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Canine Rabies and its Implications for Human Health in Sri Lanka

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ABSTRACT

Rabies is an endemic viral zoonotic disease in Sri Lanka. Dogs are the main reservoir and transmitter, making surveillance of canine rabies crucial for disease elimination. Sri Lanka is one of the Asian countries where human deaths from rabies have been reduced markedly, but it still remains a significant public health problem. Ninety-five percent of human cases in the country are attributed to dog bites. Human settlement patterns allow the existence of dogs. The size of the dog populations is dependent on the habitat, especially the availability of resources such as food, water, and shelter. Although most dogs are owned, many ownerless dogs are allowed to roam freely resulting in vaccination coverage in dogs is heterogeneous. Other terms for ownerless dogs, i.e., dogs which do not have an acknowledged owner include community dogs and stray dogs. Such type of ownerless dogs are more common in rural as compared to urban areas. The frequency of vaccination in ownerless dogs is below the required level. Human attitudes towards dogs, especially ideas of responsible ownership, dog-keeping practices, and other aspects of human behavior influence rabies transmission risk. Research is required to reduce existing gaps in understanding of the knowledge, attitudes, and practices of the general population regarding the need for both dog population control and for rabies vaccination. Additionally, an improved understanding of dog demography and the ecological context of dog populations is essential for increasing dog vaccination coverage, achieving more effective vaccination campaign planning, and better determining the needs of dog population management programs. In order to achieve control of and finally eliminate rabies in Sri Lanka, the epidemiology of canine rabies in the country should be studied in relation to dog ecology and social aspects of pet ownership. A

well-executed rabies control program needs to be based on integrated information regarding dog populations including an understanding of relevant differences in environmental habitats, in human cultures and social strata, and in different epidemiological situations. This article examines the rabies situation in Sri Lanka with respect to trends in human and canine rabies and identifies challenges ahead for rabies elimination.

ABBREVIATIONS

DALY: Disability-Adjusted Life Year; MRI: Medical Research Institute; WHO: World Health Organization; MSD: Medical Supplies Division; PEP: Post-Exposure Prophylaxis; DAPH: Department of Animal Production and Health; PHVS: Public Health Veterinary Services

INTRODUCTION

Rabies is a viral zoonotic disease has been known for centuries and occurs all over the world. It has been eradicated or limited to wildlife in many high-income countries, but it continues to have a significant impact on animal and public health in the developing world. Most human deaths due to rabies occur in low-income countries in Africa and Asia where the disease is underreported and considered neglected ^[1]. According to current estimates, rabies results in approximately 59,000 human deaths and 3.7 million disability-adjusted life years (DALYs) annually, almost all of which are the result of virus transmission through dog bites ^[2]. For combating zoonoses such as rabies it is essential to control the disease in the animal reservoir ^[1,3].

The rabies virus can infect all types of terrestrial mammals, including bats in the New World and is maintained within populations of different species which vary by geographical location and other factors. Known wildlife reservoir species include skunks, foxes, and raccoons in North America; mongooses, bat-eared foxes, and jackals in Africa; and foxes and raccoon dogs in Eurasia ^[4]. Domestic dogs play a major role as a host species in low- to middle-income countries ^[5].

World Health Organization (WHO) maps of the worldwide distribution of dog rabies and dog-mediated human rabies show that the disease is endemic in large parts of Africa and Asia. Most Latin American and Caribbean countries have recorded only sporadic outbreaks, while North America, Western Europe, Australia and several island states, among others, are considered rabies free ^[6]. Endemic countries in Southeast Asia include Bangladesh, Bhutan, India, Indonesia, Myanmar, Nepal, Sri Lanka, and Thailand, where dog bites account for 96% of human rabies cases ^[7]. Sri Lanka is one of the Asian countries that has reported a recent significant reduction in human rabies deaths ^[8]. The number of fatal cases in the country has been reduced from 377 in 1973 to 22 in 2017 ^[9,10]. However, rabies is still endemic in the dog population and poses a significant threat to public health since dogs are the main reservoir and disease transmitters to humans ^[11].

In Western Europe, reduction of rabies in dogs has been achieved by extensive vaccination and the transition to more restrictive forms of dog husbandry, e.g., requiring dogs to be kept either indoors or on a leash. Poor supervision of dogs, higher dog population densities, insufficient vaccination coverage, relatively high rates of virus exposure, various cultural factors, and limited access to resources and information may lead to human rabies in suburban and rural settlements in Sri Lanka ^[12]. In a study of several population clusters in Sri Lanka reported a significant presence of ownerless dogs (a total dog: human ratio of 1:6.7 and an owned dog: human ratio of 1:9.6), poor vaccination coverage (total owned dog vaccination coverage of 69%, with a significantly lower rate (54%) among free-roaming dogs than among confined dogs 77%), and the practice of allowing free roaming (34% of owned dogs were allowed to roam freely during daytime) ^[13]. Knowledge of dog ecology and dog population demographics in endemic countries is a key factor in achieving significant progress in vaccination ^[14]. Using a Bayesian approach estimated the dog population density in Sri Lanka to be 108 dogs per km² ^[15]. That figure is far above the threshold density of 4.5 dogs per km² (3.8-5.2 dogs per km², 95% confidence interval) necessary to maintain rabies virus transmission within a population ^[16].

Attempts to control rabies by means of dog vaccination and the elimination of stray dogs have been shown to be positively correlated with a reduction in human rabies cases in the country. However, these interventions have not succeeded in eradicating rabies from the dog population and therefore other control measures such as birth control need to be considered ^[17]. Dogs are the main reservoir and transmitter of rabies in Sri Lanka as evidenced by reports of

hospitalized patients in the Central Province of Sri Lanka from 2007-2012. A total of 54% of reported human exposures to animal was attributable to bites from unvaccinated domestic dogs [18]. Island-wide post-exposure prophylaxis (PEP) administration was reported for 500,000 dog bite victims in 2012, a rate of nearly 2,000 dog bites daily [19].

Rabies prevention and control faces many challenges in resource-limited countries. PEP is not always available or is too expensive, while diagnostic laboratory capacity is often insufficient to cope with the sample volume. Estimating the size of and accessing the entire dog population is one of the most difficult tasks, but it is essential for planning and implementing systematic surveillance, vaccination, and birth control programs [20]. There is a high level of negligence in rabies control in Africa and Asia, and investment in measures necessary for successful reduction of canine rabies comparable to that in Latin America has been lacking [21]. In the case of Sri Lanka, island-wide surveillance of animal rabies by veterinary authorities has not yet even been able to determine the actual incidence of animal rabies although several low, middle, and high-income countries have demonstrated that canine rabies elimination is feasible [22-24].

The purpose of this review is to discuss the epidemiology of canine rabies and its transmission to humans in the context of dog demography and ecology, social aspects of dog ownership, and impacts of the rabies control program in Sri Lanka.

Epidemiology of Canine Rabies

Rabies lyssavirus is endemic in dogs in Sri Lanka with most cases reported from the Western and Southern provinces of the country [11,25]. Phylogenetic analyses have revealed that the virus is characterized by a single lineage that is distantly related to other Asian strains, reflecting the isolation of Sri Lanka as an island [25,26]. The Asian rabies virus is made up of six lineages that do not share a common ancestry. Out of those six lineages, three (Philippines, Indonesia, and Vietnam) originated from a single country while the remaining three (Sri Lanka/India, Thailand/Laos, Pakistan/India/Nepal) emerged from geographically proximate countries. The Sri Lankan virus comprises a single lineage that is distantly linked to the strain found in Madras, south-India. The rabies virus is the only lyssavirus that has been documented in Sri Lanka where it has been identified as a genotype 1 lyssavirus.

Without an effective system for rabies surveillance in the animal population, it will not be possible to adequately understand rabies distribution in Sri Lanka. It is known that canine rabies is underreported since most dog cases are seen by private veterinary practitioners as there is no established system of disease reporting to the government veterinary service by private practice veterinarians [27]. Although there are community medical officers who provide public health services to communities, there are government veterinarians who play an equivalent community level service role. Improvement of diagnostic facilities and implementation of decentralized regional rabies diagnostic laboratories were identified as minimal requirements for ensuring better surveillance.

Human rabies has been a notifiable disease in Sri Lanka since 1971, and dog rabies was included in the list of notifiable diseases in the Animal Diseases Act No. 59 of 1992 [28], which is much later and adds to the reasons for underreporting of dog rabies. The number of samples received for rabies diagnosis at the Medical Research Institute (MRI, P.O. Box 527, Dr. Danister De Silva Mawatha, Colombo 08) varies by province. Most positive samples are from the Western and Southern provinces which have better access to diagnostic facilities. In the Eastern and Northern provinces, sample processing by the national reference laboratory was reduced or completely absent due to the civil war until 2009.

Dogs are known to be the main reservoir and transmitter of rabies in Sri Lanka. Analysis of surveillance data from 1999-2010 collected by the MRI found that 85.2% of positive samples originated from dogs. However, other domestic animals, e.g., cats, cattle, goats, pigs, horses, and buffaloes, and wildlife, e.g., mongooses, civets, jackals, polecats, squirrels, monkeys, rock squirrels, rabbits, foxes, deer, and bandicoots, have also been identified as carriers of the virus. The number of rabies-positive samples was found to be positively correlated with both the dog population size and the dog population density of the relevant district. Higher dog and human densities, especially in suburban and rural areas, have also been suspected of promoting transmission as reported by [29]. However, a study found no correlation between human rabies death rates and the estimated dog population densities in different districts of Sri Lanka, as dog population density of all districts was above 5 dogs per km². 4.5 dogs per km² may be able to maintain endemicity in the population while densities of < 1 dog per km² would only support sporadic introduction of rabies [30]. It has been suggested that above this threshold, rabies persistence is not density-dependent [31]. Collecting information about dog populations in relation to the immediate environment, socio-cultural context of rural and urban human populations, and disease presence may allow prediction of areas at high risk for human rabies.

Population biology and ecology of dogs determine the epidemiology of canine rabies. The role of stray dogs in the dissemination of rabies in Sri Lanka most probably consists of carrying the virus from one community to another. Pet dogs which were allowed to roam freely accounted for 33.3% of all owned dogs [32]. The low vaccination coverage in the domestic dog population combined with ineffective management of stray animals may increase the risk of canine rabies spread with dog bites constituting the most likely mechanism of rabies transmission. 92.2% of rabies patients reported

dog bites, while 7.8% reported cat bites [33]. The unvaccinated pet dog is still the most common source of human infection. This is supported by the finding that 77.0% of biting animals had owners, 49.8% of bite incidents happened at home, and 67.2% of biting animals were unvaccinated [34]. In another study on dog bite victims seeking PEP in the Central province of Sri Lanka from 2007 through 2012, it was found that unvaccinated domestic dogs and cats were responsible for 10,662 (54%) and 3,982 (20%) of exposures, respectively. The number of samples which tested positive for canine rabies in Sri Lanka during the period 1987-2016 is shown in **Table 1**. These figures show that canine rabies is still endemic in the country as evidenced by the high number of positive-tested samples. The epidemiology of canine rabies in Sri Lanka is not yet fully understood. Further investigation is needed so that elimination of the disease may eventually be feasible.

Table 1. Dog rabies cases in Sri Lanka from 1987 through 2016.

Dog heads examined at Medical Research Institute, Colombo and percent positive		
Year	No. of dogs examined	% Positive
1987	415	56.4
1988	367	66.7
1989	734	87.1
1990	963	70.2
1991	1222	67.8
1992	591	60.8
1993	664	71.8
1994	702	77.1
1995	1217	69.7
1996	795	59.7
1997	934	85.5
1998	581	73.4
1999	672	70.3
2000	559	88.5
2001	737	69
2002	670	71
2003	897	60
2004	1105	58
2005	472	42.6
2006	788	55.3
2007	659	63
2008	681	61.9
2009	709	65.8
2010	658	46.4
2011	922	59.4
2012	909	66.9
2013	973	68.24

2014	917	66.52
2015	763	61.73
2016	835	68.98

The death rate from human rabies in the country has significantly declined over the last few years, which is mainly attributable to the provision of PEP as reported by the Public Health Veterinary Services (PHVS) (**Table 2**). Over the same period, the number of dog vaccinations increased continuously. The true incidence of rabies in dogs is likely masked by the use of PEP; however, PEP does not guarantee a long-term impact as it does not neutralize the host reservoir [35]. Today about 20 to 30 people succumb to rabies in Sri Lanka every year. An analysis of brain samples from suspect patients between 2008 and 2010 showed that children represented only 21.6% of victims. The majority of victims are men who do not take action after a bite [36].

Table 2. Human rabies cases, post-exposure immunization in humans and dog anti-rabies vaccination from 2003 through 2016 in Sri Lanka.

Number of human rabies patients diagnosed at MRI				Post-exposure prophylaxis in humans	Anti-rabies vaccination for dogs
Year	Number tested	Number positive	Human rabies death rate per 100,000	Number of vaccine vials issued by the Medical Supplies Division (MSD)	Number of vaccine vials used by PHVS
2003	33	15	0.073	4,97,117	6,64,993
2004	42	24	0.118	4,34,988	8,44,123
2005	28	20	0.098	4,86,467	8,18,162
2006	44	31	0.152	4,48,150	9,71,442
2007	38	32	0.157	3,27,000	10,37,617
2008	43	30	0.147	3,43,611	11,03,258
2009	48	44	0.217	4,01,725	10,68,036
2010	42	38	0.187	3,97,825	9,61,626
2011	34	31	0.152	2,05,645	11,15,399
2012	38	32	0.157	2,68,527	12,60,310
2013	32	27	0.133	3,17,782	12,75,540
2014	28	19	0.093	3,11,255	12,68,429
2015	27	24	0.118	2,74,405	14,46,933
2016	25	20	0.098	2,84,200	13,00,000

Demography and Ecology of Domestic Dogs and Social Aspects of Humans Affecting Dog To Human Rabies Transmision

In Sri Lanka the percentage of rabies-positive samples increased with the human population size or density of an area, with the Western and Southern provinces having one of the largest human population sizes and densities. When classified by geographical area, it was found that most human and animal rabies cases originated from a small number of districts, i.e., Colombo, Gampaha, Galle, and Kalutara. The total dog population of Sri Lanka has been estimated to be over 2.5 million [37]. In the 1980s, Sri Lanka had a dog: human ratio of 1:8 [38], while the ratio was 1:4.6 in 1997. A 2013 purposively selected multi-stage cluster sample reported a dog: human ratio of 1:6.7. However, there is a lack of information on the habitat preferences, distribution, density and social structures of the dog populations in various districts of Sri Lanka.

The basic needs of dogs include food, water, and shelter. They typically choose a habitat where these resources are abundant and accessible without danger. In the areas in and around human settlements, dogs can easily find food that

has been disposed of or even find an owner who actively takes care of them. If sufficient resources of adequate quality are available, both reproduction rate and life expectancy increase and the population grow.

Various definitions of dog ownership exist in different socio-economic and cultural contexts. Some owners may consider the dog to be part of their family and will aim to provide what they consider to be the best possible care, while others may be less emotionally attached and provide only food. A responsible dog owner both provides food and limits access to waste, refuse, and other food sources. The owner also controls the mating behavior of their dog. In addition, owners are usually concerned about the health of their animals and therefore are cautious about which dogs their pets have contact. However, a large number of dogs around the world are neglected or merely tolerated by the humans in their vicinity. They are free to roam at all times or are restricted for only a few hours each day. This allows them to socialize with other animals and with other people, to mate, and to feed on garbage. Such behavior is critical for the maintenance and transmission of rabies lyssavirus. Dogs without individual owners have been often described by neighbors as belonging to the community^[39]. 58.1% of surveyed households in Kandy district, Sri Lanka, owned dogs. In a study, 19.3% of dogs in Mirigama, Gampaha district were ownerless and among owned dogs, 39.6% were either on a leash or kept indoors. Of the owned dogs, 60.4% were allowed to roam freely on the owner's land (50.7%) or around the house (9.7%). 34% of owned dogs were allowed to roam during the daytime. Compassion for animals is deeply rooted in Sri Lanka's culture and religion. Releasing animals is supposed to bring good luck and is therefore a common practice. In rural settings, most of the houses are unfenced, unlike the situation in urban neighborhoods. The human settlement patterns in Sri Lanka offer favorable conditions for dog populations along the coast and in cultivated areas.

Canine Rabies Control In Sri Lanka-Past and Present

Already during the colonial period at the end of the 19th and beginning of the 20th century, the British colonial rulers had focused on combating rabies in Sri Lanka. The Rabies Ordinance of 1893 and the Dog Registration Ordinance of 1901 were first enacted under their reign. The former describes the seizure of stray dogs and their destruction if not claimed. It was further stipulated that all suspicious or diseased dogs and other animals should also be destroyed^[40]. Rabies control was the responsibility of the PHVS of the Ministry of Health and was carried out by respective directorates at regional level.

Rabies has been recognized as an important public health problem in Sri Lanka since the early 1950s, but control measures were launched in 1975. Cabinet approval was given for an island-wide 5-year rabies eradication program (1976-1980) with the support of WHO. A vaccine production center was established by the Department of Veterinary Services that produced live-attenuated chick embryo rabies vaccine (Flury strain) for animals. Use of this type of vaccine was later banned and production ceased. Presently, imported cell culture vaccines are used for animals. Another national program for the elimination of human and animal rabies in Sri Lanka was adopted in the 1980s. That program aimed to achieve vaccination coverage of 75%-80% among dogs through mass vaccination, to eliminate stray dogs, and to provide easy access to PEP for suspected animal bite victims. PEP has been provided free of charge to dog bite victims at government hospitals since that time.

In 2005, dog elimination was replaced by dog birth control which achieved a national coverage of 2.3% in 2006. The highest reported national rate of dog elimination prior to 2005 was 7%, a level unlikely to significantly reduce the size of the dog population as reported in an analysis which evaluated the dog elimination program in Sri Lanka and its long-term consequences^[41]. Birth control has been reported to be the preferred choice of 63.6% of the population.

The national dog vaccination coverage was 49.3% in 2007, a significant increase from the 3.2% achieved in 1975. In 2015, about 1.5 million dogs were vaccinated in Sri Lanka. Throughout the study period the dog vaccination coverage remained uneven, with vaccination rates ranging between 59.1% and 94.2% within the catchment areas of different vaccination points. Unvaccinated dogs included puppies (12%), ownerless dogs (57%), and owned dogs which were not presented for vaccination (31%). Among the reasons given for low vaccination rates are the unwillingness of the community to participate in control programs and the inability to handle aggressive animals. In a study conducted in Kandy district, 69% of respondents from urban areas and 57% from rural areas said they would be willing to submit the head of a suspect animal and to support surveillance activities. Mass vaccination of dogs remains the key to controlling domestic rabies in endemic areas^[42-44]. It is also the most cost-effective approach. In a dog population with high turnover, trying to achieve high vaccination coverage with a single vaccination campaign over a period of a year is futile^[45]. Repetition of vaccination is important as a single-dose vaccine injection does not result in long-lasting neutralizing antibody titers in free-roaming adult dogs in Sri Lanka^[46]. This finding was corroborated in a later study^[47], which also showed that even in juvenile domestic dogs a single-dose anti-rabies vaccination in the first year of life did not result in adequate antibody titers. Regardless of whether the dam has been vaccinated or not, puppies between 6 weeks and 3 months are not protected. Repeat-vaccination of dogs had shown titers above 0.5 IU/ml and suggests primo-vaccination should be followed by a booster after one month and then annual boosters^[48]. Achieving the desired immunity in the dog population through mass dog vaccination programs depends on both the coverage as well as the frequency of vaccination. Thus, for complete elimination of dog rabies in Sri Lanka, dog vaccination will need to be intensified and

regularly continued over an extended period of time. New vaccination techniques intended to reach a larger number of dogs, e.g., oral baits and auto vaccinators, have been tested. The vaccine schedule in Sri Lanka specifies vaccination of dogs against rabies at the age of 3 months if the dam has previously been vaccinated. If the dam is unvaccinated, the first vaccine is given to the pup at the age of 6 weeks with a booster at the age of 3 months and subsequent annual boosters. Strict compliance with the dog vaccination schedule, streamlining of mass dog vaccination programs according to schedule, maintaining continuity of programs, and promoting public awareness of the vaccination schedule are very critical to achieving herd immunity. Presently, however, there is a lack of the island-wide dog population information necessary for more accurate campaign planning, insufficient assessment of the needs of dog population management programs, and inadequate evaluation of the effectiveness of the interventions.

Rabies control programs should target both the animal source and the population at risk. A survey of knowledge, attitudes, and practices carried out among rural and urban populations in non-randomly selected households from villages in Kandy district revealed that there was a high level of awareness that dogs are the most common reservoir for rabies (90%) and that the disease can be prevented by vaccination (88%). Most human subjects (96%) indicated they would seek treatment from a doctor or a hospital after being bitten by a dog, usually within 3 months of having been bitten. That study found much improvement in pet care practices related to rabies control, but in Kandy district there were still more dogs allowed to roam freely in rural than in urban areas. Government programs promoting the adoption of dogs have been launched and are suspected to decrease the number of stray dogs. A sufficiently vaccinated population of free-roaming dogs poses no risk of rabies transmission.

The present rabies surveillance system in Sri Lanka is based on passive reporting and recording of both clinically and laboratory confirmed human and animal rabies cases. Clinically suspected human deaths are confirmed by sending brain tissue samples obtained during post-mortem examinations conducted by Judicial Medical Officers (forensic pathologists). Members of the public may voluntarily submit samples from a dog they consider to be a rabies suspect. Government veterinary officers and private veterinary practitioners may also send samples for diagnosis. However, there is no surveillance of any livestock species. Laboratory diagnosis of human and animal rabies cases is the responsibility of the Department of Rabies Diagnosis and Research, Medical Research Institute (MRI) of the Department of Health in Colombo, which also runs the national reference laboratory for rabies in Sri Lanka. In addition, animal rabies cases are also diagnosed by the rabies laboratories of the Faculty of Veterinary Medicine, University of Peradeniya and Teaching Hospital Karapitiya, Galle. Both laboratory and clinically confirmed human cases are reported to the Epidemiology Unit of the Department of Health. Data are made available weekly, quarterly and annually in an Epidemiology Bulletin. The Department of Animal Production and Health (DAPH) collects information on animal rabies cases which have been clinically diagnosed and reported by field veterinarians. Both human and animal rabies data are compiled in the Annual Report of the Public Health Veterinary Services (PHVS) Unit of the Health Department. However, lack of availability of real-time data on mammal bites to humans, patient demographics, treatment decisions, and patient outcomes as well as the prevalence of rabies in dead mammals has hindered improvement in clinical treatment, prevention initiatives, and surveillance^[49].

Sri Lanka's ambitious goal of eliminating human rabies by 2020 is being pursued through collaboration between local public health and veterinary authorities as well as academic institutions and the media. The country has taken an important step forward and, together with Thailand, Vietnam, and Bhutan, represents a model for other countries in the South and Southeast Asia region^[8,50,51]. To be able to achieve this goal, however, it is necessary that currently non-existent key background information necessary for program planning purposes be made available so that epidemiological risk zones and vulnerable social groups can be reliably identified. Surveillance is critical for rabies elimination as evidenced by the lack of any significant reduction in the number of dog rabies cases reported between 1987 and 2016 (**Table 1**).

THE WAY FORWARD

The main goal of rabies control is the prevention of rabies in humans. This can be achieved by ensuring easy access to potent PEP and by reducing the rate of human exposure to rabies. In Sri Lanka, more than 95% of human rabies cases (all of which had a fatal outcome) did not receive any PEP therapy. Most of the victims were male. The deceased generally had a poor socio-economic background. Knowledge, attitudes, and practices related to rabies control need to be improved, particularly among the rural, economically less well-off communities, in order to control this neglected zoonotic disease in Sri Lanka.

The single most effective way to limit human exposure to rabies is to control the disease in dogs, the main vector and reservoir. Although control measures for canine rabies include reducing dog population density, in practice reducing dog populations is difficult and expensive. It is also socially or culturally unacceptable in Sri Lanka. Vaccination is the most effective and economical way to control the disease^[52]. In Sri Lanka, a national dog birth control coverage of 2.3% in 2006 and a national dog vaccination coverage of 49.3% in 2007 are clear indications of the need to strengthen control

programs for rabies elimination. According to Coleman and Dye, dog vaccination rates of >70% can prevent a major outbreak, whereas dog birth control rates of >80% are required for an effective dog population control campaign. Endemic and sporadic occurrence of canine rabies is associated with population densities of ≥ 4.5 dogs per km² and < 1 dog per km², respectively^[16,53]. In Sri Lanka, Matter et al. using a Bayesian approach estimated the total dog population at 108 dogs per km², a population sufficient to maintain endemic status if the dogs are not vaccinated. Accessing and vaccinating a sufficient number of dogs, especially free-roaming and stray dogs, is critical for breaking the cycle of rabies transmission.

The Department of Health Services was given the responsibility for rabies control in 1956, almost 63 years ago. The decline in human rabies incidence through PEP treatment of dog bite victims has been a great achievement. However, uneven dog vaccination coverage, low frequency of vaccination, and ineffective management of stray dogs means that dog rabies continues to spread the disease and will make it impossible to achieve the goal of complete rabies elimination. In 2012, the Ministry of Livestock and Rural Community Development became a collaborative partner in the control of rabies. That department was given the responsibility for the dog component of the rabies program. With the implementation of a rabies control program by the Department of Animal Production and Health, a new vaccination schedule was introduced which ensured repeated vaccination of dogs within their first year of life, including categorizing pups of vaccinated dams, pups of non-vaccinated dams, and stray dogs. To achieve the objective of achieving a sustainable and uniform 70% herd immunity among dogs on the entire island, clear intersectoral collaboration (public health, animal health, local governments, and provincial councils) in a strong government rabies control program is a must if dog-mediated rabies is to be eliminated. Community engagement to ensure dog vaccination, responsible pet ownership, socio-cultural activities, and the ecology of dog populations are important factors. The Department of Animal Production and Health (DAPH) has initiated the establishment of regional rabies diagnostic facilities at five District Veterinary Investigation Centres. Since 2017, dog rabies vaccination has been available free of charge at Government Veterinary Offices island-wide. Establishing an institutional mechanism to implement veterinary public health activities, including rabies control, within the DAPH network is under discussion and pilot projects have been launched in Southern and North Western provinces to control rabies. Crucial activities that any project should consider from the outset and should continue through all implementation stages are dog vaccination, rabies awareness/communication, accessible PEP, and sufficient capacity for rabies diagnosis and surveillance. Meeting the target of elimination of rabies in domestic dogs by 2025 will be a challenge for Sri Lanka. Evidence-based success stories and sustained efforts in other areas provide lessons on how to achieve this target that must be studied by any national rabies control program in a country which is trying to eliminate this neglected zoonotic disease.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

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