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# One medicine—practical application for non-sedentary pastoral populations<sup>1</sup>

David E. Ward & Roger Ruppanner & Philippe J. Marchot & Jørgen W. Hansen

This paper examines some theoretical and practical aspects of delivering human and animal health care to rural societies. Economic theory of the private versus the public good argues against the integration of human and animal health interventions. Judging by the scarcity of documented examples of beneficial integration of human and veterinary health care interventions, economic theory may indeed bear out what is found in practice.

Explanations for this apparent lack of integration of human and animal health care systems may stem from the Western oriented, anthropocentric way development specialists approach the problem. Examples are described where appropriate and financially viable animal health delivery systems are designed on sound veterinary epidemiology and ethnoveterinary principles. These examples may serve as a basis for designing integrated human and veterinary health care interventions.

Available tools, such as geographic information systems, sentinel cases, ethno-veterinary research and pictogram/computer systems, which may be used to design more cost effective interventions, are discussed.

## The theoretical basis for one medicine

From a holistic point of view, human and veterinary medicine are considered as but two of several components of zoology (Schwahe 1984:4–17). Modern Western medicine, both human and veterinary, has its roots in biology and both contribute to what should most properly be termed "general medicine". General medicine is used in the same sense as "general physiology" or "general biology", for these general studies deal with processes and cut across species and phyla. If this premise is accepted, then "one medicine" for both humans and animals can theoretically be applied to health care for non-sedentary pastoral populations.

Veterinarians and physicians are two parts of the health care delivery team. However they, as well as others on the team, come with more or less cultural baggage

when dealing with general medicine. Three culturally biased generalizations are pertinent to the issues of the integration of human health and veterinary interventions among non-sedentary pastoral populations.

The first generalization is that veterinarians and physicians have a different perspective toward disease. Clinical physicians, at least those educated in high tech medicine in developed countries, have a species orientation—humans are their primary focus. The basic training for veterinarians has a disease orientation which crosses species.

A second generalization is that practising veterinarians (at least practising food animal veterinarians) deal with health on a herd basis, not an individual basis, and are ever cognisant of the economic considerations of their interventions. Most physicians lack this orientation, the exception being public health physicians, who by the nature of their work and training, deal with populations through interventions which need to be cost effective for the community.

The third generalization is that practising veterinarians are primarily concerned with preventive medicine and disease control; practising physicians think in terms of the intensive management of sick individuals.

It is important to remember the cultural biases which veterinarians, physicians and others on the health team come saddled with as they approach the delivery of health care for pastoral populations. In the past, such Western cultural, gender, and numerous other biases contributed to the success or failure of such programmes.

### Economics and health care delivery

On economic and moral grounds, humans in industrialized societies have a high value; therefore, human health, a *public good*, has a high value. (utility). This anthropocentric view obligates governments to provide medical services to achieve or maintain a healthy society. Many government-provided medical services, particularly in public health, are thus considered to be carried out for the *public good*.

The practical delivery of health care to animals is also subject to economic theory (Umali, Fedder and de Haan 1992). Individual animals, particularly in extensive pastoral livestock systems, have low economic value. Health care is often not worth the marginal return, particularly if high cost professionals must deliver the health care services. In economic terms treatment of individual animals is a *private good*, the benefits accruing largely to the livestock owner. Governments are generally not obliged to provide services for the private good and in practice most governments in developing countries cannot afford to provide such services. Many governments in Africa have tried and are failing.

This is not to say that government has no role in animal health care. Some public good services can be cost effective as well as beneficial for both human and animal health.

Examples include quarantines, livestock extension advice, mass vaccination and laboratory diagnostic services. These services can provide benefits which far outweigh their costs in terms of prevention of zoonotic diseases, improving animal health and production bringing self sufficiency in food production, particularly in intensive livestock systems.

In extensive livestock systems however, there is a dichotomy in the delivery of health care for pastoral populations. On the one hand, the high moral value and the public good character of human health services can *theoretically* command high cost medical services. On the other, the low value of individual animals and the private good character of their treatment argues against expensive health care delivery.

This economic dichotomy must be confronted when designing delivery systems for integrated human health and veterinary interventions among non-sedentary pastoral populations. So despite there being a theoretical "one medicine" basis for human and animal health care, how does one overcome the economic dichotomy in the delivery of integrated care? Is it possible that the concept of private and public goods with its consequences on ownership of health care services is not applicable in the context of non-sedentary pastoralists? Are there other economic models that better reflect these relationships in pastoral populations, or will observation of these populations lead to the formulation of more compatible theories?

### Integrated human and veterinary interventions

There are few documented instances of integrated human and veterinary health care interventions; those described more often deal with delivery of health care under special circumstances such as human disease outbreaks necessitating internationally funded emergency programmes. These can serve as examples; whether these programmes are financially sustainable or cost effective can

certainly be questioned. In other instances, health care services are village based, performed by traditional healers and provide scope for further development as described below. Oddly, two examples occur independently in the same African country: Southern Sudan.

UNICEF and various non-governmental organizations (NGOs) in southern Sudan undertook vaccination campaigns particularly against DPT, polio, and measles as part of the WHO sponsored Expanded Programme on Immunization (EPI) for children (Pers.comm. 1990). Other NGOs undertook to increase vaccine coverage against rinderpest in cattle as part of the EEC funded Pan African Rinderpest Eradication Campaign. It was found that increased coverage for childhood vaccinations under EPI could be obtained when livestock owners were encouraged to bring their cattle for vaccination against rinderpest at the same time and to the same location.

The second example concerns traditional healers who provide various medical services for both humans and animals among pastoral societies in the Sudan (Schwabe and Kuojok 1991). Among these healers are the medical *Atet*, in the Dinka cattle camps, who provide diagnostic disease services and manual healing arts including the suturing of wounds, opening of abscesses, bone setting, obstetric manipulations and castrations. The latter two services are skilfully performed on animals, most likely as a result of the high demand for these services. Dinka *Atet* traditional healers are truly comparative practitioners of the one medicine concept.

### Tools to improve health care delivery for non-sedentary pastoralists

#### *Satellite imagery and modelling*

The planning and implementation of health management for humans and livestock in non-sedentary agricultural societies can be facilitated by an ability to predict patterns

of movement and to associate these with the probable occurrence and prevalence of disease vectors and related environmental changes that may affect the health status of the populations. Within this objective GIS and satellite imagery have demonstrated their usefulness in the prediction of an increasing number of factors which may influence the health and wellbeing of both pastoral and sedentary rural populations. For example, systems are now available for the accurate prediction and monitoring of locust outbreaks which contribute to improved early control and thus, enhance the nutritional status of pastoralists, particularly in the arid and semi-arid regions of Africa.

Computerised modelling of the distribution and movement of insect vectors has facilitated the prediction of the occurrence of various diseases due to environmental and climatic changes. Particular examples are screw-worm flies, ticks and tick-borne diseases, mosquitoes and more recently tsetse flies.

Studies are under way to monitor trypanosomiasis in space and time using NOAA satellite images, routinely collected and processed by the FAO remote sensing unit. Of particular interest here is the use of Normalised Difference Vegetation Index, a measurement of the amount of active green in the biomass. The likely presence of tsetse flies in specific areas may be predicted by delimiting vegetational patterns suitable for tsetse survival. The abundance of tsetse flies, in turn, is a determinant of trypanosomiasis risk in livestock and, in some instances, of the risk of sleeping sickness in humans. There is mounting evidence that intensification of tsetse transmission cycles in domestic animals may induce outbreaks of sleeping sickness in humans (Rogers and Randolph 1991). This illustrates that disease surveillance in a pastoralist system may require consideration of the entire ecological setting. Environmental monitoring via GIS and remote imagery may contribute to the targeting of scarce health resources to areas and moments of greatest need.

### Sentinel cases

History provides examples where the monitoring of disease frequency in animals has had predictive value for the occurrence of disease in humans and vice versa. For selected diseases, such as trypanosomiasis and hydatidosis, sentinel animal monitoring may give early warning for disease in humans and lead to improved health care.

One example from the southeastern United States in the 1920s is black tongue disease in dogs which served as an indicator of pellagra (niacin deficiency) in humans (Schwabe 1984:178-179). Some dogs were fed marginally nutritious diets consisting primarily of kitchen scraps which reflected the nutritional content of their owner's diet. Practising veterinarians recognised the association between pellagra in dogs and in their owners. In this instance, the appearance of black tongue disease in dogs signalled the possibility of pellagra in humans.

A second example may be taken from sub-Saharan Africa where various species of trypanosomes, transmitted by tsetse flies, affect both humans and livestock. Human trypanosomiasis induced through *Trypanosoma gambiense* or *T. rhodesiense* is normally confined to historically well known and limited areas of infection with a low incidence but outbreaks occurring every few years. In recent decades it has been shown that reservoirs of these parasites in livestock increase the prevalence of infected vectors and may thus contribute to an emergency outbreak as transmission between humans-fly-animals also increases.

The incidence of *T. brucei* in livestock could in some instances constitute an early warning indicator for increased disease in humans, such as has been found in northern Uganda over the past few years (Mehlitz 1989).

Furthermore, in such situations the immediate way to control such outbreaks is not by attacking the vector but by reducing transmission levels by removing infected persons from the community through hospitalisation and treatment whilst eliminat-

ing the animal reservoir through herd treatment with drugs.

Hydatidosis in sheep and humans can serve as a two-way indicator of disease (Araujo *et al.* 1975). Hydatid disease, caused by *Echinococcus granulosus*, was not known to occur in California sheep until 1967. In the fall of that year, a graduate student working on a research project on host-parasite interaction of that particular helminth parasite was asked by his advisor to go to a local slaughter house to collect *Taenia hydatigena* cyst fluid for want of better—*E. granulosus* cysts had never been reported. The student observed the simultaneous occurrence of liver and lung cysts in some sheep, a characteristic feature of *E. granulosus* infestation, and brought samples back to the laboratory for confirmation. Indeed, 225 mature ewes in one lot of 227 animals slaughtered had viable cysts of *E. granulosus* in their livers and lungs. When tracing back these sentinel cases to the farm of origin, it was discovered that the owner, a 40-year-old Spanish born Basque sheep rancher and his son both had had operations for removal of hydatid cysts in 1965 and 1967. The boy had never been out of California and it was therefore evident that he had acquired the infection in this state—the first documented autochthonous case.

In 1970 another student who was familiar with these events reported on the death of one sheep rancher, prominent within the Basque community of southern California. The death had occurred from complications after an operation to remove *E. granulosus* cysts from his lungs. The follow-up of this sentinel case at the farm also revealed parasite infestation in both sheep and dogs on the ranch.

Thus, in the first instance, sheep indicator cases led to the discovery of human cases of disease while in the second instance a human indicator case led to the discovery of animal disease. Both instances in turn, led to other case-finding interventions. During a large gathering of Basques at an annual picnic, participants were given the opportunity to be skin-tested for the presence of infection

with *E. granulosus*. Many took up the offer, others were reluctant. In another area of California, where sheep are raised under a transhumant system, a campaign to purge a large number of sheep dogs revealed that a number of them carried the adult parasite in their intestines. These canine sentinel cases led to the discovery of other ovine and human cases of hydatidosis as well as to a sylvatic cycle in deer and coyotes.

By 1972, such follow-up studies plus a survey of California hospital records had revealed 15 cases of human hydatid disease which had definitely been acquired in California. A much larger than expected proportion of these cases were of Basque origin. This observation triggered an anthropological study to determine Basque involvement in the California sheep industry, their husbandry practices as they might relate to the incidence of hydatid disease and their folk-knowledge about hydatid disease; it came to be known as the Basque connection.

The study was carried out by a Basque-speaking anthropologist through 300 personal visits and interviews. Although Basques represented only 0.04% of the population of California, they constituted one third of the known autochthonous cases of hydatid disease in the state. The risk of being operated upon for hydatid disease was about 1000 times greater for Basques than for non-Basques. Astonishingly, although hydatid disease is endemic in both France and Spain where most of the interviewed Basques came from, there was no indication of a Basque word for the disease. Only six of the 300 interviewees had had any first hand knowledge of the existence of the disease in Europe. Of five shepherds, who had had surgery for removal of hydatid cysts, only three knew more than that they had gotten the disease from a dog. That the disease affected sheep was unknown and surprised several of the shepherds.

One husbandry practice particularly favouring transmission of the disease was that sick and debilitated sheep—often carriers of hydatid cysts—were killed and left

for the dogs to eat. The protoscolices contained within the cysts populate the dogs intestine, mature and shed their eggs into the environment through the dog's faeces. The eggs are ingested by sheep (and occasionally by a person handling the dog) and thus the cycle is completed and maintained.

The lesson to be learnt from this example is not only that sentinel cases in one species can reveal disease in another species, but that in the case of zoonoses the most important task may be to educate the people most likely to be victims of such diseases as well as those who deliver health care to them.

#### *Ethnoveterinary research*

Sollod and Stem (Sollod and Stem 1991) describe a broad interdisciplinary collaboration to develop an animal health information system appropriate to pastoral societies in sub-Saharan Africa. In the case described, veterinary epidemiologists, anthropologists, ecologists and geographers, collaborated with the active participation of the pastoral population. Their goal was to "get the technology right", i.e. the delivery of effective animal health care, while at the same time making it compatible with cultural, economic, social and physical conditions.

They point out the pitfalls of Western cultural bias in trying to impose an etiological diagnosis on animal disease syndromes. (Sollod, Wolfgang and Knight 1984) The example given is "wilserè" which is a Fulbè (Burkina Faso) name for a chronic wasting disease syndrome of cattle which is diagnosed essentially by the exclusion of more easily identifiable diseases. The etiology of this disease includes, but is certainly not limited to, trypanosomiasis. It is clear that this syndrome can also be associated with phosphorus and vitamin A deficiencies, internal parasites, poor feed quantity and quality and a complex number of other proximate causes. Narrowly focused interventions to treat trypanosomiasis did not cure wilserè in cattle and

thus led to frustration on the part of Western trained veterinarians and pastoralists alike. Thus, wilserè is the name given to a multifactorial disease complex in cattle. A similar process of exclusion results in the name "azani" for a complex disease syndrome in camels.

This observation supports the plea of one of the authors (Ward) that a category of "unknown diagnosis" should be included in reporting systems. Lack of specific clinical diagnoses probably occurs with equal frequency within typical Western veterinary (and human) medical systems as it does in Africa. To admit that a disease is undiagnosed is both intellectually honest and practical. Furthermore, lack of a specific diagnosis does not preclude immediate treatment and/or submission of specimens for laboratory diagnosis. Treatment and advice can be given based on one's best judgement or tentative diagnosis. The following up of cases will temper judgement in the future.

### Effective and affordable delivery systems

#### *Mobile clinics versus rural clinics/dispensaries*

Mobile veterinary clinics were used (and are still proposed) to supply diagnostic and treatment services for pastoral livestock. They have not proved very successful and are very expensive. A better system is to establish clinics or dispensaries in settled areas. Livestock health providers, normally not veterinarians but animal health auxiliaries or human pharmacists, associated with these centres can dispense remedies and collect field information from the truly mobile animal health care providers—Vetscouts, Nomadic Animal Health Auxiliaries, Village Keymen, etc. Clinics/dispensaries in settled areas in conjunction with mobile animal health auxiliaries may be the most culturally, socially and eco-

nomically viable method for providing animal health care to pastoralists.

Two examples include the Basic Animal Health Service in northeast Thailand (Meemark *et al.* 1991) and the "village apotiks" in Indonesia (*Pers.comm.* 1984). In northeast Thailand key villagers are trained and supported to deliver basic anthelmintic treatments to livestock. The primary animal health problem was identified as internal parasites, ascarids and trematodes, in young animals. Key villagers are provided with appropriate anthelmintics, which they sell at a profit to compensate for their services. The revenues derived go into a revolving fund which partially supports monitoring, distribution and commodity purchases. The activities of the Village Keymen are monitored by their demand and payment for additional supplies of anthelmintics.

District veterinary officers in Ache Province of northern Sumatra, Indonesia, in conjunction with village shop keepers, have expanded the distribution network for basic livestock remedies such as anthelmintics, antibiotics and coccidiostats by supplying these remedies to village pharmacies. Shopkeepers obtain bank credit to purchase goods for sale in their shops. Use of the remedies is monitored by the frequency of resupply. At the same time information on disease occurrence is provided by the shop owner and extension advice is passed on via the shop owner to livestock raisers. Both programmes are based on privatisation and cost recovery which may account for their financial sustainability.

#### *Mass vaccination, surveillance and selective action*

Periodic mass vaccination of animals against the acute epidemic diseases such as rinderpest, contagious pleuropneumonia, Newcastle disease, rabies and foot and mouth disease is a traditional role of government veterinary services. The major constraint is the heavy logistic requirement involved in getting the animals to the right

location, at the right time, together with the vaccinators and viable vaccine. The logistic costs are much higher than the cost of the vaccines themselves.

Historically, mass vaccination campaigns have been less than successful in eradicating or even controlling most animal diseases. This may largely result from the lack of imaginative ways to solve the logistic and communication problems associated with such campaigns in nomadic areas.

An alternative method of surveillance and selective action was proposed by Zessin and Carpenter (1985). The epidemiologic approach to control contagious bovine pleuropneumonia in the Sudan was based on surveillance and selective actions which were tested in an economic analysis. An effective disease surveillance and data collection network from district sources was established and district intervention teams equipped to take "selective actions" where the disease is diagnosed. Selective action includes epidemiologically sound methods to control the disease and may include rapid mobilization to provide ring vaccination, slaughter, quarantine or animal movement control in the specific area. This epidemiologic approach was consistently more cost effective than a mass vaccination programme (50% or 65% coverage) even if the effectiveness of the surveillance and selective action was reduced by half.

#### *Western veterinary structures versus local resources*

The Western model for delivery of animal health services using private practitioners, modern remedies, mobility and laboratory support is indisputably effective in increasing livestock production in the Western farming context. When this model is applied in pastoral (as well as most other) settings in developing countries, it is usually not as successful as expected.

An animal health information system in which selected pastoralists called Vetscouts were used to gather and report animal production and disease information, and to

provide animal remedies was described for sub-Saharan Africa (Sollod and Stem 1991). It is an example in which where important principles were applied to provide a socially acceptable, financially viable and technically efficient animal health and production improvement scheme for pastoral societies. The programme used indigenous, minimally trained pastoralists to record diagnoses and individual animal treatments. This data led to frequency estimates of the most important health problems in the eyes of livestock owners and provided seasonal, geographic and species distribution information for these diseases. This in turn, gave clues to etiologic diagnosis and logistics planning. Continuing contact by the same Vetscout with the same pastoralists and herds allowed judgements on the effectiveness of treatments, correctness of disease diagnosis and impact on livestock productivity. An innovative pictogram/computerized recording methodology is described (Figure 1).

Schwabe and Kuoajok (1991) elaborate on the prospects of incorporating traditional healers into the human and veterinary health care delivery team. The medical *Atet* healers in southern Sudan practice a selection of manual healing arts in humans and animals. They are astute in diagnosing diseases including anthrax, contagious pleuropneumonia, haemorrhagic septicaemia, black quarter, trypanosomiasis, rinderpest, foot and mouth disease, infectious conjunctivitis, fascioliasis, scabies, mange, neonatal diarrhoea (in calves) and mastitis. Additional training—leading to accredited *Atet*—in asepsis, basic drug use, the correction of misconceptions and information on basic disease treatment and prevention would make traditional healers even more valuable members of the team. Added to this might be a human and animal disease surveillance and reporting function in exchange for basic drugs. This added surveillance function would be particularly valuable as a guide to specific actions (described above) to control diseases as and when they occur.



## Conclusion and proposals for the future

The "one medicine" concept is acceptable in the biological sense. One medicine, across species and phyla, applies in biology, medical research and in public health programmes. However, the practical delivery of "one medicine" in terms of primary health care, particularly to humans and food animals in pastoral settings, needs careful analysis. On economic grounds there is an obvious dichotomy between delivery of health care services (a public good) to high value humans as opposed to delivering such services (a private good) to low value individual animals.

Today there is little evidence that the integration of human and veterinary health care interventions among non-sedentary pastoral populations is viable. This suggests that the economic analysis for integrated health care delivery mentioned in an earlier paragraph is correct. Thus, in the case of integrated human and veterinary health care interventions among non-sedentary pastoralists, up to now, the theory seems to confirm the actual situation. Proposals to enhance the integration of human and veterinary health care should include:

- (1) The development of new tools and innovative ways to integrate human and animal health care delivery;
- (2) The rethinking of Western models and anthropocentric biases in the provision of human and animal health care;
- (3) Building on the examples of successful animal health care delivery systems, such as Vetscout, with the aim of seeing where human health delivery can be added;
- (4) Using traditional healers, through training, upgrading surveillance, as part of the primary health care delivery team.

## Note

<sup>1</sup> The opinions expressed in this paper are those of the authors and do not necessarily reflect the official policies of the Food and Agriculture Organization of the United Nations.

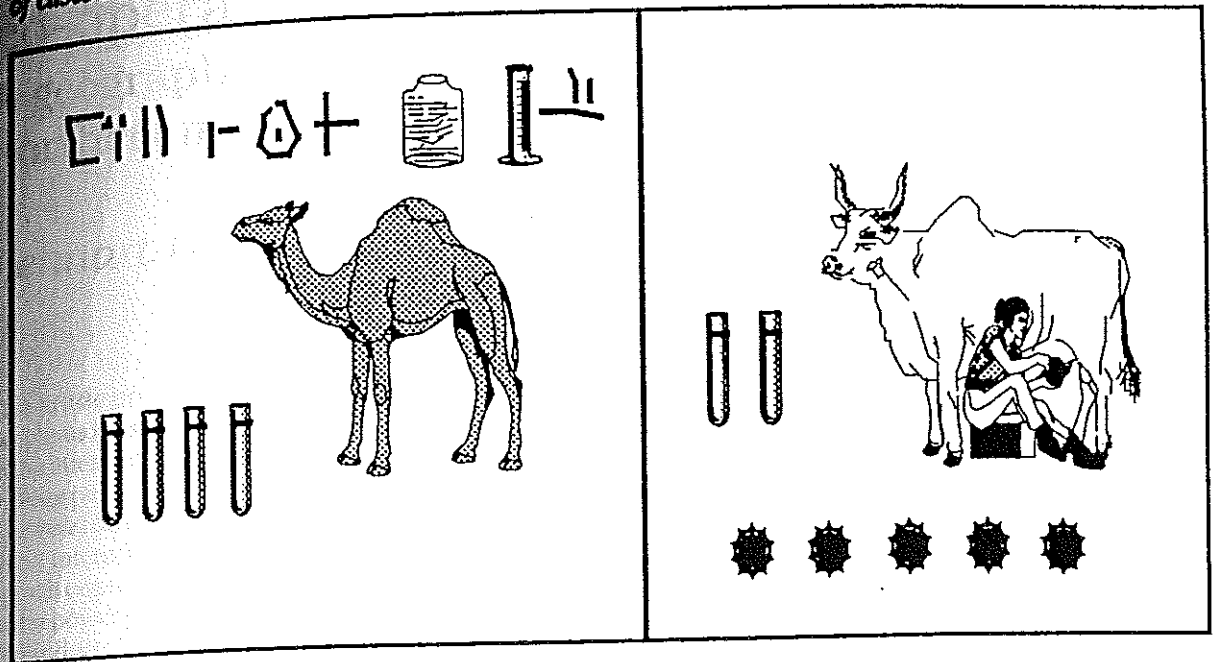
## References

- Araujo, F. P., C. W. Schwabe, J. C. Sawyer and W. G. Davis 1975, "Hydatid disease transmission in California, a study of the Basque connection", *Am. J. Epi.*, 102:291-302.
- Meemark, N., R. S. Morris, K. Leidl and S. Srihakin 1991, "Adoption of a village animal health service in Thailand", in *Proceedings of the 6<sup>th</sup> International Symposium on Veterinary Epidemiology and Economics*, Ottawa, Canada, 12-16 August. Pp. 210-213.
- Mehlitz, D. 1989, "Assessing the importance of the animal reservoir and its possible relevance to the medium of human trypanosomiasis", *Annales de la Societe Belge de Medecine Tropicale*, 69:Suppl.1:210.
- Rogers, D. J. and S. E. Randolph 1991, "Mortality rates and population density of tsetse flies correlated with satellite imagery", *Nature*, 351:739-732.
- Schwabe, C. W. 1984, *Veterinary medicine and human health*. Third edition. Baltimore: The Williams & Wilkins Company.
- Schwabe, C. W. and I. M. Kuoajok 1991, "Practices and beliefs of the traditional Dinka health healer in relation to provision of modern medical and veterinary services for the southern Sudan", *Human Organization*, 40:231-238.
- Sollod, A. E., K. Wolfgang and J. A. Knight 1984, "Veterinary anthropology: interdisciplinary methods in pastoral systems research", in J.R. Simpson and P. Evangelou (eds.), *Livestock development in subsaharan Africa: constraints, prospects, policy*. Boulder Colorado: Westview Press. Pp. 285-302.
- Sollod, A. E. and C. Stem 1991, "Appropriate animal health information systems for nomadic and transhumant livestock populations in Africa", *Rev. Sci. Tech. Off. Intl. Epiz.*, 10(1): 89-101.
- Umali, D. G., G. Fedder C. and de Haan 1992, "The balance between public and private sector activities in the delivery of livestock services". *World Bank Discussion Paper*, No. 163. Washington, D.C.
- Zessin, K. H. and T. E. Carpenter 1985, "Benefit-cost analysis of an epidemiological approach to provision of veterinary service in the Sudan", *Preventive Veterinary Medicine*, 3:323-337.

## Personal communications

- 1984 Dr. B. Harker, Provincial Development Project-Ache Province, Government of Indonesia/USAID.
- 1990 Ms. D. Marstrand, Danish Red Cross Society.

Figure 1. Pictograms communicating disease and treatment and allowing the tabulation of cases seen by veterinary auxiliaries



The writing in the left-hand box is Tifinagh, a script used by the Twareg

(from Sollod, A.E. and C. Stem 1991, "Appropriate animal health information systems for nomadic and transhumant livestock populations in Africa", *Rev. Sci. Tech. Off. Int. Epiz.*, 10(1): 89-101) by Dr. Kenji Soto, Assot Professional Officer, Animal Health Service, FAO-AGA, Rome.

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