

Meeting the Rabies Control Challenge in South Africa

Eliminating rabies in various areas in Africa is realistic and will depend on controlling this virus in dogs

Louis Nel, Kevin Le Roux, and Ronald Atlas

Although rabies is well controlled in many areas of the world, the disease remains endemic in some animal populations and still causes more than 50,000 fatal human cases per year. According to the World Health Organization (WHO), more than 2.5 billion people are at risk in more than 100 countries. Rabies has the 10th-highest mortality of all infectious diseases worldwide. Developing countries account for almost all the reported human deaths, and the tropical and subtropical regions in Africa, Asia, and South America are most affected.

In Africa rabies is underreported, in part because it is easily misdiagnosed as other fatal encephalitides, such as cerebral malaria. Infected dogs are the major source of rabies in South Africa and much of the developing world. This pattern contrasts with that in the United

States and Europe, where most concern rests with wild species that are infected with the rabies virus. For instance, rabies is epizootic in U.S. raccoons and skunks along the Atlantic coast, and also occurs in coyotes and foxes in the southwest as well as in foxes in Alaska. In Europe, foxes are the major source of rabies. Bats also carry lyssaviruses (*Microbe*, Nov. 2008, p. 521), and many recent cases of rabies in North America are associated with bat bites.

The goal of eliminating human rabies in South Africa—and potentially many other areas of the continent—is realistic and will depend on effectively controlling this disease in domestic dogs. Achieving this goal will depend on implementing a vigorous and sustained campaign throughout the country. With luck, the lessons learned from current efforts within the country will serve as a model for combating this disease in other areas of southern Africa and beyond.

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Summary

- Canine rabies came to southern Africa after being introduced into dogs in Angola during the 1940s.
- Stray unvaccinated dogs threaten human populations with rabies not only in South Africa but also throughout much of Asia.
- In the KwaZulu Natal province of South Africa, AIDS could accelerate a rabies epidemic among humans from abandoned dogs, unless better control practices are reestablished.
- Success for rabies-control and similar programs could depend upon local officials adopting the One Health-One Medicine approach when dealing with stubborn zoonoses.

Canine Rabies Is Spreading in Southern Africa, Parts of Asia

Canine rabies is relatively new to the southern African subcontinent, having been introduced from infectious cycles among domestic dogs in Angola during the 1940s. Rabies virus subsequently spread widely throughout the Republic of South Africa (RSA), with increasing involvement of wildlife, including bat-eared foxes in the western regions of the country and black-backed jackals in northern Limpopo province. In the interior plateau of RSA there is an endemic strain of rabies virus that circulates among genets and mongooses, with the yel-



FIGURE 1



Dog with rabies from KwaZulu Natal Province, Republic of South Africa.

low mongoose being the principal vector of the virus.

The real threat to humans from rabies in the RSA, as elsewhere in Africa and Asia, is with

resurgence of this disease. The stray dog population in India is estimated at 35 million.

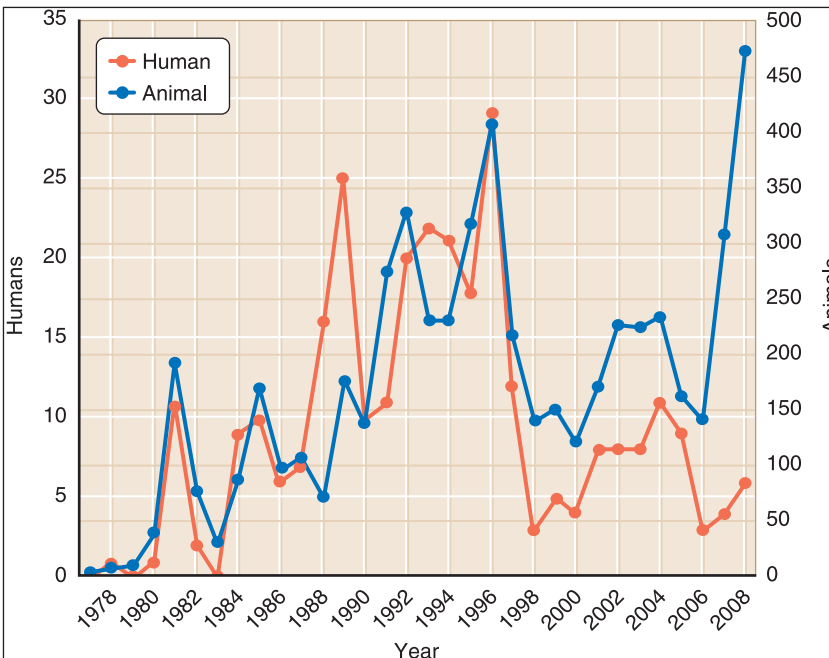
Parenteral vaccination programs cannot eliminate rabies where there are large stray dog populations. An alternative strategy for controlling rabies in stray dogs and wildlife involves use of oral vaccines to treat animals along with prophylactic use of the human vaccine to lower the prevalence of human cases.

Meanwhile, postexposure prophylaxis (PEP) is expensive. The cost of PEP in much of Africa would amount to more than 10% of annual per capital gross national income—in the RSA full postexposure treatment with vaccine and immunoglobulin G is more than \$152 per individual. Also, overuse of prophylaxis in settings with low exposures to rabies virus is exhausting vaccine supplies. Further, there is a global shortage of rabies vaccine because production was halted temporarily.

South African Rabies Occurs Mainly along Eastern Seaboard

Most of the cases of animal and human rabies in RSA occur in KwaZulu Natal (KZN), which is located along the eastern seaboard of RSA and is one of the

FIGURE 2



Incidence of animal and human rabies in KwaZulu Natal Province since 1976.

smallest (92,100 km²) but most populated (approximately 9.5 million people) of the nine RSA provinces. It extends from Swaziland and Mozambique in the north, to the province of the Eastern Cape (EC) in the south, while inland it is bound by the provinces of the Free State and Mpumalanga, and by the Kingdom of Lesotho.

Mongoose RABV biotype is not found in KZN, indicating that the Drakensberg Mountains between KwaZulu Natal and the Eastern Cape provide an effective barrier to wildlife from the mongoose rabies-endemic regions of the central plateau. In KZN, almost 90% of the positive cases of rabies during the past 8 years involve canine rabies virus and domestic dogs.

The rabies viruses circulating in KZN belong to a canine viral lineage that appears to have migrated from Mozambique and radiated outward along the coastal highway. Canine rabies virus has been endemic among dogs in southern Mozambique since 1952 and first arrived in KZN in the early 1960s. Molecular analyses reveal significant epidemic fronts of canine rabies within KZN, presumably representing separate introductions of the virus from other regions.

One epidemic of rabies that began in KZN in 1964 was eliminated by 1968, following a massive campaign to vaccinate dogs. Reinfection occurred in the 1970s during a period of political unrest. It spread to tribal areas, where there is 1 dog for every 6.5 humans. Development of informal settlements during the 1970s followed by rapid urban growth during the 1980s helped to establish large dog populations capable of maintaining the disease. Despite concerted efforts to control rabies, the virus is now established throughout the province and adjacent regions and is beginning to infect humans as well as other domestic species besides dogs. In September 2008, for example, two people and six cows died of rabies in the Eastern Cape near the boundary with KZN.

AIDS Epidemic Could Accelerate Rabies Expansion

Only a few confirmed human cases of rabies are reported each year in RSA—typically lead-

FIGURE 3



Lining up dogs for vaccination in a village in KwaZulu Natal Province.

ing to 20–30 deaths. However, concern is growing that there could be a significant increase in rabies as a consequence of the alarming rate of HIV/AIDS in the country. In some KZN villages, the HIV infection rate is 60–80%. When dog owners die of AIDS, the animals typically are abandoned to roam. Moreover, because poverty is widespread, even dogs with healthy owners may wander in packs searching for food. Because rabies is endemic among dogs along the east coast of RSA, AIDS thus could accelerate a rabies epidemic among humans from dogs, unless better control practices are reestablished.

The control of dog rabies remains the single most important factor for minimizing the public and veterinary risks of rabies in Africa and most of the developing world. When there are intensive programs for vaccinating dogs, the number of cases of rabies declines. In 2007, however, there was a worrisome increase of rabies in KZN, reaching an all-time high of 473 cases. That peak followed several years of decline in the number of confirmed cases of rabies in KZN. The reason seems to have been the result of laxness in the rabies vaccination campaigns compounded by other disease outbreaks.



FIGURE 4



Rabies control team in KwaZulu natal province.

The extent of efforts to vaccinate dogs against rabies is the key factor in the variable incidence of the disease. Postexposure prophylaxis in KZN is currently well managed; free treatment is available to all bite victims who are in danger of contracting rabies, and more than \$2 million (U.S.) is spent annually on human rabies vaccine. Further, a 24-hour rabies phone service is available to assist physicians and hospitals in identifying such patients and guiding plans to treat them.

To combat the rise in cases of rabies in KZN, Department of Agriculture officials—with help from other agencies as well as non-government organizations such as the Society for the Prevention of Cruelty to Animals—launched an aggressive rabies campaign that aims at regaining control of the disease and eventually eradicating it. Although a record number of dogs in the area tested positive for rabies last year, the number of cases is declining. Besides vaccinating as many dogs as possible, several measures were instituted to reduce the dog population, meaning 2,375 dogs were sterilized, more than 6,000 doses of contraceptive administered, and a further 2,199 problem dogs were euthanized.

Global Alliance May Join with Local Officials To Combat Rabies

While local officials continue their efforts to bring canine rabies back under control, they might soon receive valuable outside help. Thus, responding to a coalition consisting of the World Health Organization (WHO), the Alliance for Rabies Control (ARC), and Partners for Rabies Prevention (PrP), the Bill and Melinda Gates Foundation is considering whether to include KZN in a feasibility project whose overall goal is to control neglected zoonoses such as rabies in low-income countries. Meeting this goal will entail controlling and then eliminating rabies from its animal reservoir (domestic dog) within five years. As part of a review of the KZN project, a group of international scientists, including representatives from the Gates Foundation, visited sites in KZN during August 2008.

Success for this and similar programs could depend upon local officials adopting a robust One Health-One

Medicine approach that calls for integrating factors that affect both human and animal health as well as the environment, reflecting a recent realization that the health and well-being of each of these three groups is inextricably interconnected. One Health is a collaborative effort involving many disciplines working locally, nationally, and globally—sometimes taking on broad issues and other times focusing on particular diseases. For instance, on World Rabies Day, 28 September, the One Health-One Medicine community highlighted the importance of rabies through educational programs focused on that disease.

Other Efforts To Control Malawi, KZN Rabies Outbreaks

Amid such efforts to highlight the threat of rabies and to combat the disease on many fronts, substantial outbreaks continue to arise. One recent example comes from Malawi, where as many as 1,000 people were exposed to the rabies virus by eating meat from a cow that died of the disease last September. Rabies in cattle is well known in Africa, where livestock are ex-

posed to rabid dogs and jackals. In this case, despite warnings to dispose of the infected cow, it instead was butchered and its meat sold. Even though heat destroys the rabies virus and it does not establish a significant presence in blood, the virus sometimes can be found in tissues other than those of the central nervous system. Hence, vaccine was administered to 800 in Malawi who were believed to have consumed or had contact with the contaminated meat.

The current rabies control campaign in RSA, Malawi, and other parts of Africa includes house-to-house vaccinations of dogs, use of a live oral vaccine, and remote injection systems to inoculate stray and unmanageable dogs; contraception; euthanasia of suspect, unwanted, and problem animals; surveillance using fluorescent antibody (FA) tests to identify dogs that are suspected of carrying the virus; and use of more detailed molecular serotyping for unusual cases such as wildlife.

Education and advocacy are also key elements for the rabies control program in KZN and elsewhere in Africa. Despite past efforts, many people there have never heard of rabies. To better control the spread of the virus, people in these poorer regions of Africa will need to learn about the dangers of rabies and the value in vaccinating their animals, controlling their numbers, and keeping them behind fences. Moreover, the campaign needs to raise awareness and to foster community cooperation if the disease is to be eradicated.

Even with increased awareness, better surveil-

lance, and enhanced efforts to vaccinate a larger proportion of dogs, eradicating rabies in KZN presents a very difficult challenge. Much has changed since 1976 when rabies was absent from KZN. Viral pressures on wildlife are increasing, while populations of key wildlife species that are susceptible to this disease and that could become reservoir species are also on the rise. For example, rabies now is infecting hyenas and jackals within a major game reserve in KZN. New vaccines may be needed to protect these or other wildlife species that serve as reservoirs for the rabies virus. In any case, a sustained and integrated control program is needed.

On the plus side, recent international interest is raising the profile of the KZN rabies challenge, and is beginning to stir local programs—for example, veterinary services—that had remained stagnant for 30 years. Thus, readiness is improving, and technical staff is being equipped and trained to meet the demands of a comprehensive rabies vaccination program. Moreover, instead of leaving this effort in the hands of individual state veterinarians, there are plans to appoint a project manager who will standardize rabies control measures while maintaining a focus in the face of other distractions. The project manager will oversee a team that includes local and national experts from the Department of Health and from Veterinary Services and the Wildlife Departments as well as veterinarians, diagnosticians, educators, and communications specialists from the private sector.