts of Africa can often be related to the breakdown of national veterinary services. Control of ticks and tick-borne diseases has deteriorated, in many cases along with provision of healthcare to pastoral communities. Privatization has, however, improved availability of veterinary drugs and vaccines for peri-urban farming communities who could reasonably afford the cost of private service. There are examples where involvement of the private sector has actually improved control of epidemic diseases. The most notable is the case of countries of the Mercosur of South America. Here, the private farming and trading sectors became involved in the planning and monitoring of disease-control programmes, exerting pressure on governments to the extent that the efficiency of public-sector supervision and regulation actually improved. As a result, South America has made great strides in FMD control and government services have been able to react resolutely to disease emergencies. Another example is provided by the Indian National Dairy Development Corporation's involvement in FMD control on members' farms.

There is an increasing realization today that structural adjustment programmes for sector reforms have not consistently resulted in adequate provision by the private sector and civil society of essential services and markets once provided by the state. The reasons are complex, but the result is that the great majority of the rural poor do not yet enjoy access to the range and quality of services and markets that they need to support a robust livestock-related livelihood. There is increasing realization that a balance needs to be struck between developing a robust private

veterinary sector, providing animal healthcare services to the vulnerable poor groups and securing a responsible and effective public-sector regulatory service for aspects of animal health that affect the public.

THE IMPACT OF POLITICAL AND SOCIAL INSTABILITY ON ANIMAL HEALTH

When political upheaval leads to conflict, the consequences for disease-control programmes can be catastrophic. For example, following the Gulf War and the military offensive by the Iraq government forces against the rebellious Kurds in the north, there was mass migration into Turkey. The refugees took as many of their animals as possible with them and in doing so introduced rinderpest into Turkey's susceptible livestock population. Turkish farmers in the southeast, rushing to dispose of their sick animals as quickly as possible, spread the disease through the marketing chain to Ankara and as far west as the Sea of Marmara. Similarly, the 1994 upheaval in Rwanda was followed by sudden and heavy migrations of people and livestock. This was followed by widespread outbreaks of FMD and CBPP in southern Uganda, Rwanda, northwestern Tanzania and eastern Congo. In Somalia and southern Sudan, the conflicts have been hindering the progress of GREP, because vaccinators have been denied access to livestock, kidnapped for ransom or robbed and killed. As a consequence, the control campaigns have been severely disrupted. The continued occurrence of rinderpest in these countries is a matter of great concern both for the countries themselves and for the region, especially disease-free neighbouring countries, which are ceasing vaccination so that they can move along the Office International des Epizooties (OIE) pathway and achieve the goal of freedom from infection.

There are strong associations between political upheaval, civil strife and increased incidence of disease. Predicting conflicts is not easy, but judged by the experience of Africa and Asia the trend seems to be in an upward direction. This does not bode well for the animal-disease situation in affected countries or in neighbouring countries. Attending to animal health through professionally guided community-based programmes will need to be an increasing component of humanitarian programmes in conflict-affected areas in order to avoid major epizootics.

EFFECT OF CLIMATIC CHANGE ON ANIMAL DISEASES

Climatic factors can have a major effect on the rate of transmission of many infectious diseases. Microbial agents and their vector organisms are sensitive to factors such as temperature, humidity, precipitation, surface water, wind and changes in vegetation. This applies particularly to vector-borne diseases (VBDs) such as RVF, transmitted by mosquitoes, African horse sickness (AHS) and BT, both transmitted by biting midges (Culicoides spp), ASF, East Coast fever, anaplasmosis, babesiosis and Nairobi sheep disease, both transmitted by ticks, and trypanosomosis, transmitted by tsetse flies. Lumpy skin disease has long been suspected of being transmitted by arthropod vectors. In general, increased temperature and moisture will enhance transmission. It is projected, therefore, that climate changes and altered weather patterns will affect the range, intensity, and seasonality of vector-borne and other infectious diseases.

Considerable progress has been made in investigating and defining the climatic and environmental factors that influence vector biology. The data has generally been obtained by a combination of field and laboratory studies. These approaches, combined with satellite remote sensing, geographical information systems and biomathematical modelling, could be used to develop models to predict when and where disease outbreaks are likely to occur and how the situation might alter with climate change. Armed with this information, control strategies, such as the use of prophylactic vaccination and vector control, could be used to protect animals in advance of the spread of a disease and thereby reduce its impact.

Successful attempts have been made, for example, to model the abundance and distribution in southern Africa of Culicoides imicola, the vector midge of AHS and BT viruses. The abundance of C. imicola and associated climate data have been analysed in combination with satellite-derived variables with the aim of developing models of C. imicola abundance to predict risks of AHS and BT. Similarly, for the 1997/98 RVF in eastern Africa, an examination of the satellite remote sensing images could readily identify areas for intensive ground surveillance for RVF and other VBDs.

Some VBDs are zoonotic diseases and cause serious illness and death in humans. Climate change is likely to increase the prevalence and incidence of such diseases, either geographically or from seasonal to year-round. Global warming and resulting rising sea levels, for example, would displace some human populations, perhaps resulting in migration into wilderness areas where zoonotic infectious agents are being transmitted in silent life cycles.

It is predicted that global warming will be characterized by more frequent storms and flooding in certain areas. Higher temperatures, increased humidity and more extensive surface water might result in increased insect populations and higher incidence of VBD. On the other hand, periods of drought will cause extensive migration of pastoral herds in search of water and grazing and favour the spread of disease by vectors

and by contact between animals. These conditions would increase the likelihood of livestock mingling with wildlife populations and the transmission of pathogens. Support for these predictions is provided by the strong association shown between the major epidemics of AHS in South Africa, which occur every 10 to 15 years, and the warm El Niño phase of the El Niño southern oscillation (ENSO), which is mediated by the combination of rainfall and drought brought to South Africa by ENSO. Warm-phase ENSOs bring both rainfall and drought to southern Africa. Populations of C. imicola can increase 200-fold in years of heavy rain. Although heavy rainfall occurs for other reasons in many non-ENSO years, epidemics of AHS do not result; it appears therefore that a combination of heavy rainfall followed by drought is the critical combination that leads to epidemics. It has been proposed that this is because the high temperatures during droughts increase vector population growth rates; the coincidence of this with the congregation of horses with the virus reservoir (zebra) at the few remaining sources of water creates the conditions favourable for the vector to transmit AHS virus.

It follows that climate change, in particular global warming, will increase the incidence of animal diseases, especially VBDs, in regions where they are endemic. Since these are mainly the tropical regions, where there is the highest concentration of developing countries, this will impact on the livelihoods of many poor farmers. It is probable that climate change will extend the geographical distribution of many insects that act as vectors. It has been estimated that a 1°C rise in temperature will correspond to 90 km of latitude and 150 m of altitude. In this context it would be interesting to know what factors led to the introduction of bluetongue (BT) into Bulgaria and Greece in 1998 and into Italy, Spain and France in 2000, as these outbreaks occurred significantly north of 40° latitude in areas where C. imicola has previously been shown to be absent.

THE IMPACT OF ANIMAL MOVEMENT AND TRADE ON DISEASE INCIDENCE

In developing countries, movement of livestock is common in order to find grazing and water, move away from drought or follow natural seasonal migrations, or because of migrations precipitated by social tensions or local trade. Such movements inevitably bring livestock from different groups into contact. Where there are heavy concentrations of wildlife animals, the migrations of wildlife and livestock bring the two groups into contact. Inevitably, such contacts are a source of disease dissemination. The introduction of CBPP in the early 1990s into Botswana and Tanzania was due to movement of only a few subclinically infected animals from endemic areas. FMD, rinderpest, sheep pox, PPR, ND, IBD and others have been disseminated through such movements.

Increased road construction across Central and South America, Africa and Asia, aimed primarily at responding to expanding industrial needs, has made it easier and cheaper to transport animals over long distances on land. Similarly, the growth of sea- and air-freight systems facilitates the transport of animals around the world. The most common mechanism for the transmission of infectious organisms is contact between infected and susceptible hosts. Modern animal transport systems are ideally suited for spreading disease. The animals commonly originate from different herds or flocks and they are confined together for long periods in a poorly ventilated stressful environment, all of which will favour the transmission within the group of infectious disease should sick animals be present. If not destined for slaughter, the animals will be introduced into new herds or flocks, where they will be subject to social and dietary stress and an exchange of microorganisms with the resident population.

A spectacular intercontinental trade transfer of a pest was exemplified by the New World screwworm (Cochliomyia hominivorax) in Libya in 1988: for the first time, this pest became established outside its natural range in the Americas. Recent years have seen some spectacular examples of the consequences of extended trade links. The outbreaks of FMD type SAT 2 in dairy herds in Saudi Arabia and in sheep in Kuwait during 2000 probably resulted from the importation into the Arabian Peninsula of cattle or sheep from eastern Africa. While FMD type SAT 2 virus is endemic in many parts of Africa, this was the first occasion that the SAT 2 serotype had been recorded outside Africa. Another instance of long-distance spread of FMD occurred in 1999 in North Africa. In February 1999, the disease was reported in Algeria in cattle. It spread quickly there, then crossed the border into Tunisia and Morocco. Sequencing of the virus at the World Reference Laboratory (WRL) for FMD, Pirbright showed that it was closely related to strains of virus isolated previously in Côte d'Ivoire. The Algerian veterinary authorities reported that they had seized cattle illegally imported from Mali before the start of the epidemic and they suspected that these animals were the origin of the outbreaks. It was considered that heavy rainfall across the Sahara had created favourable circumstances for long-distance transport of cattle across Mali and the link with Côte d'Ivoire.

The movement of infected animals is the most common mechanism by which infectious diseases such as FMD and ND are transmitted. Spread can also result from feeding animals with contaminated foodstuffs such as hay and

MAP 2
Conjectured spread of the Pan-Asia lineage of the Near East-South Asia topotype of FMDV-O (OIE/FAO World Reference Laboratory for foot-and-mouth disease, Institute for Animal Health, Pirbright, UK).

contaminated unheated waste food of animal origin. The transport of contaminated meat and fodder around the world is a mechanism by which FMD can be spread over long distances and by which exotic strains can be introduced into new territories. Advances in molecular biology, in particular reverse-transcription polymerase chain reaction (RT-PCR) sequencing, have proved to be extremely valuable for characterizing isolates of virus and identifying their probable origin. The application of such techniques to FMD is probably the most advanced. Sequence analysis of the 1996 Albania type A virus, for example, showed that it was very closely related to isolates submitted previously to the WRL for FMD from Saudi Arabia and India. A consignment of buffalo carcass meat imported from India was found by a European Union mission visiting Albania during the epidemic and that provided further evidence of a link between the two countries.

The most dramatic example, however, is the spread of FMD serotype O that is now referred to as the Pan-Asian topotype, which over a ten-year period has spread through most of Asia and affected parts of Europe and South Africa. This virus was first identified in northern India in 1990. It spread westwards into Saudi Arabia during 1994 and throughout the Near East and into Europe (Turkish Thrace, Bulgaria and Greece) in 1996. In 1993 it was found in Nepal, in 1996 in Bangladesh and in 1998 in Bhutan. In 1999, it was reported from mainland China (Tibet, Fujian and Hainan) and then detected in Taiwan Province of China. In late 1999 and in 2000 it reached most of southeast Asia. Most recently it has been introduced into the Republic of Korea, Japan, the Primorsky Territory of the Russian Federation and Mongolia, areas free from FMD since 1934, 1908, 1964 and 1973 respectively. The total cost of the outbreaks in Japan alone has been calculated at US$77 million. The virus has been isolated from a wide variety of host species – cattle, water buffaloes, pigs, sheep, goats, camels, deer and antelope.

In September 2000, the FMD Pan-Asian topotype was identified on a pig farm in Kwa Zulu, South Africa. It is believed that infection was introduced there through swill collected from a ship originating from southern Asia.

In February 2001, the same strain was identified in the United Kingdom, again probably introduced through swill feeding. This virus has now (early April 2001) already resulted in over 1 000 outbreaks in the UK and a small numbers of outbreaks in Ireland, France and the Netherlands.

In Europe, the spread of the virus from its original focus in the United Kingdom to Europe was through movements

associated with normal trade. It is feared that the cost to the British economy alone of Panasia type O could reach £40 billion.

EFFECTS OF CHANGES IN DISEASE-CAUSING AGENTS

There are examples for which the molecular basis for virulence of disease-causing agents has been defined. It is often difficult, however, to determine whether the observed change in disease pattern is the result of specific genetic change in virulence, selection of more adaptive disease-causing agent strains, variation in genetic susceptibility of host animals or environmental factors such as changes in farming practices.

- FAO historical reports on the rinderpest episodes in Asia and Africa between 1950 and 1980 show that mild cattle rinderpest may be the natural sequel to rinderpest epidemics and may have been more widespread than has been acknowledged. Elimination of all traces of mild rinderpest will thus be crucial for the success of GREP.
- FMD is a prime example in which asymptomatic carrier animals or subclinically affected animals have set up outbreaks in previously free areas or have disseminated infection widely during the course of an outbreak. During the 1990s, several countries in eastern Asia, including the Philippines, Taiwan Province of China and Viet Nam, experienced outbreaks of FMD by a virus strain that caused disease only in pigs. The FMD outbreak in Argentina early in 2001 is believed to have been introduced by asymptomatic carrier cattle. The dissemination of FMD in February and March 2001 in the United Kingdom and thence to Ireland, France and the Netherlands has been principally by subclinically infected sheep.

CONCLUSIONS

It is imperative to accept that control of animal diseases is an international public good. It has been amply demonstrated that a long period of freedom from such diseases is no protection from tomorrow's catastrophe. In order to safeguard sustained livestock development in developing countries and permit legitimate participation of these countries and the poor communities within them in local, regional and international trade, and to diminish the risk of epizootics to livestock farming in industrialized countries, the international community must heed the call by the World Food Summit for internationally coordinated measures for prevention and progressive control of transboundary animal diseases and pests.

Chapter 3

Trends in VPH and food safety: problems and challenges

INTRODUCTION

The WHO definition of VPH is that component of public health activities devoted to the application of veterinary skills, veterinary knowledge and veterinary resources for the protection and improvement of human health. This definition implies in many ways an unrestricted assignment to the veterinary and para-veterinary professions. It is restrictive, however, because it implies application of veterinary knowledge and skills to protect and improve human health without acknowledging the coordinated effort necessary from all related disciplines in a rapidly changing environment to achieve this goal.

The environment is changing rapidly, but developing countries have not been able to respond with new structures and initiatives. Reports from developing countries on the status of VPH service delivery in 1991 compared to reports from the same countries in 1999 show insignificant changes to meet challenges identified more than a decade ago. After all these years, it appears that discussions to allocate institutional responsibility for the delivery of VPH services and to define their scope are still continuing. Several major animal disease incidents in the past decade have triggered this sensitivity: the BSE crisis in the United Kingdom and subsequent increased incidence of BSE in other European countries, the current FMD crisis in the United Kingdom and the rest of the world, food-borne disease incidents caused by salmonella and E. coli and deaths caused by major disease outbreaks such as Nipah virus in Malaysia, avian influenza in Hong Kong and RVF in East Africa.

Two diverging strata for VPH and food safety are emerging. The first comprises the rapidly intensifying livestock-production systems in urban and peri-urban areas. Intensifying systems occur in almost all regions of the developing world, particularly southeast and southern Asia, East and West Africa and the Andean region of Latin America. The second stratum is the traditional pastoral and agro-pastoral sector. Three crucial zoonotic disease and food safety issues present themselves:

- failure to control classical zoonoses, such as brucellosis, zoonotic tuberculosis and hydatid disease in traditional systems;
- increased food-borne infections and intoxications and livestock pollutants in rapidly intensifying urban and peri-urban systems, such as salmonellosis, enterotoxigenic coliform infections and aflotoxicosis;
- emergence of new or previously non-apparent zoonoses such as Nipah virus infections and BSE in rapidly changing and intensifying livestock-production systems.

There will be a dichotomy of issues and approaches in intensive versus traditional livestock systems, but the impact of zoonotic diseases and food-borne infections and intoxications on health and wellbeing will be greatest among the 800 million food-insecure livestock keepers, consumers, traders and labourers.

Innovative approaches will be required to address rapidly evolving VPH and food-safety environments in intensifying systems. Expected changes and trends include:

- increasing globalization and trade in livestock and livestock products;
- greater livestock densities, with increased transmission of zoonotic and food-borne infections;
- more varied and intensive feed sources and feeding systems for livestock;
- increasing pollution due to more intensive livestock rearing.

Intensified systems in developing countries will be responsible for supplying 60 percent of the world's meat and 52 percent of its milk by 2020. This increasing proportion of livestock production will lead to pressure to modify OIE and World Trade Organization (WTO) regulations (see Chapter 5).

The proportion of livestock produced by traditional pastoralist and agro-pastoralist systems will decline. As a result, there are major risks that farmers and consumers in these systems will be forgotten or marginalized with regard to VPH and food-safety innovations and that the current impacts of classical zoonoses and food-borne infections such as anthrax will persist or even worsen.

CHANGING ECOLOGY AND LIVESTOCK PRODUCTION SYSTEMS ASSOCIATED WITH ZOONOTIC AND FOOD-BORNE INFECTIONS

Intensification of livestock production systems in many

BOX 10

Examples of recent major VPH problems.

Nipah virus. Between October 1998 and May 1999, 901 228 pigs from 896 farms in Malaysia were destroyed following diagnosis of the previously unknown Nipah virus. There were 257 cases of febrile encephalitis and 100 human deaths. The disease was diagnosed in abattoir workers exposed to body fluids of slaughtered pigs. This outbreak accentuated the need for speedy diagnosis and early assessment of VPH implications. It forced countries importing from Malaysia and receiving tourists to reassess their contingency plans for safeguarding human and animal health. Over and above the direct consequences of the disease, the ease and speed of international travel and contingent risks are becoming major factors in safeguarding human and animal health.

RVF. Until 1977, this mosquito-borne viral zoonotic disease was confined to sub-Saharan Africa. It occurred in Egypt in 1977 and again in 1993, causing an estimated 200 000 human cases with some 600 deaths, as well as numerous deaths and abortions in sheep, cattle and other livestock species. Following heavy El Niño rains in 1997-8, a serious outbreak was experienced in East Africa that caused livestock losses and human deaths as well as disrupting the valuable livestock trade to the Near East. During 2000, an outbreak of RVF occurred in Saudi Arabia and Yemen, the first time that the disease has been recorded outside Africa.

BSE. This prion disease of cattle was first recognized in the United Kingdom in 1986. Since then, over 180 000 cattle have died or have been slaughtered. The disease is associated with the feeding of contaminated meat/bone meal. Cases have now occurred in other European countries. Discovery of a causal link between BSE and nvCreutzfeld-Jakob disease in humans in 1996 led to major disruptions in the world beef trade.

Crimean Congo haemorrhagic fever. Several incidents in abattoirs indicate that traditional procedures of ante and post mortem inspections need to be complemented or revised, taking into account risk factors associated with procurement of animals. In 1996, 17 abattoir workers at an ostrich abattoir in South Africa contracted Crimean Congo hemorrhagic fever after handling a carcass suspected of being in the viraemic phase of the disease.The disease is caused by bites from infected ticks of Hyalomma spp. The abattoir workers who contracted the disease were all working in the defeathering section, where the process of removing hard feathers from dead ostriches resulted in scratches and other injuries on their hands that gave entrance to infected blood from the sick ostrich.

Anthrax. This disease is still prevalent in many countries. Serious outbreaks, with deaths among domestic and wild animals, have ocurred in recent years in Africa and Asia, where there have been human fatalities through eating infected meat. Poor livestock farming communities are particularly vulnerable.

Avian influenza. Epidemics have occurred in a number of countries in recent years, causing severe losses in poultry flocks. The AI virus strain that caused a major outbreak in Hong Kong in 1997 also caused human disease with deaths. It may have the potential to cause human pandemics.

Brucellosis and **tuberculosis**. These diseases still cause major losses in small and large ruminant animals in many parts of the world. They remain major VPH problems.

Salmonella enteritidis, verotoxic E. coli, and **listeriosis.** These are emerging as major food borne disease problems around the world.

countries will increase the risk of spread of serious zoonotic diseases. Concentration of livestock production, particularly pigs and poultry, in peri-urban areas will increase the interface between animals and humans and hence the opportunity for zoonotic diseases to spread from animals to people. It is therefore likely that there will be increased incidence of serious viral diseases such as RVF and avian influenza, bacterial diseases such as salmonellosis and brucellosis, parasitic diseases such as cysticercosis, hydatidosis and trichinellosis, and zoonotic diseases.

Changes in feeding practices for livestock are likely to bring about new VPH and food safety problems. Examples

are BSE, salmonella enteriditis of poultry and drug and pesticide residues.

Changes in the ecological situations in which animals are farmed may lead to new VPH problems. Increased irrigation may bring about increased incidence of mosquito-borne and parasitic vector-borne diseases. The clearing of forested areas for farming may result in the spread of novel disease pathogens from wildlife species to domestic animals and humans.

INSTITUTIONAL ISSUES AND IMPACT OF STRUCTURAL-ADJUSTMENT PROGRAMMES

Evaluations of VPH services in the eastern Mediterranean and Africa have identified a number of challenges that need to be addressed, including:

- lack of awareness of food-safety issues in relation to consumer protection;
- non-integration of food safety into primary healthcare systems;
- insufficient information and diagnostic capacity on the magnitude of the food-contamination problem;
- inadequate food legislation;
- lack of proper evaluation of food-safety activities.

Addressing these challenges requires an interdisciplinary approach. Developed countries and international organizations have made major changes in their approaches to VPH and food safety in recent years in response to intensifying production systems and the increased requirements for risk-based assessment resulting from increased international, regional and national trade in livestock and livestock products. In New Zealand, Canada, the United Kingdom and the European Union, for example, food-control authorities were established by combining functions previously carried out by traditional agriculture and government health departments into one governmental executive body. The FAO/OIE/WHO forum on VPH in Giulianova (Italy) noted, however, that such an interdisciplinary approach to VPH service delivery has not occurred in many developing countries.

Different requirements exist for VPH and food-safety services at local, national and international levels. Current regulations are in many cases complex, with different standards for quality, health certification and acceptance for human consumption applied by a multitude of disciplines and government agencies. In many developing countries, controls over production, health certification or sale of animal products and food in general are governed by an astonishing number of acts, regulations and by-laws executed by an increasing number of government agencies, each with its own vested interest. This often results in confusion and multiple involvement. Most countries need to consider adopting three basic standards: an international standard for international trade, a national standard for national trade and a standard for local consumption.

As with control of purely livestock diseases (Chapter 2), structural-adjustment programmes have greatly influenced the delivery of VPH and food-safety services. Effective structural adjustment is more easily attainable in developed countries, because they already have an established hygiene culture and high levels of VPH awareness. In such circumstances, the private delivery of public goods is more easily regulated and phytosanitary guarantees in terms of international conventions and commitments can be met. Constraints in developing countries, however, prevent them from following this pathway. Structural adjustment in developing countries should be a gradual process of phasing in essential VPH concepts, with local and national commitment to VPH and food-safety goals being established before attempts are made to comply with international requirements.

THE IMPACT OF POLITICAL AND SOCIAL INSTABILITY ON VPH

Of the 40 poorest countries in the world, 24 are either in the midst of armed conflict or have recently emerged from it. The effect on food safety and VPH issues was seen in the increased incidence of anthrax in cattle in Zimbabwe during the 1970s, when more than 140 people were alleged to have died after consuming infected meat. Recent conflict over land reform in Zimbabwe is impeding normal animal-health practices, resulting in deaths among inhabitants of rural communities in southern Zimbabwe after consuming meat from infected carcasses.

In Burundi and Rwanda, continuous conflict resulted in massive movement of animals and humans across international borders, contributing to an unstable animal-disease situation and total collapse of regulatory services in respect of animal and human health.

In many developing countries, getting the technology right is only part of the solution; making it compatible with cultural, economic, social and physical conditions is also necessary. The practice of transhumance, particularly in North and West Africa, poses unique animal-health and VPH challenges that cannot be solved by traditional approaches. This relates especially to ways of addressing ownership and the relationship between ownership and herd productivity. Establishment of communication and delivery of new technology, especially in attempts to establish the need for veterinary interventions, are challenging and beyond the scope of normal VPH perceptions.

An important issue is the trade-offs between food security and food safety. In situations of food insecurity, farmers

and consumers are more likely to consume unsafe products such as meat from carcasses infected with anthrax or parasitic diseases. In some countries, for economic reasons, unregulated meat and milk markets have developed with little or no food-safety capacity.

EFFECTS OF CLIMATE CHANGE ON VPH AND FOOD SAFETY

Evidence suggests that human activities are warming the planet; climate models predict an increase in global mean temperature of between 1ºC and 3.5ºC during the twenty-first century. Global climate change will alter the distribution and risk of vector-borne zoonoses. There is speculation that this will contribute to the increase of West Nile fever in the United States of America. Expected changes in rainfall, wind patterns and seasonal weather variations became evident with the floods in Mozambique in 2000 and 2001. These floods resulted in severe food-security risks and accompanying health incidents such as cholera and malaria. Other examples include an increase in fascioliasis in Bangladesh, China and countries in the Mekong delta.

ISSUES OF TRADE AND RISK ASSESSMENT

As with livestock diseases (see Chapter 2), an increased risk of zoonoses and food-borne infections is associated with globalization and increased trade in livestock and livestock products. The changing international environment has resulted in an apparent dichotomy in VPH involvement: increasing demand for food-safety and health assurances to facilitate international trade and simultaneous increased demand for safe and wholesome food. There is no clearly defined response to the enormous challenge of meeting both demands, especially in developing countries.

Most developed countries and international organizations have responded significantly to the new challenges to VPH service delivery and consumer concerns over food safety. It remains debatable, however, whether these responses will have the same outcome for the 830 million food-insecure people in developing countries. Developed countries have encouraged initiatives towards regional and multilateral trade agreements, reducing government support for the farming sector and liberalizing market access. They have established science-based food-safety regulations in terms of the sanitary and phytosanitary standards under the Uruguay Round global trade accord. The Agreement on Sanitary and Phytosanitary Standards of the WTO (the SPS Agreement) aims to eliminate the use of unjustified, unscientific regulations to restrict trade. Under the new rules, countries have the right to set their own standards of food safety and animal and plant health. This right has been put to the test mostly by developed countries. These untested new standards, however, may be subject to some of the more contentious trade issues in the new millennium and will exert increasing pressure on delivery of VPH services in developed and developing countries. Recent disputes between countries under the SPS Agreement gave rise to accusations of protectionism and creation of non-tariff barriers to trade. There has been confusion resulting from a perception of different sets of standards to differentiate between quality and food safety, quality and hygiene requirements, household food security and international trade, regional and international trade and the needs of household consumers and international demand.

Current live and postmortem meat inspections are usually restricted to the application of hygiene procedures from the time when an animal enters an abattoir until the carcass leaves the premises. In many countries, these procedures may be inappropriate to diseases present in a particular class of livestock. In some situations, less intensive procedures may achieve equivalent results. It is unrealistic to think that the delivery of VPH and food-safety assurances in developing countries can always reach international trade standards. Simpler procedures may be sufficient for food-safety assurances at grassroots level. Application of Hazard Analysis and Critical Control Point (HACCP) procedures and other manufacturing processes are commendable but must be adapted to local demands such as informal slaughter of animals within villages. The primary aim should be to ensure that safe food is offered for sale, even if the animal was slaughtered under a tree. Even under these primitive situations, establishment of a VPH hygiene culture should be the aim, with the application of adopted HACCP and good management practices to ensure that food leaving a place of slaughter poses no health risk. Development of appropriate risk-assessment is a challenge to all developing countries.

Chapter 4

Improving national animal-health policies and delivery systems

INTRODUCTION

The worldwide resurgence of many serious infectious livestock diseases and VPH problems has been clearly demonstrated in earlier chapters; this trend is likely to continue in the future. There is in addition the challenge of new diseases and new manifestations of existing diseases through changing epidemiological circumstances, livestock husbandry and trading patterns. Although this poses a major challenge for all countries, developing countries are particularly vulnerable. The livelihoods and health of poor livestock farmers and farming communities in such countries are under severe threat.

Endemic, production-limiting diseases are continually present. They are less dramatic but tend to make livestock raisers vulnerable to external shocks, which keeps them in poverty. Diseases and conditions such as high neonatal mortality, suboptimal birth rates, mastitis and the like reinforce the vicious circle of poverty, because livestock assets do not grow and products for home consumption or sale are not harvested. VPH programmes are often absent in rural areas. Rural dwellers are at high risk for zoonotic diseases because of their close contact with livestock or domestic animals. The rates of brucellosis, hydatid disease and other intestinal parasitic diseases in certain rural populations are the highest of any.

At the same time, the capabilities and resources of many countries to meet these animal-disease and VPH challenges are being constantly eroded. This is exacerbating the situation and maintaining poverty by keeping livestock raisers vulnerable to external shocks such as drought, flood or civil disturbance.

This chapter explores ways in which animal-health policies and delivery systems may be strengthened to provide a better outcome for all livestock sectors, from commercial farmers to subsistence and marginalized farmers.

PUBLIC VERSUS PRIVATE COMPONENTS OF ANIMAL-HEALTH SERVICES

Because of competition for limited financial and other public resources, there are strong pressures for rationalization, devolution, decentralization and privatization of animal-health services in many countries. This is inevitable and does not necessarily mean that available veterinary services to livestock farmers or animal-health status are seriously compromised – providing the process is progressive and effectively managed. There is no single formula that will suit the particular circumstances of all countries.

As a prelude to this planning, countries need to review the public and private components of their animal-health services. Although this will vary according to circumstances, some principles are probably universal.

It is argued that the public end of the spectrum should focus on two elements. The first is prevention, control or eradication of major epidemic livestock diseases, which have the potential to affect the national economy through high production losses, losses in export trade or food insecurity at a national level. Individual farmers, particularly poor and marginalized farmers and private animal-health providers are relatively powerless to protect themselves from these diseases, which require a national or even international approach for their control. The second element is zoonotic diseases and other VPH and food-safety issues that could cause substantial public-health concerns in communities.

At the private end of the spectrum are the more endemic diseases – internal and external parasites and reproductive disorders – for which control is mainly of benefit to individual farmers.

Between these extremes, there is a continuum of diseases and animal-health concerns with varying public and private attributes. Brucellosis, for example, is a classic zoonotic disease with high infection rates in rural populations. It frequently affects whole families in a short time, causing severe disability and family crisis, because most of the wage earners will be sick simultaneously. If medical treatment is sought or available, the disease results in significant economic loss to individuals and countries. There is a clearly recognized public good in controlling this disease in livestock, the only source of infection for humans. Brucellosis species cause abortion and decreased lactation in female cattle or small ruminants, so prevention is clearly a private good for livestock owners. Both individual owners and the public

sector could have obligations to pay the costs of controlling this disease; assessment is a matter for countries to decide in consultation with stakeholders.

Strict separation of tasks or services into private or public is not necessarily easy or useful. What is important is that nationally agreed disease-control tasks are carried out in a sustainable manner. Sustainability often means that individual owners, through cost recovery, and the public sector will pay for disease-control programmes. Countries must decide on the correct balance between public and private good for their own circumstances and plan allocation of resources and delivery of services accordingly.

CORE FUNCTIONS OF NATIONAL ANIMAL-HEALTH SERVICES

National policies are needed to determine the core functions for their public-sector animal-health services. These may vary from country to country, but the following are generally regarded as core activities:

- ministerial briefing and support;
- planning, coordination and implementation of national disease-control programmes;
- disease surveillance and other early warning measures, epidemiological analysis, disease reporting at national and international level;
- risk analysis as an input to quarantine, surveillance, contingency planning and priority setting;
- quarantine and animal-movement controls;
- VPH and food safety;
- preparedness for high-threat epidemic diseases;
- international and regional liaison and cooperation;
- licensing of vaccines and drugs;
- close liaison with farmer groups and private-sector animal-health services;
- quality assurance of public and private animal-health services;
- providing an enabling legislative framework.

It does not necessarily follow that delivery of tasks or services related to agreed core functions cannot be devolved. This may be part of a managed devolution or privatization process. Nevertheless, ultimate responsibility for policy formulation and obtaining favourable results cannot be abrogated, and should remain in the hands of the national or public-sector animal-health services.

DELIVERY OF ANIMAL-HEALTH SERVICES AT NATIONAL LEVEL

In the modern environment in developed and developing countries, where there may be devolution, regionalization, privatization and other fragmentation of animal-health responsibility and delivery, the operating systems of national animal-health services will need to change to give more emphasis to the points listed below.

Consultation and a client-oriented approach

The clients of national animal-health services include livestock owners and consumers of livestock products. Formal and informal consultative mechanisms to assist planning, policy formulation and animal-health programme delivery will be important in national animal-health services and between the services, clients and other stakeholders. The latter would include private-sector animal-health service providers and representatives of livestock-producer organizations, exporters and traders.

In the context of pro-poor development, it is vital that there be an outreach of the consultative process to include poor and or marginalized livestock-farming communities, so that their concerns and needs can be addressed.

There is increasing evidence that improving access by poor farmers to animal-health services will improve their livelihoods. Analysis of means to bring about development in rural areas over the last two decades has seen a gradual trend toward direct involvement of farmers in the process. Farmer participation is an essential ingredient to the development process. The degree of farmer involvement is an important factor in determining long-term sustainability: improved results are obtained when farmers are encouraged to record, measure, discuss and analyse their existing situation and raise problems.

Successful community-based animal-health approaches in Africa have aimed to:

- build on what people already know;
- use and develop people's abilities and skills to analyse and evaluate their surroundings;
- reveal whether human and material resources are being used efficiently and effectively;
- help people to analyse their situation and see how activities may be improved, thus setting local priority needs;
- enable people to study their own methods of organization and management;
- provide good information for making decisions about planning and direction;
- increase the sense of collective responsibility for implementation, monitoring and evaluation;
- identify indicators for monitoring and evaluation.

Analysis of rural-development programmes indicates that forms of community participation such as empowerment and self-mobilization are required for sustainable change (Pretty, 1995). But what do “community participation” and

"self-mobilization" really mean? Reviews of community participation in animal-health initiatives have demonstrated mixed interpretations and uses of community participation on the part of animal-health professionals (Catley and Leyland, 2001). This implies that increased awareness and training in participatory development are required for those veterinary professionals who determine how programmes for poor farmers are designed and implemented. This is arguably one of the first methods to be applied when shifting major institutions towards more pro-poor behaviours and norms.

People-oriented approaches to development of pro-poor veterinary services are time-consuming and require significant levels of commitment. There is no fast-track solution to development in poor rural communities: an integrated approach will often make the results more durable but will require more time and organization. It is noticeable that even small-scale integrated rural-development programmes in pastoral areas, such as those developed by Oxfam in Kenya and ActionAid in Somalia have identified nine- to ten-year timeframes.

It is usual for any community to prioritize problems that threaten livelihoods. Whilst developing solutions to priority problems, issues that are not perceived as major needs can be addressed. In a pastoral community, animal health is commonly the standpoint for studying issues such as local capacity building, conflict resolution, human health, shared use of range resources, land-tenure issues and improvement of livestock marketing. In a more agronomy-oriented system, livestock issues are likely to be secondary. Recognition of these local priorities is a fundamental principle that will significantly influence the methodology used to develop animal-health services, livestock extension services and adoption of livestock programmes.

Work at farmer level is one end of a continuum when it comes to development of livestock or agricultural sector policy. The client-oriented approach outlined in the previous chapter is used to varying degrees by the organizations working in the sector. Non-governmental organizations (NGOs) tend to adopt a more participatory approach to development, though there are considerable variations between organizations. Government departments, international agencies and research institutions are less participatory. It is the government ministries that will, at the end of the day, set national policy. By making livestock policy-makers more client-oriented the chances of fostering effective national animal-health services that are inclusive of all livestock producers and farming systems is more likely.

How is it possible to make policy-makers more client-oriented? This almost certainly requires reorientation of government and international agencies, which influence international or global norms and behaviour. The first step, therefore, is to change the approach and attitudes of agencies such as FAO. One example of an institutional learning and change process is summarized in Figure 4 (Thompson, 1998). Working through the five stages of the cycle can lead to improved, more participatory practices throughout an agency. Crucial stages and processes are initial recognition at senior level of the need for change and innovation, followed by training and learning, again at senior level. Although fundamental, these stages can be problematic. How often, for example, do senior managers or technical advisers invest time and effort in critical self-reflection and training? A common response is: "But we are the international experts – we don't need training!" Unless attitudes and approaches change at an individual level, meaningful institutional change is unlikely to occur.

At national level, experiences from Kenya, Uganda and Tanzania are indications that policy reform to support improved animal-health services is possible. The first requirement is for policy-makers to be open to the views of stakeholders within the livestock sector – a broad range of farmers, farmer's groups, public and private service providers, regulators and researchers. This can be achieved through a process of stakeholder analysis and consultation, exposure to the problems of poor farmers and fact-finding missions to client-oriented institutions. Such exposure could be used as a catalyst for change in relevant government departments.

If carried out thoroughly and with conviction, stakeholder analysis will get to the root of many problems and allow policy-makers to see issues from several angles. Policy priorities and practical solutions can be developed through dialogue. Stakeholder analysis can, for example, readily explore issues such as those affecting sub-Saharan Africa – for instance, how can the veterinary profession regain the initiative in delivery of veterinary services? What are the policies preventing such a development? The solution to a combination of poor livestock marketing, inappropriate training, poor understanding of the roles of public and private sectors and lack of credit all require policy change and updated legislation. Is it possible to modify the hierarchical, top-down approach of line ministries in such a way that they become more responsive to needs and more transparent and flexible while retaining their important regulatory and monitoring mandates?

Although important policy reform initiatives to improve animal-health services are underway in Indonesia, Nepal, Kenya, Uganda and Tanzania, it is too early to say how new policies will impact on the livelihoods of poor livestock keepers. As new policies and legislation emerge and are enacted, monitoring and evaluation will be required to determine if and how policy reforms have borne fruit.

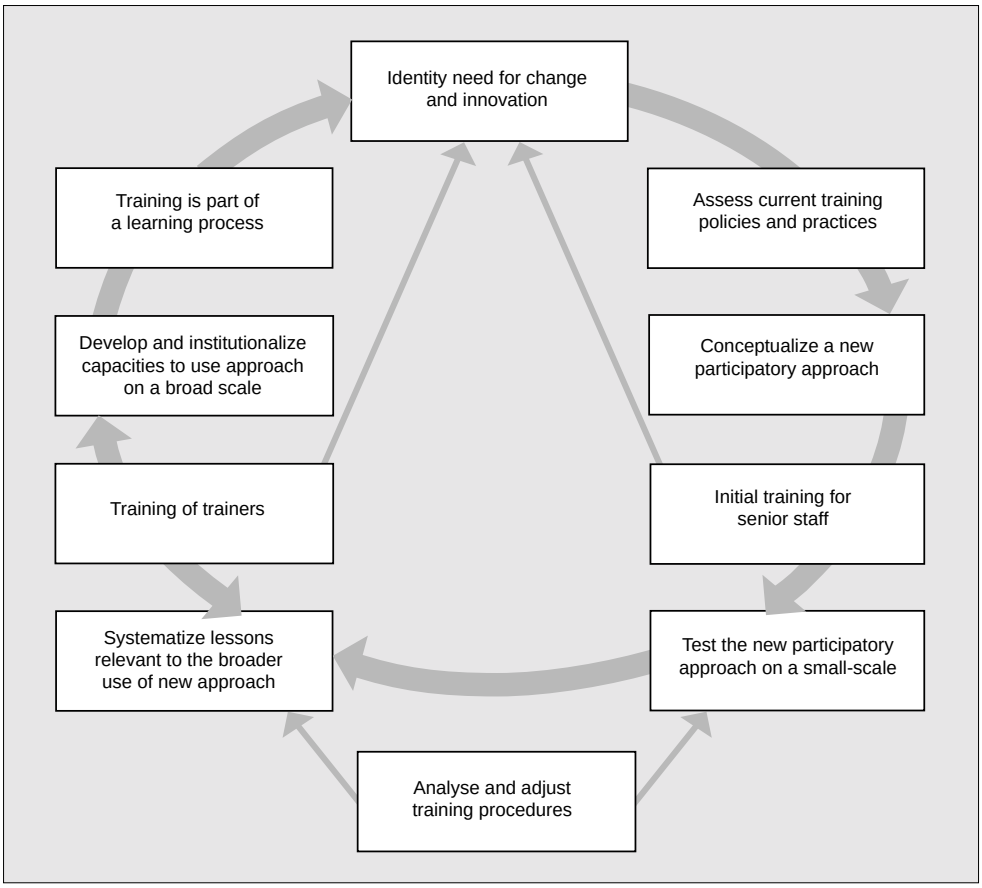


FIGURE 4
The institutional learning process and training cycle (Thompson, 1998).

Although substantial progress has been made in a sector notorious for its conservatism and resistance to change, reform has been heavily dominated by the voices of professionals, academics and donors. The involvement of poor livestock keepers can often be defined as consultation, answering questions rather than participating actively. Unless poor people are genuinely empowered to take a central role in the policy-reform process, new policies may not lead to sustained benefits for the poor.

Quality assurance

It will become increasingly important for government animal-health services to act as quality-assurance agents. This is to ensure that agreed core activities are properly carried out at all levels and in all areas of the country and to ensure that farmers and consumers are receiving the type of veterinary support they need.

The quality-assurance function should be underpinned by development of standard operating procedures and performance indicators. There needs to be a system of monitoring and evaluation to ensure that performance indicators are being met, irrespective of whether deliverers are in the public or private sector.

Quality assurance will involve coordination, support and training throughout public and private animal-health sectors at professional and para-professional levels. In many instances, NGOs may be the major link with poor and marginalized farming communities; it is therefore important that they be fully included.

Epidemiological focus and capabilities

The government animal-health service is likely to be the only organization in a position to make well informed, overall epidemiological analyses of the evolution of animal diseases in the country and to monitor the effectiveness of national disease-control and eradication campaigns. It is therefore important that it should have a strong epidemiological base, including maintenance of a good early-warning system for diseases, based on surveillance and reporting, and a central epidemiological unit capable of carrying out in-depth epidemiological analyses, risk analyses and risk-management strategy definitions.

Investigation of disease outbreaks is a prime support service to community-based and central veterinarian planners. Community-based veterinarians need early confirmation of clinical diagnoses in order to increase their knowledge and competence, so that they can provide better service to individual clients and national authorities. National authorities urgently require reliable disease information in order to make decisions for emergency reaction or control.

Emergency disease management

Devolution, regionalization and privatization of animal-health services can be made to work well in most circumstances, given goodwill on all sides. But when there is a major disease emergency, say through the introduction of a serious epidemic disease to a country or region, there is a need for quick decisions and rapid response to minimize the spread of disease and its severe socioeconomic consequences. Mechanisms should be in place for emergency powers that will allow for a command-structure response by national animal-health services, so that a quicker and more effective response can be assured.

Public awareness

Developing public awareness will become an increasingly important function for national animal-health services. An essential component for the success of any major livestock-disease control or eradication effort is an effective, broadly based public awareness programme. It must be directed at all levels of the public – producers, consumers, traders, transporters, processors, wholesalers, retailers and travellers, and it must include decision-makers from all levels of government, private industry and livestock organizations.

The programme should aim to provide credible, accurate information in a form that is readily understandable and immediately useful. Such programmes need to be undertaken by professionals in the field, who will package technical information provided by veterinarians.

Market research must be undertaken to identify the media to be used (print, radio, television or theatre) for each audience. The preferred medium for one is often not applicable to another. For example, early-morning radio was useful for School-of-the-Air programmes for smallholder livestock owners in rural parts of Asia, where many recipients were illiterate and had no access to television but all had transistor radios; live plays were useful in remote mountain regions where radio reception was poor or irregular. At the other extreme, busy decision-makers need concise, quantitative, cost-oriented scenarios to make informed judgements.

Information must be accurate, factual and timely. High-quality photographs and film for television should be produced and made available. Subject matter should be provided by the disease-control agencies but should be packaged by communication specialists.

Incentives

Recent economic theory endeavours to establish incentives for carrying out socially and individually desirable tasks. The new institutional economics and the restructuring of animal-health services have been applied by Professor David Leonard and colleagues to human and veterinary medicine in the African context. The lessons learned are applicable to delivering public and private veterinary services in many countries.

One lesson is that demands for vector and helminth control, curative treatment and preventive vaccination are not as price-sensitive as has been suspected. If clients perceive benefits, they demand the services and are willing to pay for them. Rates of vaccination against rinderpest in East and West Africa did not fall when livestock owners had to pay. On the other hand, meat inspection and livestock-movement restriction for animal disease control are viewed negatively by Ugandan herders no matter who pays, because no direct return is provided from these services. The accessibility of veterinary services is a determining factor in demand, even when quality is less than optimum. Veterinary auxiliaries, community animal-health workers and traditional healers are in demand for some services, which livestock owners perceive as well delivered and beneficial, and these providers are close at hand.

Transport costs of service delivery are quite high for livestock owners notifying providers of the need for assistance or bringing animals to veterinarians and for providers travelling to reach animals. In Kenya it was found that over half the business of private animal-health providers came from services requested once they were in the neighbourhood of the first caller. There is scope for reducing transport costs by modest payment to enable delivery of a public service that provides private goods and services at the same time. Similarly, sharing of service-delivery costs among sectors needs to be more fully developed in order to reduce overall costs.

DELIVERY OF ANIMAL-HEALTH SERVICES AT LOCAL LEVEL

Extensive pastoral areas

Development needs of rural, poor and marginalized farmers. Rural populations, livestock owners and others require access to a range of services in order to enjoy reasonable livelihoods. These services include human healthcare, education, light and heat, roads, veterinary and agricultural extension services, personal and livelihood-related inputs and radio or television communication. In developing countries, rural populations generally have access to these services in proportion to their proximity to major cities. Even in North America, rural farm families have had easy access to affordable electricity for home and farm use only since the 1930s or within three generations.

They still do not enjoy the quality of human healthcare available in large metropolitan areas.

Provision of many of these needs over wide areas will require major expenditure on infrastructure. Some "softer" services, however, such as animal health, primary human healthcare and extension, are human resource- and mobility-intensive. A cadre of educated staff and the mobility to bring services to rural populations are required. Developing countries generally have a large number of university-educated veterinarians, agriculturists, primary care nurses and veterinary auxiliaries. Operating finances are certainly not in surplus in any country these days.

In order to reduce poverty and increase services for rural inhabitants in developing countries, it is necessary to consider innovative ideas and policies that recognize available resources and build on existing rural institutions.

It will take much more than technology to change extensive livestock-raising and other societies. It is suggested that the framework for change in extensive pastoral populations should include:

- fine-tuning existing social institutions;
- altering government institutions by policies and actions supporting and harmonizing with social institutions;
- empowering people to be involved in both of the above;
- setting local priorities and determining best use of locally generated funds in a decentralized and flexible way;
- effective, culturally sensitive communication by central government of national and global priorities to local level;
- financial support, perhaps matched by provincial or district funds, so that communities buy into concepts and programmes.

Why animal-health services are a key entry point for improving rural livelihoods. Veterinary science can be the only effective vehicle for facilitating outreach of services, two-way communication and service delivery in extensive rural communities within the above framework. Veterinarians have for many years been posted in rural areas, particularly in Africa, and have worked in close contact with the remotest rural populations. District and provincial veterinary officers have constituted the largest pool of university-educated human resources in the agricultural sciences and in rural areas of many countries. This is partly because veterinarians, in collaboration with auxiliaries and private practitioners, deliver disease-prevention services of recognized value to livestock owners and partly because the roots of western veterinary medicine are rural and have historically dealt with farm animals and horses. Veterinarians have not required large specialist facilities, which can only be located in areas of high population density, in order to work. They do not require rural people to come to them for services, but take services to farms, and they offer continuing services.

More recently, water projects and emergency-relief agencies, acting through development projects or as NGOs, have been occasional visitors in rural areas. But these visits are infrequent, even one-off in the case of borehole drilling, or by nature temporary, as in the case of emergency food aid. These outreach services suffer from the same lack of mobility as veterinary and human health services.

Veterinarians and the services they have historically provided are more available, more sought after, more valued and more visible in extensive rural areas – key advantages for veterinary services to deliver an array of social and livestock-related services to reduce poverty and enhance the livelihoods of poor livestock owners. There are recognized constraints to continuing delivery of services, mainly finances for mobility, which veterinary personnel have to accept. But there are policy changes, based on practical experience in Africa and services in North America, which could alleviate many of these delivery constraints. We will return to these key points later.

Why should veterinary services be considered a vehicle for reducing poverty among extensive rural livestock owners? The conventional wisdom is that for livestock owners to prosper there is a need to control economically disruptive and development-inhibiting diseases. These are the killing plagues of all species which, if not prevented, lead to periodic depopulation of herds and flocks. Many of the present and emerging plagues were mentioned in Chapter 2. Conventional wisdom regarding priorities in controlling these plagues still seems valid if livestock owners are even to maintain subsistence-level livelihoods and not become poverty-stricken. The debate is not so much about the need to control these diseases but about how to get it done.

An immediate priority for enhancing livelihoods is control and prevention of zoonotic diseases. Animal-transmitted diseases such as rabies, hydatid disease, brucellosis, salmonellosis and over 200 others attack villagers, crop raisers and livestock owners in rural areas. Urban dwellers are not immune to most zoonotic diseases. Veterinary science is, therefore, pivotal for control of many zoonotic diseases. Human livelihoods cannot be improved without access to healthcare and reduction in the pressure of preventable zoonotic and other diseases.

A close follow-on and terribly neglected priority is a package of research, extension and delivery of services to control non-infectious and production diseases in livestock. Transferring technologies to enhance reproductive efficiency,

reduce neonatal mortality, control internal and external parasites and improve livestock genetically have historically been keys to creating rural wealth in developed countries. We recognize that policies on subsidies, marketing, taxation and water prices have all had a major role in creating rural wealth in developed countries. The potential to improve rural livelihoods through pro-poor policies in developing countries is clearly recognized. Effective policies are critical for reducing poverty. Delivering services to prevent livestock plagues and improve human health, followed by asset-building technologies seem unavoidable steps to creating wealth – thereby reducing poverty – and improving livelihoods for rural livestock owners.

In short, what is advocated for improving policies and delivery of animal-health services to help poor or marginalized livestock-farming communities has two components. First, there is a need for an information-based infrastructure, and second a system to deliver policy-based services to rural livestock owners. Providing an action arm to deliver services that complement pro-poor policies seems to be a logical process that should lead to reduced rural poverty and improved livelihoods. The appropriate action arm is intersectoral but based on an information-based, mobile veterinary service and on fine-tuning of existing social institutions.

Need for intersectoral cooperation for service delivery. Other services can be based on the demand for and delivery of veterinary services to even the remotest rural livestock owners; an example is intersectoral cooperation among veterinary and human health service providers. Southern Sudan is a model for this cooperation in which cold-chain facilities, staff, transport-repair shops and laboratory facilities are shared by human and veterinary service providers. A subsequent step is to cross-train veterinarians and primary healthcare nurses to deliver basic animal and human healthcare services.

Only policies, and a few attitudes, need to be changed for this cooperation to be favourably appraised and adopted. The pragmatic appeal of the concept is that operational costs are shared among government agencies, so mobility of all providers is enhanced to the point where rural residents will actually have improved access to the services they require. It follows that services and inputs for boreholes, official documents, limited restocking of supplies such as vaccines, printer cartridges and essential spares and a range of extension activities from livestock to household nutrition and sanitation could be provided to more remote areas. It is feasible to envisage that this lateral thinking would link essential services to local demands of rural livestock owners.

The other essential is to assure delivery of information-based services, for example delivery of preventative animal and human vaccinations or treatment services based on where diseases are actually occurring or likely to move. This is epidemiological decision-making, which best exploits scarce resources. The WHO-led smallpox eradication programme and the EMPRES programme for rinderpest eradication realized that locating disease and applying immediate local measures were the keys to elimination. Mass vaccination against both diseases is not the method of choice for eradication of either clinical disease or viruses.

For enlightened policies to be formulated, particularly if they are to take into account stakeholders in extensive rural areas, social, technical and other information needs to be communicated from rural areas. Attention to cultural sensitivities is likewise essential if stakeholders are to adopt policy changes.

A classic example is drought-monitoring information. Sporadic current information on forage quality, livestock condition, water supplies, market prices and local awareness could all be useful inputs to drought response and food-aid interventions. This information needs to be gathered consistently and analysed centrally in order to plan for mitigation. It is not foreseen that separate government management of ranges, water resources and famine-relief agencies could be financially viable to ensure mobility even to gather this information, much less act on it in advance. The financial rationale for intersectoral cooperation is therefore evident.

For information-based, intersectoral cooperation to become a mode of development, policies and attitudes need to be changed at central and local levels. These social changes will be harder in some countries than others. Nonetheless, there are examples where such collaboration has taken place.

Mixed-farming systems

Mixed farming. The majority of rural, poor and marginalized farmers in Asia operate various mixed-farming systems in which livestock are few, diversified in species and make an integral but not exclusive contribution to the farmer's wellbeing. It is not unusual for an individual to own or manage six to ten chickens, a small pond with 40-50 fish, two or three sows (in non-Islamic countries), two or three small ruminants, usually goats for meat and milk, and one or two large ruminants such as cattle or buffalo for draught power, manure and capital for emergency financial requirements, while also working a typically 0.5 ha rice field, a vegetable garden and some fruit trees. Management and care of the livestock is often the responsibility of the women and children in the villages. They usually establish strong community groups, allowing for effective communication

BOX 11

Examples of animal-health services delivery in extensive rural areas.

Operation Lifeline Sudan animal-health service model

This has been an example where effective animal-health services, including rinderpest control, have been provided in an area with a long history of civil strife and minimal resources. The innovative community animal-health approach has emphasized regular community dialogue using participatory rural appraisal techniques: training programmes for livestock herders and community animal-health workers, capacity building based on existing social structures and judicious privatization with some built-in incentives.

Animal-health measures bring about market accessibility – the example of Namibia

Namibia is a southern African country with a strong involvement in meat export. Most exports go to South Africa and to the European Union. Differences in animal-health status in various parts of the country, however, meant that many Namibian livestock farmers were excluded from marketing opportunities. The northern part of the country, infected with CBPP and constantly at risk of FMD, was cut off in terms of marketing: an impermeable veterinary cordon prevented movement of livestock and livestock products to the rest of the country.

To address this need, the government put in place measures to improve animal health north of the veterinary cordon. These included:

- erection of quarantine camps for small ruminants at strategic points near the cordon, where sheep and goats could be quarantined and checked before movement to farms south of the cordon;
- construction of quarantine camps near abattoirs north of the cordon, together with some abattoir upgrading, to allow slaughter of cattle after three weeks' observation, primarily for FMD, with subsequent movement of beef to areas south of the cordon;
- improved surveillance and health-service delivery, including farmer education, in areas north of the veterinary cordon.

The results of these improvements were quite dramatic. Settlements at Khowarib and Sesfontein – remote, poverty-stricken parts of the country – began to experience cash inflows for the first time, providing a valuable stimulus to the local economy. This was largely thanks to the regular sale of valuable Damara sheep from the area.

Within two years of the opening up of some hitherto no-go areas for marketing, some areas populated by traditional herders had pushed their annual market offtake from zero to nearly 7 percent. Throughput at a major abattoir in the north of the country increased from only a few hundred cattle per year to around 18 000.

Animal-health measures aimed at turning local livestock into a readily marketable commodity succeeded, creating a new source of wealth in impoverished parts of the country.

The Afghanistan experience

The major constraints to livestock production in Afghanistan are insufficient control of endemic production-limiting diseases, periodic occurrence of acute, infectious epidemic diseases and insufficient forage preservation for use during the winter. To improve livestock health and production, a basic community-based veterinary service was established in the 1990s to provide primary healthcare through vaccination, drenching against parasites and various curative treatments. By late 1999, about 700 trained veterinary personnel delivered services from 255 district-based veterinary field units (VFUs) in 70 percent of the country. The VFUs are essentially private veterinary practices and their staff deliver clinical and preventive animal-health services to livestock-owning clients. Many provide clinical laboratory services such as faecal egg identification and counts and blood smears for haemoparasite identification. Some VFU veterinarians are increasingly involved in herd-health and production programmes as peri-urban dairies are revived in Kandahar and Kabul. In addition to these private goods and services, VFU veterinarians act as the front line of defense against infectious epidemic transboundary diseases. Since 1996, FAO has implemented a participatory extension programme through the Integrated Livestock Programme (PIHAM) to improve veterinarian/farmer interaction and thus the health and productivity of herds. By early 2000, a convenience sample of 4 050 farmers in 450 villages was in regular direct contact with VFU and livestock production staff. By this third full year of the PIHAM programme, neonatal death rates are relatively low in cattle and sheep (2 percent) and in goats (9 percent). Birth rates in cattle average nearly 70 percent, a calving interval of over 17 months. Birth rates for sheep and goats are 87 percent and 113 percent respectively. Female herd sizes are growing rapidly for cattle (10 percent) and sheep (21 percent) and modestly for goats (2 percent). Purchase rates are modestly high for cattle (11 percent), sheep (7 percent) and goats (4 percent). These figures for 1999 must be seen in the light of a worsening drought in much of the country. Dramatic changes in production indicators may occur in the next few quarters.

BOX 12

The Indonesian eastern islands veterinary services project.

During the early 1990s, a project was undertaken to develop effective and sustainable animal-health services to subsistence farmers in the eastern islands of Indonesia, one of the poorer parts of the country. The government employed sufficient veterinarians at numerous animal-health posts strategically located in the islands of Lombok, Sumbawa, Flores, Sumba and West Timor. These people were generally recent graduates and conscientious, but poorly paid and ill-equipped. Project funds provided motorcycles, basic equipment for clinical, surgical and disease-investigation activities and a range of locally available medications, such as antibiotics, anthelmintics and anaesthetics for immediate use. Approval was given by the local provincial governor for these veterinarians to work as government employees from 7am-2pm and as private practitioners for the rest of the day. Minimum fees were approved and implemented for such services. Income generated provided fuel for the motorcycles, electricity for the refrigerators and replacements for medications. In-country training was provided for various disciplines of veterinary services and overseas scholarships allowed recipients to experience the business aspects of providing user-pays services. Within three years, the majority of these veterinarians had developed viable and sustainable practices that had reduced dependence on government funding, were targeted to the needs of the livestock owners, gave the veterinarians improved job satisfaction and provided the government with accurate, up-to-date information about the livestock-disease situation in the province.

on animal-health extension activities, and tend not to travel or trade far from their own villages.

The animal-health service needed by these people is thus broad in nature but implementation is oriented towards the single animal. Needs vary according to location and need to be identified; they may be based on disease control or the farmer's goals. Farmers' needs are often very different from national needs and include nutrition, management, husbandry and reproduction. The smallholder farmer in Vietnam is more concerned with his single buffalo having a foot abscess at the time of plowing than he is with a national FMD control programme; the smallholder farmer in the Philippines is more concerned with the sow having trouble farrowing than he is with the national rabies control programme; the main goal of the smallholder farmer in Indonesia is often to produce sufficient surplus to allow for a pilgrimage to Mecca. Unless directly affected by a major disease epidemic, they often see the constraints applied for disease control as having only nuisance value.

Animal-health services to smallholder farmers in mixed-farming systems must be quickly applied, realistic and empathetic to the farmer's needs. It requires mobile local staff trained in veterinary science and many other facets of livestock production who are familiar with local farming systems, cultural customs and disease situations. To be viable and sustainable, such services must be demand-driven by recipients: their needs must be met to give this front-line service acceptability and credibility, enhance the job satisfaction of the veterinary providers and supply accurate timely information on national disease events.

A demand-driven service allows recognition of its value by the recipients, who are then able to maximize its benefits and expand into semi-commercial livestock-production enterprises. There are many examples where basic viable animal-health services have given smallholder farmers the confidence to invest time, effort and money into producing eggs, meat and milk in excess of their immediate needs and thus get themselves out of the poverty cycle.

In establishing effective services, special policy considerations must be given to long-term sustainability which, in effect, means to determine who pays for them. Such services have traditionally been regarded as a national responsibility, dependent on sufficient government funding being available. In reality, such funding is universally inadequate and susceptible to changes in government priorities. In many areas, various forms of a "user pays" system have been developed for individual veterinary attention, which has a number of distinct advantages:

- the farmer values the service and is able to assess its worth;
- the veterinarian has a vested interest in supplying a service;
- the veterinarian has regular access to smallholders' problems;
- the government does not have responsibility for supplying the service and can concentrate on broader disease-control programmes;
- from daily diaries and regular weekly or monthly reports, the government has accurate and reliable disease information to assess priorities and plan disease-control and prevention strategies.

To be effective, national policies need to allow the

BOX 13

The Philippines FMD campaign.

In response to a major outbreak of FMD in the Philippines in 1995, the Government initiated a major control and eradication programme. The policy of devolving disease-control activities to 78 provincial government units resulted in highly variable, inconsistent and usually insufficient funding for essential activities such as vaccination programmes, compensation to owners of slaughtered stock, staffing of checkpoints, etc.

The disease was unique in that the virus strain was particularly pig-adapted. Although FMD was recognized as an immediate and significant threat to the food security of smallholder pig owners, the main long-term beneficiaries of the programme were obviously going to be the small but influential group of commercial hog producers. These groups were approached and agreed to provide targeted and complementary assistance to the government programme by providing ring vaccination in villages around their commercial farms, replacement pigs for those slaughtered from smallholder units and meals and accommodation for checkpoint staff at remote locations.

numerous currently available, underworked and generally poorly paid government veterinarians the opportunity to develop and provide this "user pays" service. An example from Indonesia is given in Box 12.

Another alternative for providing animal-health services to smallholder farmers is to investigate the involvement of the private sector. In many parts of Asia, large-scale intensive-production units for poultry, pigs, small ruminants and cattle are developing. These are serviced by veterinary professionals, who are better trained and better paid. As an insurance for their own enterprises, such producers are often willing to provide veterinary services to smallholders in adjoining villages. An example from the Philippines is given in Box 13.

Landless livestock farmers. A particularly vulnerable, numerically large and often the poorest of the marginal group of smallholder livestock producers are those without any claim to land. This includes large communities around major capital cities, such as the thousands of swill-feeding pig owners in squatter villages on the outskirts of Manila, and those congregating along major roads, such as the landless poor of Bangladesh. The only assets these people have are their meagre livestock. They are predominantly women, who have the added responsibility of caring for their children while their menfolk are absent searching for or undertaking labouring work.

Other vulnerable livestock producers include those with migratory habits and tenant farmers. Migratory herds and flocks can be constantly at risk through contact with a wide variety of animals, presence in constantly changing locations and markets and resultant exposure to a continually changing environment of infectious agents. The landless tenant farmer is more vulnerable to financial constraints: the slightest variation in costs and prices can have a major impact on his existence.

Provision of animal-health and other services to such farmers presents major problems.

Chapter 5

Opportunities: providing the tools and solutions to improve animal health and support poor livestock farmers

ANIMAL AND PUBLIC HEALTH ISSUES WHICH NEED GLOBAL RESPONSE STRATEGIES TO PROTECT POOR FARMERS

There are three key features of current developments which impact on the welfare of poor livestock farmers and which require effective and innovative responses:

- After a period when it appeared that epidemic animal diseases were being brought under greater control internationally, expansion and diversification of global trade have resulted in a surge of outbreaks of old and new diseases. These have resulted from illegal movements and legal trading resulting from rapid changes in practices, increased speed of movement of animals and animal products and products reaching communities which never previously had access to items sourced outside their local area. This has exposed the poor farmers of the world to increasing risks of serious diseases they have never seen before breaking out in their area, with devastating effects on their welfare.
- Poor farmers previously largely outside the cash economy have become far more involved in building herds, trading and using their animals as a source of income, not just as a financial reserve and a source of traction, fuel and other traditional benefits. Endemic diseases have grown in importance to them, and in many cases have increased in severity because of management changes. Farmers are more aware of the possibility of treating and controlling these diseases, but there are major problems of giving poor farmers access to the tools they need for control, such as anthelmintics to treat parasitism, and the knowledge to use these tools effectively to enhance income and food security.
- There are growing issues throughout the world of ensuring a food supply safe from food-borne hazards and protecting people against transfer of novel diseases, such as Nipah virus and new strains of influenza viruses, from animals to humans because of increased exposure of people to wild animals and other sources of previously unrecognised human pathogens. These changes have arisen from the growth of the global human population and the extreme pressures it has placed on the environment, particularly at the interface between human food-production systems and natural ecosystems. There is a high risk that products from poor countries may be excluded from international markets because they cannot meet increasingly stringent food-safety requirements.

KEY FEATURES OF THE REQUIRED RESPONSE

Each of these emerging dangers to the welfare and food security of poor farming families requires a targeted and carefully planned response. The proposed strategies are set out below.

- Develop effective risk-based disease-surveillance systems. These can be used internationally to prevent pandemics of serious diseases that would threaten large areas of the world and used by governments in the lowest-income countries to protect farming populations against the threat of major disease outbreaks in high-risk areas. These need to be linked to rapid-response strategies that ensure that rapid, effective action is taken to stop such epidemics and prevent diseases becoming established in village and family livestock.
- Develop private enterprise and partnership approaches to delivering cost-effective animal health care. This applies to endemic diseases in regions of the world where farm family income is most at risk from disease effects.
- Develop approaches to meeting food-safety expectations and the control of zoonotic diseases. These are applicable at low cost in countries where farm family incomes are very low. The measures should be linked to improving protection of fragile ecosystems in such countries, destruction of which is a crucial element in the increasing emergence of novel diseases affecting humans. There is a growing range of examples of new forms of food gathering and animal contact leading to exposure of people to animal pathogens, which have subsequently become widely disseminated in human populations in affected areas and in some cases worldwide.

A development strategy for the elements of the programme is given in the following paragraphs.

Detection, prevention and control of high-impact (epidemic) diseases

The first element of the proposed strategy to assist poor and marginalized farmers is to build more effective systems to reduce the risks of high-impact animal diseases spreading to new areas or intensifying their effects in regions least able to manage such problems.

Many of these high-risk regions of the world are areas where incomes, knowledge and resources to respond are extremely scarce. They are at trading crossroads of the world and hence exceptionally prone to disease outbreaks, because trade through these routes is increasing. What were once well established trade networks are becoming increasingly complex webs of movement, involving opportunities for exposure of large numbers of animals to serious and highly transmissible disease agents. Many of what are now the highest-risk situations were not of such concern when trading followed traditional patterns for which the risks were well understood by local people.

Clear examples of these issues can be seen for rinderpest and FMD (see Chapter 2).

The decline in strength, capacity and distribution of veterinary services over recent years means that the capability to respond has been substantially impaired.

It is therefore necessary to produce innovative approaches for global and regional management of these high-impact diseases, using novel techniques that will provide maximum benefit in relation to the inescapably limited resources available. A strategy for achieving this is outlined below.

Building a strategy to minimize risk of disease spread to new areas. Effective prevention of disease spread requires modern techniques of risk management, in which epidemiological skills and knowledge are combined with a structured process of identification of likely disease agents, assessment of the severity and nature of the risks and the areas of the country at highest risk for entry and spread of the disease. Appropriate strategies can then be developed and implemented to minimize the risks.

It will therefore be necessary to strengthen epidemiological expertise and approaches in national animal-health services to provide skills to enhance the effectiveness of disease detection and control in these countries.

Risk analysis. Only a few of the most advanced countries have well developed risk-analysis systems, and their efforts are mainly devoted to assessing risks in relation to import of high-value products from other countries.

There is a need to promote wider adoption of risk analysis and apply it to the problems of low-income countries, not just to the richest countries. This will require an investment in making risk analysis easier for such countries to conduct by developing suitable tools and adapting them to differing needs, training in the application of techniques and implementing pilot projects in which analytical templates can be developed and applied in data-sparse countries. The case studies are then written up and used to train other countries.

Risk-based animal disease surveillance and early warning systems. The core requirement for enhancing the effectiveness of control activities against high-impact diseases is to develop surveillance systems that focus on the greatest payoff in detecting disease and demonstrating freedom from specific diseases. Surveillance funds are always scarce, so the aim will be to take available funds and invest them in a portfolio of surveillance procedures that will provide the best possible benefit in relation to the funding available. The system will include "scanning" elements, which provide a broad assessment of the disease status of the country, and "focused" elements, which answer specific questions about national disease status. It will be risk-based, in that it will direct surveillance resources at activities and areas of the country in a way that is weighted according to the probability of adverse events and the likely consequences of such events.

In recent years, new and improved epidemiological methods have been developed to deliver disease surveillance. These include structured clinical and observational surveys of the population, serosurveillance, use of geographical information systems and remote sensing to provide information at lower cost than field data gathering, application of low-cost strain-differentiation methods using molecular epidemiological techniques delivered through kits to eliminate high processing costs and interview methods to gather information direct from livestock herders.

There is growing scope for gathering particularly valuable predictive information through image analysis of remotely collected data, such as vegetation mix and growth patterns, which can then be used to target field examination at sentinel sites most likely to yield representative information, such as the typical mix of herders, or indicator information such as areas subject to flooding or growing particular feed types. By using remote sensing to choose sites at which to conduct interviews and sampling, comprehensive data can be accumulated and used to develop statistically valid indicator variables that can be measured in place of the variable of interest, but provide a low-cost guide to disease developments.

Use of a portfolio of these techniques is making it progressively more practical to identify emerging patterns of disease early and put disease prevention and control measures in place, using economic methods to determine what mix of measures is most cost-effective.

Data from a structured mix of techniques can now be integrated through an information system and analysed to extract maximum value, using new epidemiological techniques that synthesize various types of data to yield the best assessment of the current situation and detect warning signals.

Such systems can be provided to low-income countries in a form that allows them to be implemented cheaply; resources can then be redirected to more productive uses. The systems can be used to provide reassurance about the current situation and early warning of unfavourable developments, which will then allow protective action to be taken.

Development of effective surveillance systems requires substantial investment in training of personnel, since the current level of skills in most countries is not yet adequate.

More accessible disease diagnosis

Major losses to disease-control effectiveness in recent years have been the decline through under-resourcing of veterinary diagnostic services and the slow development of alternative ways of providing reliable diagnostic capability. This situation can have serious effects on the speed and effectiveness of the national response to an emerging disease threat.

It seems unlikely that laboratory services will be fully restored, so there is a great need to take steps to restore the capability they provided. This can be achieved through a mix of new diagnostic technologies such as pen-side tests and kit-based strain typing and rebuilding core competence in national and regional laboratories. This will involve training in specific diagnostic techniques and application of these techniques to effective disease surveillance.

Early reaction and measured response to unfavourable disease trends. Surveillance and early-warning systems will only produce a payoff if prompt decisions are made about how to respond to information, followed by effective implementation. This means responding quickly and decisively to imminent threats but adopting a measured approach in which instinctive reactions are avoided and each response is appropriate to the scale and nature of the threat.

To achieve this, contingency planning for high-risk diseases and their control will need to be intensified and considerable effort devoted to assisting countries to plan and manage control programmes for diseases present in the country or threatening it. Such efforts benefit the recipient country and all its neighbours, who are likely to suffer if control measures are inadequate.

There is a need to strengthen the practical effectiveness of regional cooperation efforts in disease surveillance, early warning of emerging problems and coordinated response to potential disease incursions. This will require more effective contingency planning at regional level, joint training, effective liaison and sharing of access to scarce resources that will assist control efforts.

A key area on which animal-health services need to focus is ensuring that their actions are acceptable to and supported by the community, including how to build effective partnerships for action among public, private and NGO sectors involved in animal health. In many countries, this will require development of more effective and comprehensive stakeholder-consultation processes and creation of cooperative links among sectors contributing to animal-health delivery. This in turn requires consensus on the role of each sector and mutual recognition of value. If this is achieved, each sector can be empowered to fulfil its functions effectively.

Solving problems of vaccine and drug delivery systems for disease prevention and control measures. Although there is still scope for developing new vaccines and treatments for various diseases, the shortfall of greatest significance to poor livestock farmers is in low-cost, easy-to-use delivery systems. There is growing evidence of the potential of novel delivery systems for vaccines in food, water or by aerosol, for example, which can reduce costs and increase population coverage because of ease of administration. There also needs to be greater emphasis on achieving high immunogenicity of new and traditional vaccines at the point of administration, without the need for expensive cold chains from source to user; considerable progress has been made with this. There remains a problem of changing attitudes towards accepting these techniques as genuine, useful alternatives or complements to traditional vaccination technology.

There is a need to move from current disease control through routine mass vaccination towards more subtle approaches in which management changes, targeted vaccination and other techniques are combined in integrated low-cost strategies. Such control programmes can make effective disease control a realistic possibility in poor communities by bringing the costs within reach. The potential for this is greatly increased if the immune response to the vaccine is such that it is still possible to differentiate infected animals from vaccinated but uninfected ones. Vaccines with accompanying discriminating tests are becoming more readily available and seem likely to be an important tool in the future. Local strain variation in disease agents needs to be considered. Although it is much more cost-effective

to use generic vaccines that can be used for different populations, this must not be allowed to override the need to ensure that each vaccine genuinely provides protection in the various populations, otherwise the confidence of low-income communities in vaccination will be undermined.

There is scope to achieve comparable delivery enhancements with a range of drugs used for treatment and prevention, although this is a long-term task.

Expanding access of low-income countries to international market opportunities

Many of the poorest countries and communities have little or no opportunity to enter the international market for animals and animal products, even at regional level, because they do not meet expectations for veterinary services or disease status. There is a danger that globalization trends will exacerbate this exclusion from markets. What is needed is a long-term strategy to build marketing opportunities for poor countries, without putting other countries at risk. This will provide encouragement to poor farmers to pursue market opportunities for their animals and products.

In the developed world, performance standards are increasingly applied that can assess the adequacy of veterinary services and hence identify elements that exceed or fall below the required range. Imposing the same standards on low-income countries excludes them from trade, so there is a need to develop a sequential approach whereby countries can move up by steps in animal-health services, as they do in disease status, and progressively gain access to market opportunities. This would provide poor countries with achievable goals and benchmarks of other countries against which to evaluate themselves. In comparison with areas such as medical care or education, animal-health services make less use of benchmarking as a tool and there is scope for it to help rather than disadvantage poor countries.

Developing effective partnerships for delivering animal-health care to low-income communities

In recent years, considerable experience has been gained in development of animal-health services for low-income groups through community-based animal-health workers. They receive simple training from people with formal veterinary skills and then offer standard packages of extension advice and treatment, deriving income from selling products. Such services have typically expanded from an initial pilot study to cover much larger areas and have generally been very successful. They have, however, depended for cohesion and continuity on the enthusiasm of the people leading the programme. Long-term viability rests too heavily on this leadership, so there is a need to link such services more closely with other delivery systems.

While this bottom-up approach has been growing in popularity, there is a top-down requirement for privatization of veterinary services in countries where they have been predominantly public. This process has operated successfully in countries with a commercial-farming sector, but has not expanded in countries where few people can pay private-sector fees for animal-health care. In such situations, poor farmers urgently need animal-health care, yet scarce veterinary resources are diverted to areas which generate income for the veterinarians but little benefit to the low-income communities.

It is proposed that a major strand of the proposed programme should focus on broadening coverage of effective animal-health services for low-income communities, integrating all personnel and delivery mechanisms into strategies that are flexible but targeted to the needs of particular mixes of animal species, spectra of important diseases and lifestyles of the communities. This will involve investigating successes and failures, then building on that experience to guide country studies to test integrated private/public approaches to meeting animal-health needs. Experience gained would then be applied on a larger scale by assisting other countries in the target group to develop approaches based on the results.

Best results are likely to be achieved where the distribution and marketing skills of commercial enterprises are combined with the local knowledge and community standing of NGOs, official veterinary services and community organizations to develop delivery models that are effective in the circumstances of the country. In many countries most needing to overcome the barriers, the relative infrastructure is weak to non-existent. Organizations are needed to ensure that mechanisms are in place throughout low-income countries, not just in limited areas where the drive exists locally, to meet this need and make such systems work in the long term. This will require a methodical process of identifying suitable organizational structures and assisting them to provide the services.

Opportunities for applying newer technologies to communicate with target groups

Village farmers have been prevented from adopting high-return investments in animal-health because it is difficult to distribute appropriately targeted information over large areas where travel is expensive and time-consuming. Experience in evaluating communication strategies for animal-health messages in such situations suggests that strong emphasis on traditional communication methods is important, but that many communities are strongly influenced by information received through technologies that are new and exciting to them. In view of the high cost of using

traditional communications methods to reach remote communities, the benefit of disseminating disease-control messages through newer technologies, chosen according to local availability, should be evaluated.

Control of food-borne hazards and other zoonoses

Low-income farming communities are exposed to a range of zoonotic diseases; in some parts of the world these diseases are among the most serious health threats to the community. Some of these, such as Brucella melitensis and anthrax, are diseases traditionally associated with animal production and processing animal products for local consumption in traditional ways. They remain serious risks in many low-income communities. As human activity impinges more and more on natural ecosystems, increased interaction between rural communities and wildlife has apparently led to the emergence of new and in some cases devastating diseases. The link has not been fully proved, but AIDS, Ebola virus, Nipah virus and Hendra virus all appear to fit this description.

It is proposed that strategies be developed to improve protection of poor rural communities against zoonotic infections, using a risk-based approach to identify low-cost prevention methods for serious zoonoses, with special emphasis on food-borne diseases. In cases where a major risk is exposure to wildlife, approaches should be developed to widen separation between people and wild animals and protect the ecosystems against further degradation.

This could be done using about four case-study areas, each representing particular types of problem, to build experience in approaching these problems.

As food safety becomes a dominant issue in world trade in animal products, lowest-income countries are likely to be further disadvantaged by exclusion from favoured markets. The fact is, however, that traditional production methods provide natural protection against the food-borne diseases that mainly concern importing countries.

It is therefore proposed to develop food-safety protocols and procedures to demonstrate that products from these sources are low-risk. Very low-cost procedures in these countries can therefore provide protection matching that of sophisticated systems in developed countries. This will not be true of all products and all countries, but it offers market niches which can provide income to the poorest countries.

DEVELOPMENT STRATEGY FOR THE PROPOSALS

Each of the components outlined requires an organization to set direction and identify mechanisms for establishing the three major strands of the action plan.

Each strand requires a mix of infrastructure development, training, resource development, organizational management and operational research to provide the proposed elements and hence develop and apply an integrated strategy for achieving the anticipated results.

It would be best to take example countries for each of the strands and work through the development steps, then adapt the model for other countries, using the original sites as resources.

It is fully recognized that changing the situation at village level will be a major challenge – but that is exactly why the task needs to be done.

Bibliography

Abdou, A.H. 1991. History of veterinary public health in the Eastern Mediterranean and Africa. *Rev. Sci. Rech. Off. Int. Epiz.*, 1991, 10(4): 1 041-1 066.

Arambulo III, P.V. 1991. Veterinary public health: perspectives at the threshold of the twenty-first century. *Rev. Sci. Rech. Off. Int. Epiz.*, 10(4): 255-260.

Belino, E.D. 1991. Organization of veterinary public health in Africa. *Rev. Sci. Rech. Off. Int. Epiz.*, 10(4): 99-116.

Bōgel, K., Griffiths, R.B., Mantovani, A. & Matýās, Z. 1990. Guiding principles for planning, organization and management of veterinary public health programmes. ISS/WHO/FAO-GC/IZST, e/90.11.

Brückner, G.K. 1997. The impact of global climatic change on terrestrial ecosystems: possible effects on the occurrence of animal diseases. *In* L. Shackleton, S. Lennon & G. Tosen, eds. *Global climatic change and South Africa.* Cleveland, USA, Environmental Scientific Association. 160 pp.

Brückner, G.K. 1999. Structural adjustment programmes, transition economies and privatization of veterinary services and the implications for veterinary public health. WHO/FAO/OIE specialist consultation: future trends in veterinary public health, March 1999. Teramo, Italy.

Carney, D., ed. 1998. Sustainable rural livelihoods: what contribution can we make? London, DFID.

Catley, A. 1999. *Non-governmental organizations and the delivery of animal health services in developing countries*. Discussion paper for the Department for International Development. Edinburgh, UK, Vetwork.

Catley, A. & Leyland, T.J. 2001. Community participation and the development of veterinary services in Africa. *Preventive Veterinary Medicine*, 49: 95-113.

FAO. 2000. *Impacts of trypanosomiasis on African agriculture,* by B.M. Swallow. PAAT Technical and Scientific Series, No. 2. Rome.

FAO. Emergency Prevention System (EMPRES) Livestock. Tracking trends and analysing threats from epidemics of transboundary animal diseases. http://www.fao.org/livestock/agah/empres/x3249ep2.htm

Friedman, T.L. 1999. *The lexus and the olive tree.* New York, Farrar, Straus and Giroux. 394 pp.

Government of the United Kingdom. 2000. *Eliminating world poverty*: *making globalization work for the poor.* White Paper on International Development. London.

Heffernan, C. & Misturelli, F. 2000. *The delivery of veterinary services to the poor: preliminary findings from Kenya*. Report of DFID project R7359. Reading, UK, VEERU.

Henninger, N. 1998. *Mapping and geographic analysis of poverty and human welfare – review and assessment.* Report prepared for the UNEP/CGIAR initiative on GIS. Washington DC, World Resources Institute.

Holden, S. 1999. The economics of the delivery of veterinary services. *Rev. Sci. Tech. Int. Off. Epiz.*, 18(2): 425-439.

Kitching, P. 2000. OIE list A diseases as a constraint to international trade. *Annals of New York Academy,* 916: p. 50-54.

Leonard, D.K. 2000. *Africa's changing markets for health and veterinary services: the new institutional issues*. London, MacMillan. 320 pp.

LID. 1999. *Livestock in poverty-focused development*. Crewkerne, UK.

Linthicum, J.L., Anyamba, A., Tucker, C.J., Kelley, P.W., Myers, M. & Peters, C.J. 1999. Rift Valley fever and satellite imagery. *Science*, 285: 397-399.

Majok, A. A. & Schwabe, C.W. 1996. *Development among Africa's migratory pastoralists*. Westport, USA and London, Bergin & Garvey. 284 pp.

McDermott, J.J., Randolph, T.F. & Staal, S.J. 1999. The economics of optimal health and productivity in smallholder livestock systems in developing countries. *Rev. Sci. Tech. Off. Int. Epiz.*, 18 (2): 399-419.

McInerney, J. 1996. Old economics for new problems – livestock disease. Presidential address. *J. of Ag. Economics*, 47(3): 295-314.

McMichael, A.J. 1997. Integrated assessment of potential health impact of global environmental change: prospects and limitations. *Environmental Modelling* 2, 1997, p. 129-137.

Mellor, P.S. 1998. Climate change and the distribution of vector-borne diseases with special reference to African horsesickness virus. Towards livestock disease diagnosis and control in the 21st century. *Proceedings of the IAEA/FAO symposium on diagnosis and control of livestock diseases using nuclear and related techniques*. Vienna, IAEA.

Omore, A.O., McDermott, J.J., Staal, S., Arimi, S.M., Kang'ethe, E.K. & Ouma, E.A. 2000. Analysis of public health risks from consumption of informally marketed milk in sub-Saharan African countries. *Proceedings of the 9th International Symposium on Veterinary Epidemiology and Economics*, paper 502. Breckenridge, Colorado, USA.

Pretty, J.N. 1995. Participatory learning for sustainable agriculture. *World Development*, 23(8): 1247-1263.

Rweyemamu, M.M. & Leforban, Y. 1999. Foot-and-mouth disease and international development. *Advances in Virus Research*, 53: p. 111-126.

Schwabe C.W. 1984. *Veterinary medicine and human health*. 3rd edition. Baltimore, USA, Williams and Wilkins.

Sonaiya, E.B., Branckaert, R.D.S. & Gueye, E.F. 1997. *Research and development option for family poultry*. Introductory paper, First INFPD/FAO Electronic Conference on Family Poultry. Rome.

Swallow, B.M. 2000. *Impacts of trypanosomiasis on African agriculture*. PAAT Technical and Scientific Series, No. 2. Rome, FAO.

Thiermann, A.B. 2000. Protecting health, facilitating trade, or both? *Annals of New York Academy*, 916: p. 24-30.

Thompson, J. 1998. Participatory approaches in government bureaucracies: facilitating institutional change. *In* J. Blackburn and J. Holland, eds. *Who changes? Institutionalising participation in development*. London, Intermediate Technology Publications.

Thornton, P.K., Randolph, T.F., Kristjanson, P.M., Omamo, W.S., Odero, A.N. & Ryan, J.G. 2000. Assessment of priorities to 2010 for the poor and the environment. *ILRI Impact Assessment Series*, No. 6. Nairobi, ILRI.

Walton, T.E. 2000. The impact of diseases on the importation of animals and animal products. *Annals of New York Academy*, 916: p. 36-40.

This manual is one of the outcomes of the 1996 World Food Summit resolutions on the need to achieve global food security. It examines the serious and worsening problems of animal diseases and veterinary public health worldwide. Animal diseases are a major constraint to livestock production and safe utilization of animal products everywhere. They are devastating for poor livestock farmers and farming communities in developing countries.

Improved animal health for poverty reduction and sustainable livelihoods **examines practical ways of reducing poverty and creating sustainable livelihoods among rural populations in the developing world by improving the health of livestock. Demand for animal products is likely to increase dramatically in the next two decades, and producers will benefit from increased trade opportunities. The extent to which producers in poor countries will share the benefits depends on the production levels they can achieve and on whether their products will be accepted as tradable commodities. These determining factors are inextricably linked to the health of their livestock. The manual looks at ways of improving national animal health policies and delivery systems through objective analysis of problems and training of personnel; the importance of raising public awareness is underlined. It stresses the need for global response strategies to support animal and public health issues and sustain national and local initiatives. An important element of the manual is that its lessons are drawn from extensive practical experience worldwide, particularly in developing countries.**

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