

5.4. What are we going to do – dog component?

This section provides practical guidelines for the actual implementation of measures to control dog rabies.

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5.4.1. What techniques are available to estimate the number of dogs?

If information on number of dogs present in the community is not available, ecological surveys should be conducted before implementing a canine rabies control programme for more accurate planning of the campaigns, to assess the need for dog population management programs and evaluate the effectiveness of the intervention. If the campaigns need to be implemented with some urgency, first rapid estimates can be made, as described [here](#), and additional surveys can be implemented post-vaccination (e.g. combined with surveys for estimation of vaccination coverage, described [here](#)).

The options for estimating the number of dogs to vaccinate are as follows:

- ▶ Expert opinion based on historical data of previous campaigns or on registration records if available.
- ▶ Expert opinion based on [estimations](#) made in other geographic areas/demographic settings.
- ▶ Commonly used census techniques:
 - **Questionnaire surveys** can be used to establish the mean number of **owned dogs** per household and dog:human ratios. Since the total human population or number of households is generally known through national population censuses, an estimate of the owned dog population can then be extrapolated. These surveys can be conducted before, during or after campaigns (e.g. combined with post-vaccination surveys to estimate vaccination coverage, described [here](#)). Households for interview should be selected randomly. Additional information can be obtained on:
 - (1) Dog characteristics (e.g. sex, age, population turnover and dog handling/keeping practices), which are important to understand reproductive patterns, annual recruitment into the dog population (critical to determine the required frequency of campaigns) and level of supervision and accessibility.
 - (2) Household characteristics including determinants of dog ownership (e.g. socio-economic status, livestock ownership, religion and sex of the head of households), which can be used as predictors of dog population size and distribution (as shown in [this study](#)) and to gather information on accessibility for vaccination.
 - (3) Knowledge of rabies in the household which can be useful for targeting public awareness campaigns, as described [here](#).

It should be understood that the additional information is not always necessary and priorities should be based on resources available to carry out the surveys.



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- Methods are also available to assess the number of [roaming dogs](#) - i.e. both owned and unowned dogs, but not accompanied by an owner – such as:
 - **Indicator counts** which consist of counting dogs (e.g. males, females and pups) along selected representative routes. Counts can be repeated every year (at the same time of the year) to evaluate changes in population over time (i.e. if the number of dogs has increased or decreased). Click [here](#) to learn more about this method.
 - **Capture-mark-recapture methods** consist of temporarily marking dogs, e.g. with a dye or distinctive collars (click [here](#) for examples of devices to mark dogs), and then subsequently recording the proportion of marked individuals in the population during a “visual recapture” effort. From the number of dogs marked and the observed ratio of marked to unmarked dogs the total number of street dogs is calculated. Marking can conveniently be done during vaccination campaigns. However, it is important to perform marking and recapture within a time period of a few days in order to minimize mark loss, dog movement and mortality effects. Also it is better to work in a defined area of only 0.5 to 2km² than in transects. The observations can also be combined with estimates of the number of owned dogs obtained through household questionnaires to estimate the number of unmarked dogs as shown in [these studies](#). Estimates of population densities can also be obtained from the rates of capture during a marking campaign lasting a few days. Dogs may also be given permanent marks if the intervention includes anaesthesia for additional studies.



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- **Population estimates** can be obtained by extrapolating counts made in a sample (e.g. randomly selected subregions) to whole cities. These surveys can also be repeated to detect changes in the number of roaming dogs. Click [here](#) to learn more about this method and how to estimate the total number of dogs from the sample.

5.4.2. Why is epidemiological surveillance important and what can we do to enhance it?

- ▶ Rabies surveillance is the key index for the success of any intervention programme. It involves the collection of essential data to (1) determine the rabies situation at the start of the programme, (2) monitor and evaluate the progress and impact of intervention, and (3) manage potential human exposures adequately. If surveillance measures are not in place at the start, they must be implemented quickly and strategically.
- ▶ Rabies in animals can be suspected based on bite history and [clinical signs](#), but **laboratory confirmation** is the only definitive means of diagnosis. Countries embarking in a rabies control program must have the minimum infrastructure for laboratory-based diagnosis, as described [here](#), using the gold standard [direct fluorescent antibody test](#), at least at the central level (national rabies

laboratories). Click [here](#) for a list of basic supplies you need to run this test. If alternative validated techniques are used, as described [here](#), confirmation of results should be carried out at central laboratories using the fluorescent antibody test.

► [Simple sample collection techniques](#) that can be implemented by a range of operators, including veterinary, livestock and extension officers and game wardens can be introduced to facilitate field collection and transport of samples in remote rural locations and in general to improve sample submission rates. Click [here](#) for the list of supplies rabies surveillance personnel need in the field. It is essential that transport of specimens to rabies diagnostic facilities is organized in an efficient way to ensure timely and safe delivery.



Photo courtesy of Serengeti Carnivore Disease Project

► Rabies recognition by communities living in rabies-endemic areas is generally relatively accurate. Information on (unconfirmed) cases of human and animal rabies and animal-bite injuries can therefore be obtained during **questionnaire surveys**. However, this is generally of most use for rapid assessments rather than determining incidence, unless all reports can be followed up for further investigation. Questionnaire surveys may also be of value in understanding local knowledge, attitudes and behaviors and this information can be used for more targeted communication and education programmes.



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► **Animal-bite injury data** from hospitals are an easily accessible source of data and can be used as indicators of animal rabies cases in an area and rabies exposures, and to assess the impact of dog vaccination on human rabies exposures.

► Hospitals can also provide information on **post-exposure prophylaxis doses** administered which can be used to evaluate the cost-effectiveness of canine rabies control programs through reduction in public health expenditure on costly human rabies vaccines (resulting from reduction in dog rabies).

► **Geo-referenced data** on human and animal rabies cases (including clinical, laboratory-confirmed and animal-bite injury data) are useful to identify regions most affected by rabies and to ensure targeted actions.

► [Mobile phone technology](#) could also enhance rabies surveillance by allowing real-time reporting/detection of cases and animal-bite injuries as well as providing timely information on availability of anti-rabies biologicals.



5.4.3. Are there specific signs in an animal that we can watch to confirm that it is rabid?

Clinical signs of rabies are rarely definitive, therefore if a likely exposure occurs humane euthanasia should be carried out and the brain tissue of the animal should be tested by fluorescent antibody test in a reliable diagnostic laboratory. However, if facilities for caging are available, the animal can be caught and observed daily for [clinical signs of rabies](#). If the animal stays alive for more than 10 days rabies can be ruled out, whereas if it dies within 10 days brain tissue should be examined. Click [here](#) to learn about the ‘six step’ method for a presumptive diagnosis of rabies in living dogs.

5.4.4. How do we dispose of animals that have died of rabies?

If possible remove the brain or parts of the brain or decapitate the animal first and send the samples/head to the laboratory for examination as soon as you can. Click [here](#) to access the protocol for sample collection. The rest of the body should be incinerated or buried.

5.4.5. What methods and strategies are available for dog vaccination?

► In communities where a substantial proportion of the total dog population is accessible for vaccination (i.e. many communities in Africa, Latin America and Asia) parenteral immunization should be adopted. Click here to learn about [restraining](#) and [inoculation](#) techniques for parenteral immunization. If dogs are less accessible (e.g. in communities with many free-roaming and poorly supervised dogs), [oral vaccination](#) can be used exclusively or in conjunction with parenteral vaccination ([CASE STUDY PHILIPPINES](#)) ([CASE STUDY TURKEY](#)) ([CASE STUDY KWA-ZULU NATAL](#)). Be aware of the fact that depending on the region dogs may prefer locally made baits instead of those provided by the supplier.

► Different strategies can be used for domestic dog vaccination. A single strategy or a combination of strategies should be selected on the basis of the setting or known socio-cultural factors. Vaccination strategies available for parenteral and oral immunization are as follows:

- **Continual vaccination at fixed vaccination posts** in well-recognized sites to which dog owners take their dogs/cats (including private or government veterinary clinics). Although this technique requires little government effort, it may fail to reach many owned and all unowned dogs resulting in poor population coverage or coverage that is difficult to measure.
 - **Mobile teams** that set up temporary vaccination points at a central location within individual villages or cities conveniently located for dog owners (central-point vaccination strategy). This strategy is relatively inexpensive and can achieve the recommended level of coverage if vaccination is provided free-of-charge ([CASE STUDY TANZANIA](#)). It may be indicated to make a judgement on the size of catchment areas of temporary clinics and decide on their spacing accordingly.
 - **House-to-house campaigns.** This strategy may be required in remote areas. It usually results in a sufficient percentage of dogs being vaccinated and it causes only minimal disruption of the normal community functions, but it is costly and logistically difficult ([CASE STUDY TANZANIA](#)). If vaccines need to be administered orally, baiting of owned dogs can be carried out using this strategy.
 - Inaccessible or unrestrainable dogs can be immunized orally by presenting baits directly to dogs on the street (**hand-out model**).
- Independently of the strategy adopted, **synchronized campaigns** (i.e. one-day or one-week campaigns covering whole municipalities or states) may be very effective in mobilizing many sectors and the public, in view of the short duration of their involvement and higher media and public profile.



5.4.6. How do we plan the vaccination campaign on the ground?

Planning of campaigns on the ground requires communication with local authorities to obtain permission and support. Vaccination team members, accompanied by village leaders, should then visit the selected area in order to plan the campaigns on the ground. The proposed area should be carefully mapped and broken into daily work blocks and further into sub-team blocks, allocating teams to certain areas. It might be useful to conduct smaller-scale campaigns first (e.g. pilot projects) to gain experience and subsequently expand to cover larger areas. Logistics should be planned carefully and time allowed for purchase of equipment and preparation. Before starting briefing sessions should be conducted.

5.4.7. How do we make sure that dog owners know about the vaccination campaign?

Advertising of campaigns locally can be carried out a week before the earmarked vaccination day by distributing leaflets, posters and letters to community leaders (who will inform villagers in formal and informal meetings). The information should be posted at all popular places including schools (as children are an important target group), political party offices, shopping centres/markets and government offices. More intensified efforts can be made by using specialized advertisement teams that will deliver information about the vaccination day across a village using a megaphone (using vehicles, bikes or motorbikes). Appropriate adoption of local tools for reaching a wide audience is critical. Click [here](#) for guidelines. At local, regional and national levels a range of media and materials such as leaflets, newspaper advertisements, radio and TV programs can be used. The involvement of religious leaders (e.g. in Islamic countries the mosque and imam) is also highly effective. The announcement of 'vaccination weeks' to be conducted once a year at fixed time points should also be considered.



Photo courtesy of Serengeti Carnivore Disease Project

5.4.8. At what age can dogs be vaccinated?

Although it is often assumed that pups should be vaccinated only after 3 months of age, it is important that dogs of all ages, including young pups, are vaccinated during a vaccination campaign. If pups are not included in campaigns, it is likely that the overall population vaccination coverage will not be high enough to prevent rabies in the interval between campaigns. There is good evidence from African campaigns that pups younger than 3 months mount a solid (protective) immune response to rabies vaccine and that commercial inactivated vaccines are entirely safe.



Photo courtesy of Serengeti Carnivore Disease Project

5.4.9. How often should dogs be vaccinated?

For most commercial inactivated vaccines, a single dose of vaccine should provide protection for at least one year (for some vaccines up to 3 years). If campaigns are carried out annually, it is recommended that vaccinated dogs should receive yearly booster vaccines to ensure protection as part of the campaign. This allows a simple message to be conveyed to the community i.e. “Bring all dogs for vaccination at every campaign” and it is likely to increase coverage rates.



Photo courtesy of Lusaka Animal Welfare Society and University of Lusaka Veterinary Department

5.4.10. How often should campaigns be conducted?

- ▶ The traditional approach to rabies campaigns has been annual campaigns and there is evidence that in many populations an annual frequency of campaigns is effective.
- ▶ While this is a reasonable starting point for planning purposes, it is important to be aware that in populations with high birth and death rates, the vaccination coverage may drop off very rapidly after a single campaign. In these populations, more frequent campaigns are likely to be needed (for example in Mexico 6 monthly campaigns are carried out).
- ▶ Campaigns can also be timed just after breeding seasons to cover the maximum number of dogs including pups. The situation should be monitored through surveillance and planning of campaigns could be refined with more detailed information on dog population dynamics, as described [here](#).



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- ▶ In outbreak situations, or at the start of a new regional/national campaign, it may be advisable to plan for two campaigns in the first year, particularly as turnout may be low during the first campaign due to lack of awareness.

5.4.11. Should cats be vaccinated?

Although cats are not the target species for vaccination in terms of controlling or eliminating the disease, they are an important source of infection for humans in many areas and vaccination of cats is recommended for reducing the human rabies risk. It is suggested that during campaigns, owners should be advised to bring cats for vaccination, but limited resources should not be used for house-to-house or stray cat vaccination. Once rabies is controlled in the dog population, the disease will also disappear in cats.



Photo courtesy of Serengeti Carnivore Disease Project

5.4.12. How many people are needed on an average vaccination day?

It depends on the size of the village and accessibility of households by road. A team of four people/village at a central-point vaccination station should be sufficient to complete the tasks of dog registration, certificate writing, and vaccine administration for between 100 and 1000 dogs/day. However, if numbers of people with their dogs are low (less than 100), one or two people can easily carry out the tasks. Therefore, the make up of teams should be flexible based on estimated numbers and may need to be adjusted based on turnouts during initial campaigns. The vaccination station and personnel should be under the supervision or responsibility of a veterinarian.

5.4.13. How can the level of vaccination coverage achieved be estimated?

Vaccination coverage can be estimated using several methods:

- ▶ From post-vaccination questionnaire surveys as the proportion of vaccinated to unvaccinated dogs in households. During these surveys dog owners should be asked to produce vaccination certificates in order to identify dogs vaccinated in current vaccination campaigns.
- ▶ From direct observation of marked and unmarked dogs, as described [here](#).
- ▶ From doses of vaccine used in relation to the estimated dog population, but this methods requires calculations using good estimates of the overall dog population as the denominator value.

5.4.14. Is it important to include dog population management in rabies control programs?

This will depend on whether the number of unwanted dogs in the specific location is considered a problem. This will not always be the case. Given the wide differences in composition and size of dog populations between and within countries, dog population management needs must be assessed before planning and implementing any intervention following published guidelines with monitoring and evaluation being a critical component of the program, as explained in [this document](#). Currently recommended tools for dog population management are described [here](#).

5.4.15. Should dogs be removed as part of rabies vaccination campaigns?

Dog culling (i.e. removal) alone has never been effective in controlling or eliminating dog rabies and can often be counterproductive. It is therefore not recommended as a rabies control strategy on its own. However, removal of unvaccinated dogs as part of a strategy linked with dog vaccination campaigns can enhance the effectiveness of disease control. Euthanasia may also be required when dealing with sick (e.g. rabid), injured or aggressive owned or unowned dogs. Removal of dogs must be carried out humanely and any campaigns that include removal or euthanasia of dogs should follow [published guidelines](#). Click [here](#) for practical guidelines for euthanasia. If culling is considered, it is important to ensure that previously vaccinated dogs are not removed.

5.4.16. What dog population management tools are currently recommended?

A **combination of approaches** is required for a successful [dog population management program](#). Planning an intervention comprised of these approaches should follow an initial assessment phase and analysis of the local dog population to ensure the approaches are appropriate.



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Currently advocated components in addition to rabies vaccination include:

- Implementation of education programs for **responsible dog ownership**, which should improve the level of guardianship over individual dogs, ultimately leading to healthier and safer (vaccinated) dogs that are not abandoned. Registration and identification of dogs is also used to formally and physically establish ownership. Read [here](#) about laws and recommendations available for dog identification and registry. Commonly used methods for dog identification can be permanent (e.g. microchips and tattoos) or temporary (e.g. collars and tags) and they are described [here](#) and [here](#).

► **Legislative measures** (e.g. tie-up orders, abandonment legislation, mandatory registration, identification and regular rabies vaccination, etc.), which you can find in the [legislation section](#).

► Intervention aiming at **controlling dog reproduction**. The currently recommended technique for reproductive control is **surgical sterilization**, which requires trained personnel, infrastructure, equipment (listed [here](#)), appropriate anaesthesia and pain management. Research is currently being carried out to develop safe and effective methods for **chemical sterilisation or contraception**. Click [here](#) for information on non-surgical methods for controlling the reproduction of dogs and cats and [here](#) for specific advice on chemical castration. A non-invasive and inexpensive method is **isolation of females in oestrus** which could be implemented by dog owners through education. Additional vaccinations and parasite control are often also provided alongside sterilisation to improve the health of individual dogs, hence improving owner interest in engaging with the intervention and increasing the value of individual dogs to reduce abandonment and reducing population turnover by improving survival.



Photo courtesy of WSPA

► Removal of unwanted dogs for **re-homing**. Needs for opening re-homing centres must be carefully evaluated and when a re-homing centre is required in a given area building and managing it must follow published guidelines, provided [here](#) and [here](#). As an alternative to rehoming centres, networks of foster homes involving dedicated volunteers have been successfully created in some parts of Asia, as described [here](#). **Euthanasia** may be required for dogs that are not suitable for rehoming or release back into the community due to health or behavioural reasons. Euthanasia only deals with the symptom of a population management problem and not the cause, so must always be used in conjunction with other approaches and never in isolation. As discussed in [the section on culling](#) above, this must always be carried out humanely.

► **Habitat control**. Areas without adequate garbage disposal are especially prone to large populations of roaming dogs. In specific areas where dogs are not tolerated (e.g. schools and hospitals) access to these resources can be restricted using measures such as animal proof bins and regular removal of garbage and education to prevent purposeful feeding and careless disposal. Opening of any new sites that could provide high value resources such as slaughter houses must include regulations to control disposal of waste. Any significant alteration in access to resources must be done with care to ensure that dogs are not left without food leading to greater movement of dogs, potentially higher levels of competition and aggression over food and ultimately starving of the dogs. In general, any changes to habitat should be localised, the impact on the dog population should be carefully monitored, and large scale habitat changes should not be used as a method of population management.

WSPA = World Society for the Protection of Animals

5.4.17. Our programme has been successful and we have eliminated dog rabies from an area - how do we maintain this area rabies-free?

Once the first objective of the dog rabies control project has been achieved (i.e. elimination of dog rabies from a given area), efforts should be made to keep this area free from rabies (**maintenance phase**).

It is recommended to consult WHO and OIE guidelines for definitions of rabies free countries and regions, available [here](#) and [here](#). Please note that the OIE definition of rabies free areas is valid only for import regulations and is not intended to guide post-exposure treatment and other public health decisions.

A region or country is recognized as free from dog rabies only if adequate epidemiological vigilance and surveillance does not uncover animals infected with dog rabies viruses. Adequate surveillance includes, but is not limited to, submitting all suspect animals to laboratory diagnosis, as described [here](#).

The maintenance of an area free from dog rabies requires effective import and quarantine regulations as they are defined by international bodies, as explained [here](#).

A risk assessment taking into account the presence of wildlife rabies (including bat rabies), the prevalence of dog rabies in neighbouring areas, the effectiveness of import regulations and the quality of surveillance will inform decisions on the necessity of maintaining high vaccination coverage in dogs once the region is dog rabies free. For example, continued dog vaccination in transport hubs and border areas to ensure buffer zones may be necessary in the initial stages of the maintenance phase, while maintaining intensive surveillance and implementing prompt response strategies (i.e. containment vaccination) following new introductions.

The export of dog rabies control efforts to neighbouring jurisdictions should be attempted through increased cross-border collaborations involving relevant ministries and agencies and may be supported with resources as they become available. For example in KwaZulu-Natal, a rabies across borders group, comprising representatives from neighbouring territories (Mozambique, Swaziland and Mpumalanga), has been formed as part of a national canine rabies control programme.

WHO = World Health Organization

OIE = World Organization for Animal Health

5.4.18. How can we monitor dog movements?

Control of dog movements is important in maintaining freedom from rabies following control of dog rabies and to prevent reintroductions. Zoo-sanitary controls at border crossings and ports of entry (e.g. zoo-sanitary inspection points, police check-points, ranger posts, harbours and airports) and road checks, including checks on dogs and cats, need to be established. Regulations should be put in place regarding restrictions on dog movements and the zoo-sanitary requirements to move dogs. Laws and recommendations available for dog importation can be found [here](#). Quarantine (in areas where facilities exist) or vaccination of dogs and cats at designated checkpoints could also be implemented, but it is important to link these efforts with appropriate education and awareness campaigns to ensure compliance.

5.4.19. How can we prevent a rabies outbreak?

Outbreaks can be prevented via effective surveillance and case-reporting systems, and rabies control measures. The consequences of not having such programs in place can be very severe.