Since 1912, when the first case of rabies was diagnosed in a dog in Kenya, the disease has existed in the country with varying incidence. It was not until 1982, however, that the number of cases diagnosed annually rose to 200 and above. The disease, which is a problem both in the rural and urban areas, is now more widespread and prevalent than at any time in the country's history.

The rabies situation

Although all mammalian species can be affected by rabies, the species of most importance in Kenya is the dog. The dog is also the major vector of rabies in man. Approximately 55 - 65 percent of animal rabies cases diagnosed in our investigation laboratories occur in dogs. The other animal species probably play only a limited role in the maintenance of the disease in most parts of Kenya. This statistic is significant because of the close links between dog and man.

The number of positive animal rabies cases reported annually from 1991 to 1994 are shown in Table 1. Although the number of positive cases decreased from 205 in 1992 to 72 in 1994, there is no evidence that the incidence of the disease has decreased in the country. In fact, the official figures given represent only the tip of the iceberg. The reasons for this apparent decrease have to do with submission of specimens for diagnosis.

The figures for human rabies shown in Table 1 represent a significant under-estimate of the true statistics because a number of cases die in their homes and these are not reported.

Since 1987, only slightly more than 9 percent of the national requirement for post-exposure treatment was allocated, due to limited availability of funding. Control of rabies in dogs is one effective way of reducing cost of post-exposure treatment in man.

Surveillance

In Kenya, all cases of suspected rabies are dealt with by a qualified veterinarian wherever practicable and all outbreaks are reported immediately to the Provincial Director of Veterinary Services and the Director of Veterinary Services. Specimens are submitted to Kabete or Mariakani Veterinary Investigation Laboratories (VIL), these two being the only laboratories that carry out rabies diagnosis both in animals and humans in the country.
The VILs and District Veterinary Offices (DVO) are the regional collection points of all rabies specimens since they have facilities to transport the specimens to the diagnostic laboratories. However, distances between these collection points are often quite long, thus discouraging farmers or the public from submitting specimens or reporting cases. This is the major drawback in our rabies surveillance and explains, in part, the reason for the low number of samples submitted for diagnoses.

The Department of Veterinary Services (DVS) has a small computer facility that inputs rabies diagnosis data, amongst other data. These data are analysed and reports compiled, at no fixed interval, and disseminated to all offices handling technical matters in the Department.

The surveillance system described above underestimates the true incidence of rabies in the country. This is due to non-reporting and non-presentation of suspected animal cases at veterinary clinical centres and non-availability of local diagnostic facilities. The general public is not adequately educated to create the necessary awareness regarding rabies. Figure 1 is a map of Kenya showing the location of various VILs and their relative distances from Kabete and Mariakani VILs.

The wish of the Department is to have all eight VILs carry out rabies diagnosis so as to improve our surveillance system. At the moment, this is not possible due to lack of funds to purchase the required equipment and to lack of adequately trained virologists.

Table 1. Positive cases according to species, 1991 - 1994. (Source: Kabete and Mariakani Investigation Laboratories.)

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Human</td>
<td>47</td>
<td>31</td>
<td>49</td>
<td>UK</td>
</tr>
<tr>
<td>Dogs</td>
<td>112</td>
<td>129</td>
<td>113</td>
<td>40</td>
</tr>
<tr>
<td>Cattle</td>
<td>32</td>
<td>46</td>
<td>50</td>
<td>21</td>
</tr>
<tr>
<td>Cats</td>
<td>17</td>
<td>4</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Sheep</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Goats</td>
<td>1</td>
<td>2</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Horses</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Camel</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Pigs</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Wildlife</td>
<td>4</td>
<td>18</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Total animal</td>
<td>172</td>
<td>205</td>
<td>190</td>
<td>72</td>
</tr>
</tbody>
</table>

UK = Unknown, no data available.

1 Mariakani VIL cases not included.

2 The wildlife species include: honey badger, mongoose, bat, jackal, squirrel, wild-dog, leopard and hyaena.
Figure 1. The districts of Kenya, showing the locations of the Veterinary Investigation Laboratories (VILs). # VIL which diagnoses rabies. *other VIL.

**Diagnosis**

The majority of specimens arrive at the laboratory as carcasses. A few heads are submitted. Some live dogs are brought in for observation and are released to their owners if they do not develop rabies. Opening of the heads is done in our pathology laboratory and the brain specimen is subsequently sent to the virology laboratory. With human cases a brain sample or occasionally a saliva sample, is submitted.
The FAT and mice inoculation are the only methods of rabies diagnosis routinely carried out in the country at the moment. The FAT is done on all samples as a first procedure, then all cases that are suspicious on FAT and all cases with a history of human contact are put into mice. Results of FAT can be available within two hours of submission of the specimen while results of mice inoculation take up to 30 days. Depending on the urgency, the results are communicated by telephone.

**Control**

In Kenya, legislation exists to ensure adequate control of rabies. If fully implemented, such legislation would be perfectly effective in the control and eventual eradication of the disease. However, in most cases, we operate under significant financial constraints leading to shortages of vaccines and insufficient logistical support for rabies control policies.

Our control measures are a combination of dog vaccination, destruction by baiting of "stray" dogs and restriction of dog movement.

The main factor limiting the efficacy of dog rabies control at the moment is our inability to vaccinate an adequate proportion of the dog population during any one year. Furthermore, given the rapid turnover of the dog population, it is essential that any such vaccination programme is sustained in the long-term, and not carried out as a "one-off" exercise.

Kenya's human population in 1994 was approximately 24 million people. Using a dog:person ratio of 1:8 (Bögel and Meslin 1990) and 1:6.5 in Zimbabwe (Brooks 1990), Kenya's dog population in 1994 can be estimated at between 3 - 3.7 million. To eliminate canine rabies in the country, it is desirable that approximately 75 percent of the dog population be vaccinated, i.e. approximately 2.3 - 2.8 million dogs. As all the vaccine used in the country is imported, the kind of funding necessary to mount and sustain campaigns of this nature would be colossal and unaffordable through the government's normal expenditure allocations.

The amount (doses) of rabies vaccine purchased in recent years is as follows: 44 000 in 1991, 150 000 in 1992, nil in 1993 and 150 000 in 1994. The use of vaccine doses is as follows: 85 026 in 1991, 96 510 in 1992, 42 108 in 1993 and 42 249 up to October 1994. It is therefore evident that the country has fallen short of the amount of vaccine required to conduct meaningful vaccination campaigns.

**Vaccine development**

Production of LEP vaccine started at Kabete in 1967 and continued until 1989 when it was discontinued due to equipment breakdown. Commercial vaccines made outside Kenya have been in use since then. However, with increasing use of tissue culture systems worldwide, Kenya Veterinary Vaccine Production Institute (KEVEVAPI) is developing an inactivated rabies vaccine in tissue culture. It is hoped that with the current equipment production of approximately one million doses of the vaccine will be possible by the end of this year.
Production levels can be increased substantially (up to 10 million doses per year) with the proposed acquisition of modern equipment.

**Acknowledgement**

I wish to register my gratitude to the Director of Veterinary Services, Kenya for enabling me to attend the meeting. While compiling this paper, I held useful discussions with officers involved in rabies work in various institutions. The officers include: Dr K. Bangat and J. Macharia (Department of Veterinary Services, Kenya), Dr J. McDermott (University of Nairobi), Dr Githaiga (Kenya Wildlife Service), Dr Kinyili (Kenya Veterinary Vaccine Production Institute), Dr Ngichabe (Kenya Agricultural Research Institute) and Dr Sigei (Ministry of Health).

**References**
