Accessibility of dog populations for rabies control in Kathmandu valley, Nepal

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The accessibility of dogs in urban areas of Kathmandu valley was measured using the following approaches: determination of the proportion of dogs that bore signs of having been the objects of religious worship and other signs of household association, supplemented by information obtained by interviewing people in the neighbourhood; and the vaccination coverage attained in a rabies control campaign that was preceded by intensive activities to encourage the community to participate. An accessibility rate of 90–95% was determined using the first of these approaches, whereas 75–80% of the total dog population was reached in the vaccination campaign.

Introduction

The management of dog populations is of great public health significance in many developing countries, since the population density and mobility of dogs increase in proportion to human populations (1). Dogs provide the reservoir of rabies virus in 87 out of 167 countries and territories. An estimated 2700 million humans live in areas infected with canine rabies (2), where about 5.4 million people require specific postexposure treatment each year (3). The South-Asia Association for Regional Co-operation (SAARC) has identified rabies as one of the six infectious diseases for priority control through primary health care.⁴

Canine rabies can be eliminated if, in addition to the classical measures of outbreak control and movement restrictions, about 70% of the dog population are immunized (4). In most countries effective dog control operations are initiated with reluctance, since 30–70% of dogs are held to be non-accessible in many countries. According to current sanitary principles and regulations, the majority of these animals are “unowned” or “strays” and have to be removed and destroyed. Programmes to eliminate canine rabies in such countries have either failed or have not been attempted, because it has been held that there were too many stray dogs and that programmes for their removal were inadequate. Such attitudes hindered effective rabies control even further, since mass destruction of dogs became increasingly unacceptable for communities and politicians.

A review of published literature shows that none of the assumptions, citations, or official statements about the proportion or size of stray dog populations have been based on investigations and sound data.⁵ Terms such as “stray dog”, “street dog”, “community dog”, “ownerless dog” or “unwanted dog” have generally not been defined. Such terms have been used to describe dogs by inclusion or exclusion on the basis of their behaviour or activities (e.g., free roaming at night, sleeping and searching for food in commercial areas) or those of humans (e.g., dog registration, results of stray dog removal), without sufficient consideration of the family or household association of dogs and of seasonal and spatial factors.

In order to understand dog populations better, WHO in 1979 began to develop procedures for their assessment.⁶ In the absence of pertinent methods that were specific for dogs, most of the ecological procedures were derived from experience gained in fox ecology in Europe.

Research efforts have been directed at providing answers to the following questions:

- What are the ecological factors that determine the segments of dog populations and how can these segments be defined?
- What is the population turnover and what is its importance for control measures?

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⁴ Consultation on dog ecology studies related to rabies control. Unpublished document WHO/RAB Res/86.35.
⁶ Intercountry Practical Training Course on Dog Population Management, Kathmandu, Nepal, 1986. WHO Regional Office for South-East Asia, Assignment Report SEA/Rabies/19
What constitutes dog population management from the ecological and ethical points of view?

The present article deals specifically with the first of these questions. In his report on the WHO Intercountry Practical Training Course on Dog Population Management, in Kathmandu, Nepal, 1986, Wandeler concluded that "dog populations are more heterogeneous than populations of free-living wild animals", and distinguished segments of dog populations according to their ownership, levels of supervision, and protection. As a result, "stray dog" ceased to be used as an ecological term, but was retained to define dogs that are not kept in compliance with ordering regulations. This restricted use of the term "stray dog" was corroborated by the WHO Consultation on Dog Ecology Studies Related to Rabies Control, held in Geneva in March 1989. A still simpler concept that defined dog population segments according to levels of supervision (human activity) and dependence (canine activity) had, however, emerged, so that also the terms "owned" and "unowned" no longer had any relevance for the ecology and control of canine rabies in developing countries.

A more pragmatic classification of dog populations results from application of operational research methods. In this way the proportion of dogs that can be reached using chosen methods (e.g., mass vaccination by house-to-house visits) can be defined under given conditions. The terms concerned with the "accessibility" of dogs originated, however, from accidental observations related to the religious practice of worshipping dogs in Nepal. The data that were obtained strongly supported proposals for rabies control by mass vaccination of dogs without any requirement to first remove them. This is a completely novel concept in Nepal where, in accordance with recommendations made by the WHO Expert Committee on Rabies, it was advised that removal of all "stray dogs" (estimated to be 40-60% of the dog population) was necessary for successful rabies control.

This paper compares the data obtained on the prevalence of dogs in Kathmandu valley, following observations of religious practices there in 1986, with the results of a campaign to vaccinate dogs against rabies in 1989.

Materials and methods

Dog accessibility and religious practices in Nepal

Surveys were conducted from 1 to 3 November 1986 in two areas of Kathmandu city and in two other places in the Kathmandu valley.

On 31 October 1986, on the holy day kukor puja, people in the study area painted marks on the foreheads of their dogs. In addition, the dogs were adorned with a yellow flower collar. Those families that did not own a pet or family dog gave food to a dog from the street and worshipped it by marking it with the same religious signs that the pet dogs received. Those dogs that were thus marked could be considered to be accessible and easy to handle.

No observations could be made on kukor puja itself, since the dogs were still receiving their ceremonial marks until late in the day, while, because of failing daylight, capture became difficult after 17 h 00. On the days following worship, the dogs were not observed until around noon or later, when market and shopping activities were at their height and traditional food-serving places attracted many dogs. This provided maximum opportunity to record dogs with weak household/family associations, since many well-supervised dogs were inside their owners’ houses at this time. Accordingly, almost no puppies were observed during the survey.

Dogs were recorded as being accessible if at least one of the following signs or reactions was noted or if the persons in their vicinity indicated that a dog was associated with a household.

- Signs of worshipping.
- Signs specific for pet and family dogs, e.g., a leather collar, barking from apartments, playing with children, being kept on a lead or chain or in special premises of courtyards or gardens.
- Results of interviewing persons from the neighbourhood (shopkeepers, farmers, housewives, children, etc.) about any household associations ("ownership"). Positive replies were generally spontaneous and precise. In many cases the owner was present at the interview.
- The reactions of the dog when approached by the interviewer.

Other characteristics of the study areas and of the procedures used in the surveys are described below.

Survey No. 1, Kathmandu city (10 h 45-12 h 00, 1 November 1986). The procedure outlined below was employed.

- Location: the footpath (length, about 1.5 km), which served about 70% of lower-to-middle class
residential areas, 15% of the fruit and vegetable market, 15% of the roads where butchers' and bakers' shops and traditional food-serving areas were situated.

—*Dog classification:* by observing for signs of worship or household association, by interviewing in the neighbourhood, and by approaching the dog.

—*Special conditions and observations:* the survey was carried out on the day after the dogs had been worshipped. An unknown proportion of pet or family dogs were within households. No puppies were observed on the street and very few dogs wore leather collars.

The results of the survey are shown in Table 1.

**Survey No 2, Kathmandu city** (12 h 30–13 h 30, 1 November 1986). The procedure outlined below was employed.

—*Location:* the bicycle rickshaw path, which covered about 50% of the residential area, 40% of business areas (shops that sold textiles, souvenirs, jewellery, books, and furniture), and 10% of traditional food-serving areas, food shops, and restaurants.

—*Dog classification:* made from a rickshaw by observing for signs of worship and household association (e.g., leather collars, barking from upper-floor apartments, etc.), without interviewing people or approaching dogs.

—*Special condition:* the survey was carried out on the day after the dogs had been worshipped.

The results of the survey are shown in Table 2.

**Survey No 3, Banepa town** (10 h 00–11 h 30, 2 November 1986). The procedure outlined below was employed.

—*Location:* the part of the town (10 000 inhabitants, located 29 km from Kathmandu) chosen had a footpath of about 1.5 km length that served 80% of rural/residential areas and 20% of commercial/residential streets.

—*Dog classification:* by observing for signs of worship and household association, and by interviewing persons in the neighbourhood. The sex of dogs was also recorded.

—*Special conditions and observations:* the survey was carried out 2 days after the dogs had been worshipped and included a rural part of the town where the population is not used to the presence of foreigners. In this area the interviewer was voluntarily accompanied by about 30 children who knew each dog and its associated household. The search was therefore more active than in the other surveys, and its result depended less on the presence of signs of worship on the dogs.

The results of the survey are shown in Table 3.

**Survey No 4, Budhanilkantha** (16 h 00–17 h 30, 3 November 1986). The procedure outlined below was employed.

—*Location:* most of the coherent part of the village (2000 inhabitants), located 8 km from Kathmandu, was served by a 1 km footpath passing farmhouses (about 85% of the path), a central place with some food shops, a restaurant at a bus stop, and a temple of particular interest to tourists.

—*Dog classification:* mainly by observing for signs of household association and by interviewing persons in the neighbourhood. Signs of worship were observed on less than 15% of the dogs. The sex of the dog was also recorded.

—*Special condition:* the survey was carried out 3 days after the dogs had been worshipped.

The results of the survey are summarized in Table 4.

**Dog accessibility in connection with the rabies vaccination campaign**

From 9 June to 2 July 1989 an intensive dog vaccination campaign was carried out in Lalitpur town *panchayat*, a typical suburban area of Kathmandu valley (about 16 km from Kathmandu city centre). The *panchayat* consists of about 100 000 inhabitants (97 417 in 1987) who live in 22 administrative wards, each of which was represented by a chairman.

Because of the high number of free-roaming dogs, the Kathmandu valley, and especially its urban areas, have long been considered to be a problem from the point of view of eliminating rabies. The procedure used in Lalitpur was therefore based on an operational research technique that had been employed in a health systems research study in the Kathmandu valley and on experience gained in mobilizing community participation in Guayaquil, Ecuador. Recent results on canine ecology and vaccination strategies from projects in Tunisia and Sri Lanka were also used. This was made possible by a
joint effort between government services, WHO
operational research teams, and the supporting and
continuing efforts of Vétérinaires sans Frontières
(VSF). This cooperation comprised the elements out-
lined below.

—Comprehensive planning, including a clear in-
stitutional framework and plan of action.

—A public information and education campaign that
included local administration meetings, training
sessions, loud-speaker hailing, banners, posters,
leaflets, radio and television broadcasts, newspaper
articles, the participation of school teachers, as well
as school meetings, etc. A WHO videotape on
control of canine rabies was also used. A house-
hold survey (see below) may also have influenced
the population.

—Household survey: from 14 to 22 May 1989, informa-
tion was gathered from 755 households on the
dog population and the awareness and co-
operation of the people.

—Dog ecology studies: dogs were marked with
collars when they were vaccinated; also efforts to
count and photograph dogs provided essential
data on vaccination coverage.

—Dog vaccination campaign: imported vaccine,
syringes, and needles were provided by VSF and
stored at the Nepal National Rabies Control
Project Headquarters, Tripuresvar, and also
locally at the Lalitpur Veterinary Hospital. Five
vaccination teams, each consisting of three per-
sons, operated during the first phase (19 days) at
fixed vaccination points from 06 h 30 to 10 h 00.
During the second phase, starting on 7 July, two
“clean-up teams” were sent to areas of the city
where vaccination was considered to have been
insufficient. These teams went from house to house
along predetermined routes. In addition to the
campaign executed by these teams, Lalitpur
Veterinary Hospital offered rabies vaccination
services from 9 June to 1 August 1989.

Results

The data obtained in the 1986 surveys are shown in
Tables 1–5. Screening of dogs for signs of worship
greatly facilitated assessing the dog population one
day after they had been worshipped. Ceremonial
signs were observed on 60–70% of dogs observed in
the streets of Kathmandu (Tables 1 and 2). Even two
days after worshipping, ceremonial signs were iden-
tified on 40% of the dogs observed in Banepa (Table
3). Where signs of worshipping were recorded at a
lower rate than in Kathmandu, signs of ownership (in
Banepa), and more extensive interviewing compen-
sated for the difference.

Table 1. Results of the survey to determine the acces-
sibility of dogs in Kathmandu city, Nepal, 10 h 45–12 h 00,
1 November 1986

<table>
<thead>
<tr>
<th>Category of dog</th>
<th>No. of dogs counted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility identified by</td>
<td></td>
</tr>
<tr>
<td>Observation of signs of worship</td>
<td>56 (60)*</td>
</tr>
<tr>
<td>Leather collar</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Barking within house</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Interviews (ownership)</td>
<td>11 (12)</td>
</tr>
<tr>
<td>Friendly reaction to strangers</td>
<td>9 (10)</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>80 (86)</td>
</tr>
</tbody>
</table>

| Accessibility questionable since        |                     |
| Dog defensive when approached by         | 6 (6)               |
| strangers                               |                     |
| Fugitive when approached by strangers   | 8 (8)               |
| **Subtotal**                            | 14 (14)             |
| **Total**                               | 94 (100)            |

* Figures in parentheses are percentages

Table 2: Results of the survey to determine the acces-
sibility of dogs in Kathmandu city, Nepal, 12 h 30–13 h 30,
1 November 1988

<table>
<thead>
<tr>
<th>Category of dog</th>
<th>No. of dogs counted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility identified by</td>
<td></td>
</tr>
<tr>
<td>Signs of worship</td>
<td>50 (70)*</td>
</tr>
<tr>
<td>Accessibility questionable since</td>
<td></td>
</tr>
<tr>
<td>Dog not wearing signs of worship</td>
<td>21 (30)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>71 (100)</td>
</tr>
</tbody>
</table>

* Figures in parentheses are percentages.

The results of the four surveys are consistent, in
so far as 86–97% of dogs were found to be accessible
and amenable.

Some differences were noticed between the areas
surveyed. In the rural areas of Buddhanilkikhan
(Table 4), all dogs were household-associated,
whereas in the social and commercial centre of this
village some dogs had no identifiable household
association; five of the latter dogs were bitches.
Except for two bitches, all the “homeless” dogs were
very tame and should not pose any problem in
vaccination campaigns.

In Banepa a high proportion of dogs (about
40%) wore leather collars; local awareness and
initiative may be the reasons for this phenomenon. In
the other areas surveyed, dogs that wore collars were
rare, hardly exceeding 5–10%. Further evidence of
the relatively high level of responsible dog ownership
in Banepa was the remarkably low proportion of bitches in the rural part of the town, which differs markedly from the situation in Buddhannikanta village (Table 5).

Experience in the management of community participation and delivery of rabies vaccine increased during the 1989 rabies campaign in Lalitpur town panchayat, and the overall results are encouraging. During the first phase, 6798 dogs were vaccinated, while during the second phase 1080 dogs were recorded and 520 received vaccines at the Lalitpur Veterinary Hospital. About 8400 dogs therefore received vaccine, i.e., 68% of the estimated 12,500 dogs in the town. The results are even more favourable if they are based on the proportion of dogs that wore collars as a sign of vaccination. According to the study, the first phase led to a vaccination coverage of 66%, which ranged from 17% to 89% in the 22 wards, depending on the population density of the pet dogs and quality of vaccine delivery services. The overall vaccination coverage after the "clean-up teams" had completed their work was 75–80%.

### Discussion

One of the most crucial factors in planning programmes to control canine rabies is the proportion of the dog population that is accessible to the control measures. Probably one of the major difficulties in eliminating canine rabies has been that low vaccination coverage has been linked with the low accessibility of dog populations. However, this explanation does not consider sufficiently the full participation of the community in instances where the management was inadequate, or dog owners were asked to pay for the vaccination or to have their dogs registered for tax purposes.

Also, rabies control programmes have not been popular in areas where they have been vigorously and almost indiscriminately connected with programmes to kill stray dogs.

Our findings are in accord with studies and empirical observations on dog ecology and rabies vaccination projects in North Africa, Latin America, Sri Lanka, and Thailand.\(^*\)

The level of dog accessibility (86–97%) associated with religious practices was higher than the vaccination coverage of about 75%. However, the difference between these two methods of determining dog accessibility should not necessarily be attributed to the greater number of people involved in the religious practices. Both procedures neglect an un-

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\(^*\) See footnote in p. 613.

\(^{b}\) See footnote b, p. 611.
known proportion of well-supervised and completely accessible dogs that were inside houses and could therefore not be observed. Information on these animals would presumably result in an increase in the recorded vaccination rates. On the other hand, a small proportion of the dog population lived in remote locations and was therefore less likely to be observed.

The data obtained in the accessibility study (1986) and in the mass vaccination and dog marking activities (1989) may also differ because they were collected at different times of the day and in different areas of the Kathmandu valley and its surroundings; furthermore, the 1986 data covered only the 190 dogs that were fully investigated by inspection, and by approaching and interviewing local people (Tables 1, 3 and 4). Also, it is reasonable to assume that the proportion of accessible and vaccinable dogs is greater than that shown in Tables 1–5 or recorded as being vaccinated in the 1989 project.

It may be asked whether “homeless” dogs exist at all in the study area. If they do, they are present only in small numbers in cities such as Kathmandu, Bhaktapur, and Patan and in very restricted commercial areas of smaller towns and villages as well as in temples. The majority of such “homeless” dogs observed in temples and market places exhibited a friendly attitude towards the investigator—they were easily accessible and amenable and should not pose any problem in vaccination campaigns. The question arises whether the few fugitive or defensive or aggressive dogs observed were “homeless”. Their behaviour was reminiscent both of dogs that were not in their own neighbourhood (fugitive reaction) or of those that were close to their own territory and home, which they had to defend, particularly in the absence of family members (Tables 1, 3 and 4).

The survey results suggest that the number of dogs that are less accessible and amenable is almost negligible for programmes that have a vaccination coverage of 70%.

Planners might ask how communities can be encouraged to participate as enthusiastically in dog vaccination programmes as they do in religious customs or in ordinary household surveys. Ideally, at least in the major cities of Nepal, vaccination of dogs against rabies should be carried out in conjunction with or become part of the kukor puja religious ceremony.

The procedure of mass vaccination at defined dates and places as foreseen in the national plan should be supplemented by house-to-house visits in the evening between 16 h 00 and 20 h 00, when most dogs are sleeping on the road, on pavements, or in houses. Carrying out rabies vaccination activities along roads and paths may also be effective around midday, particularly in market and food-serving areas.

In rural areas a different situation prevails. In the evening almost all dogs are found in and around houses when the family returns from work. Of considerable help could be the collaboration of schools and children in public education and in searching for dogs.

The survey provided evidence of relatively high public awareness and responsible dog ownership in Banepa, even in the absence of a special vaccination campaign. The reasons for this should be investigated and the results made available to other areas.

Probably the most important finding of the surveys in 1986 and the vaccination project in 1989 was that dogs need not be removed to eliminate “strays” or to reduce their numbers since the dogs appeared to be sufficiently accessible to vaccination. This does not exclude the necessity of removing dogs that are not kept in compliance with control measures, should it be necessary to impose them. Moreover, it is encouraging that it should not be too difficult to plan and implement a programme for the elimination of canine rabies from the whole of the Kathmandu valley.

Résumé

Accessibilité des populations canines aux fins de la lutte antirabique dans la vallée de Kathmandou, au Népal

La mise en œuvre de programmes d’élimination de la rage canine au Népal et dans d’autres pays aux caractéristiques socio-économiques analogues a toujours été jugée difficile en raison du grand nombre de chiens errants, que l’on évaluait au minimum à 50% de la population canine totale. Toutefois, on s’est aperçu récemment que la proportion de chiens totalement abandonnés est le plus souvent inférieure à 10% dans les pays en développement, ce qui a incité l’OMS à s’intéresser aux recherches sur le problème de l’accessibilité des chiens.

Au Népal, ces études ont été facilitées de façon assez inattendue par une pratique religieuse particulière, l’adoration des chiens. Les signes de cette pratique (par exemple, la présence de colliers de fleurs au cou des chiens), l’observation du comportement des animaux et l’interrogatoire des habitants ont montré que 90 à 95% des chiens de la vallée de Kathmandou étaient accessibles. Cette constatation a été vérifiée par la suite lors...
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d'une campagne pilote de vaccination au cours de laquelle on a fait appel aux techniques modernes de gestion et de communication pour favoriser la coopération de la communauté. La couverture vaccinale a été de 75 à 80% dans une zone urbaine qui comptait au total environ 12 500 chiens.

References
