



Fight against rabies in Nepal: Immediate need for government intervention

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Rabies is an invariably fatal, highly pathogenic zoonotic, yet non-notifiable viral disease in Nepal. The disease kills between 100 and 200 animals and 10–100 people in Nepal every year [1,2]. In Nepal, there exist two epidemiological cycles of rabies: named the urban cycle involving infection in dog populations and a sylvatic cycle involving wild animals. Dog bite accounts for approximately 92–94% of human rabies cases followed by 4% due to Jackle, Mongoose, Cat, and other domestic animals [1] (The actual figure could be higher as under reporting and misdiagnosis is quite common in Nepal). The districts in Nepal are classified as high risk (20 districts), moderate risk (39 districts) and low risk (16 districts) with regard to rabies [2]. Currently, however, rabies surveillance is passive, and rabies cases are reported in an irregular manner. The diagnostic capabilities of rabies in Nepal are very weak as there are only a few diagnostic laboratories located in major cities [3]. However in rural areas, in which quality health services are very poor, the burden of rabies is quite high [4]. Some non-governmental organizations like Kathmandu Animal Treatment Centre (KAT), Himalayan Animal rescue Trust (HART), Animal Nepal, and governmental organizations and offices like Directorate of Animal Health (DoAH) and Veterinary Public Health (VPH) have lead role in prevention and control of rabies in Nepal [1,5]. Though the Government of Nepal (GoN) has no realistic and systematic national rabies control policy and strategy [5], some preventive and control measures, like awareness, elimination of stray animals and mass vaccination of domestic dogs and cats are in place [5].

Among the SAARC countries, the largest number of deaths from rabies per country occurs in India, with 18,000–20,000 human deaths for each year [6,7]. The lack of research-based policies is a key gap in India's rabies control strategy [8]. Nations such as Bhutan, Sri Lanka and Bangladesh had significantly reduced rabies deaths over time. In the South-East Asia region, Sri Lanka was the first to develop a national strategy for Rabies Control. The principal pivot of rabies control in Sri Lanka has been the accessibility of free post-exposure vaccination in all government health facilities. Along with dog mass vaccination, Sri Lanka had decreased the rabies deaths to under 50 in 2012 [9]. With a One Health approach, Bhutan reduced the rabies death to 17 over the last 10 years [10]. Similarly, Bangladesh implemented multi-sectoral

One Health approach ranging from dog mass vaccination to availability of free post-exposure vaccine in all its districts. This drastically decreased the rabies incidence from over 2000 before 2010 to 1500 in 2012 and even low to 200 in 2015. For this, the Bangladesh government had raised its budget allocation in rabies control from US\$ 0 in 2010 to US\$ 7 million (2011–2016) and subsequently to US\$ 33 million (2017–2022) [11].

In the South Asian region four countries that include Thailand, Nepal, Indonesia and Sri Lanka, have provided with nationally organized campaigns for prevention and control of rabies. The VPH Unit was established by Nepal and Sri Lanka in their Ministry of Health; and Thailand introduced anti-rabic activities into the primary health care (PHC) system. Rabies control efforts are fragmented and must be better coordinated in Bangladesh, India and Pakistan. In Nepal, the multi-sectoral One Health approach is yet rudimentary with poor coordination among these sectors [12]. Nepal succeeded in producing anti-rabies vaccine (ARV), but this is inadequate to meet national demands to vaccinate susceptible animal populations. Furthermore, Nepal is fully dependent on import for post-exposure prophylaxis (PEP) and pre-exposure prophylaxis (PrEP) vaccine in human health sector, which is freely available on 54 public hospitals of Nepal [5,6,13].

Preventive and control measures must be taken to avoid the transmission of rabies to humans through animals, since this disease is always fatal to humans. Rabies induced human deaths are mostly caused by the bite of rabid animals, mainly dogs. So, rabies in animals can be controlled and prevented by education/awareness on pre- and post-exposure prophylaxis and mass immunization of dog population. As the human rabies vaccines need multiple applications, in limited resource situations, poor health services and limited population accessibility vaccination of all susceptible human population is not feasible in Nepal. Dog vaccination is described as the most economical method to disrupt the process of transmission and to avoid the incidence of human deaths caused by rabies. Under these conditions, rabies elimination programs are largely justified and logical, focusing mainly on mass vaccination of dog population. Therefore, controlling this disease condition in animals through mass vaccination, in order to achieve minimum immunization coverage of 70%, is essential. But attaining 70% vaccination coverage is

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difficult to get in Nepal due to high illiteracy rate, varieties of cultures and traditions, spatial population distribution, lack of awareness on pre-and post-exposure prophylaxis, and non-compliance of dog owners to pre-and post-exposure prophylactic measures.

Rabies surveillance is fundamental of any rabies control program. Rabies surveillance is still not up to the mark in Nepal and national authorities with the help of international agencies should address this deficit. It is strongly recommended that, in countries like Nepal where diagnostic facilities are insufficient or lacking, laboratory capacity be developed to permit effective rabies surveillance. Rabies epidemiological data should be collected, processed, analyzed and outcomes should be disseminated rapidly between sectors and different administrative levels for the development of effective policy alternatives.

Sustained dog vaccination programs are capable of preventing a large number of rabies-related human deaths. Though mass dog vaccination campaigns have been going on, the majority of dog and cat populations in rural areas are out of reach of such control measures. In some places, inhumane way of dog population control such as killing by strychnine poisoning, cruelly bitten with sticks, drowning, throwing hot water or hot black road topping materials over them and shooting, is still in practice [14,15].

Roughly on an overall basis, 35% population in Nepal, with 37.51% of the population in rural areas and 15.8% in urban areas, is illiterate [16,17]. Interestingly, in these rural areas of Nepal, which make the largest illiterate population, rabies is mostly prevalent [3]. The greater rabies burden in these areas may be related to the increasing number of stray dogs linked to poor implementation of animal birth control (ABCs) measures, open slaughtering and wide availability of garbage and leftover foods available for these animals [5]. Rabies control and prevention programs are mainly concentrated to Kathmandu Valley and other urban areas; but has hardly reached to the rural far off areas of Nepal which account for 94% of total reported dog bites and rabies cases [5]. However, in the recent years, with the efforts of various charity organizations like Himalayan Animal Rescue Trust (HART), Sneha's care, and governmental organizations, dog population management activities like ABC programs along with awareness and mass dog vaccination program has been going on. This has raised more awareness on rabies, and pre-and post-exposure prophylaxis. But, one important aspect of dog population control measures- waste management has been largely ignored. Still, control measures are not that much effective due to lack of awareness, and incomplete implementation of post-exposure prophylaxis, failure of proper waste management practices.

Over the years, different Government and non-Government actors have begun programs related to rabies control in the country, but efforts are typically focused, short-term, and not harmonized. Currently, veterinary and human health authorities have limited communication and strategic coordination, which further complicate control of rabies in the country like Nepal. Significant research gaps in rabies control and management in Nepal may include the poor disease surveillance resulting from improper reporting for rabies cases both in human and animals, living conditions for stray dog populations and the actual contribution of the other animal species than dogs causing rabies. Insufficient availability and accessibility of vaccines across the country impairs the present control of rabies. It is quite obvious that only a coordinated One Health approach can effectively regulate this disease. Thus, the Government of Nepal should identify the overall situation of rabies in Nepal and include it as a priority notifiable disease. The government should also focus on a "One Health approach" with activities like a better communication among medical (human & veterinary) professionals, education to school children, awareness on pre-and post-exposure prophylaxis, effective waste management practices, and mass

dog vaccination. Similarly, it must establish a federal system for rabies surveillance & reporting with a well-equipped diagnostic centre in regional laboratories. Last but not least, it must never stop to assess the potential of any innovative rabies control strategies. Further cooperation, both within the country and in the region, will provide a way forward for successful rabies control programs. The implementation of these recommended actions to ensure effective rabies control in the country requires high level political commitments.

Ethics approval and consent to participate

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Declaration of Competing Interest

There are no competing interests.

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