

Original Article**Human Rabies Outbreak in Jaffna District: Is it due to the impact of COVID-19 on rabies control activities?****S. Sivaganesh¹, S. Suganja²**¹Regional Directorate of Health Services, Jaffna; ²Faculty of Medicine, University of Jaffna.**Abstract**

Though the number of rabies deaths in Sri Lanka has not changed significantly during/post COVID 19 period, cases in Jaffna has shown a significant increase during this period. This study aimed to determine the possible factors for the increased rabies deaths in the Jaffna District, Sri Lanka.

A Desk review was conducted by collecting data of years 2019-2022 from the registers/records maintained in Regional Directorate of Health Services, Jaffna and Medical Officer of Health offices in the Jaffna District. Data was collected using data extraction sheets prepared in Microsoft excel from notification registers, e-mail notifications, special surveillance forms, dog immunization registers/records, dog sterilization registers/records and monthly returns from the hospitals. Triangulation of data was done to ensure data quality. Collected data was analyzed using Microsoft excel functions. Simple descriptive statistics was used to describe the distribution and comparison.

Out of 14 rabies death, most of the cases (93%) have occurred among economically active adults and (64%) among males. Distribution of cases was mainly in two land masses, namely Valikamam and Vadamaradchi. MOH Sandilipay had the highest incidence (36%). Proportion of animal bites among OPD attendants varied from 6.9% in 2019 to 11.1% in 2020 and 17.6% in 2021. A reduction was observed in 2022 compared to 2021. Number of dog sterilizations has been fluctuating over the years. Annual dog vaccination coverage in the district varied from 29.3%

in 2019 to 86.2% in 2022. In 2019, it varied from 0% in MOH Chankanai, MOH Karainagar, MOH Kayts and MOH Kopay to 105.5% in MOH Chavakacheri. Similarly, in 2022, it varied from 46.3% in MOH Jaffna to 106.6% in MOH Thellipalai. It has observed reduction in human rabies death following increased dog vaccination coverage over the years. There is enough evidence that rabies control activities had been reduced during COVID-19 period and resulted high incidence of animal bites and rabies cases in Jaffna District.

Keywords

Human Rabies, Jaffna District, rabies control activities

Introduction

Rabies is spread via bites and scratches from infected animals. Dogs are responsible for most of the human cases. Clinically, rabies is characterized by fitful consciousness, hyperactivity, hallucinations and hydrophobia (furious rabies), or paralysis and coma (paralytic rabies), progressing rapidly and inevitably towards death. While a variety of animal species can host rabies, dogs are responsible for 99% of human cases (1). Disease models and real-world experience show that sustained vaccination coverage of 70% of dog populations is sufficient to stop transmission of the disease between dogs, and from dogs to humans. Therefore eliminating rabies in dogs is the key strategy to sustainably preventing human disease (2) however northern regions – such as the Northern Peninsula Area (NPA).

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Rabies is a neglected tropical disease. Most rabies cases occur in Africa and Asia. An estimated 59 000 people die from rabies each year. That's one person every nine minutes of every day, 40% of whom are children living in Asia and Africa. As dog bites cause almost all human cases, we can prevent rabies deaths by increasing awareness, vaccinating dogs to prevent the disease at its source and administering life-saving treatment after people have been bitten. We have the vaccines, medicines, tools and technologies to prevent people from dying from dog-mediated rabies. For a relatively low cost it is possible to break the disease cycle and save lives (3).

A systematic review has found that human rabies deaths in Sri Lanka have been reduced for the last half century by successful implementation of mass dog vaccination, animal birth control and awareness raising activities. However, the country is still facing on sporadic rabies cases, limited dog vaccination coverage and insufficient dog population management in the district level. Despite the nationwide standard of dog to human ratio of 1:8, there are huge disparities or unknown of dog ecology in regions. Awareness raising including has been enhancing for both general public and school children. Surveillance system is poorly operated so that simultaneous data analysis for decision-making is impractical (4).

Rabies in dogs and dog immunization

According to the World Health Organization, rabies-infected dogs serve as the main source of human rabies transmission globally all rabies cases in humans, while in the Americas, bats are the most common source of human infections. Vaccines stimulate adaptive immunity, which is antigen-dependent and antigen-specific; therefore, rabies vaccination provides protection specifically from rabies infection. Multiple vaccines are licensed for use in domestic animals, and inactivated (killed) vaccines are available for use in dogs. Rabies vaccine is a core vaccine according to

the American Animal Hospital Association (AAHA) and is the only companion animal vaccine required by law in most states. In Canada, rabies vaccination of dogs is only required in the province of Ontario. Licensed veterinarians are legally required to vaccinate dogs for rabies in most U.S. states. Some states also allow canine rabies vaccines to be administered by licensed or certified veterinary technicians or lay people working under the direct supervision of a licensed veterinarian. After vaccination, a rabies vaccination certificate is issued for verifying the vaccinee, the health of the vaccinee, the product used, the booster interval, and the administering veterinarian to identify the vaccinated dogs. Inactivated rabies virus vaccines can be administered either intramuscularly or subcutaneously. The first vaccination is given per label recommendations at a minimum of 3 months of age due to the potential interference by maternally derived antibodies and a relatively poor immune response in the young. Regardless of the age of the first vaccination, a booster vaccine is repeated 1 year after the initial vaccine, with subsequent boosters given annually or triennially depending on the labeled duration of immunity of the vaccine used and local public health regulations. A recently published challenge study with virulent rabies virus demonstrated that the duration of immunity conferred by rabies vaccine extends beyond the 3-year label, which may change vaccination schedules in the future (5).

Human rabies in Sri Lanka

Rabies has been endemic and a major public health problem in Sri Lanka with its peak in the 1970s where 300 to 400 human deaths per year, occurred mainly among economically active people. As a result of establishment of the anti-rabies campaign of the ministry of health Sri Lanka in 1981 for disease control and strategic measures, currently the reported cases is in controlled stage where the number of human deaths have dropped down to less than 30 annually. Anti-Rabies

Campaign at public health veterinary services of the ministry of health which is currently the focal point of rabies control in the island, entrusted with national responsibilities of preventing human and animal rabies in collaboration with other stake holders. Since the establishment of the campaign various strategies have been practiced for rabies control which mainly includes dog vaccination programs, population control for domestic and free roaming/stray dogs and post-exposure vaccination of human. In order to reach the national target of 'zero human deaths due to dog mediated Rabies disease', the need of more special tactics was observed. This was the foundation for the development of the 'National Strategic Plan' on elimination of dog mediated human rabies from Sri Lanka (2022-2026), in order to eliminate the last few cases of Rabies from Sri Lanka and to achieve our target of zero dog mediated human rabies deaths by 2026 and eliminate dog mediated Rabies by 2030 (6).

In the last decade, reported rabies cases have been reduced in Sri Lanka with similar pattern in subnational levels. Though the number of deaths in Sri Lanka was not changed significantly during/post COVID 19 period (23, 25, 26, 26 from 2017 to 2020 respectively), cases in Jaffna has shown a significant increase during this period. The present study was undertaken to determine the possible factors for the increased rabies deaths in the Jaffna District, Sri Lanka.

Methodology

A Desk review was conducted by collecting data from 2019 to 2022 from the registers/records/information maintained in the regional epidemiology unit and rabies control unit in the office of the Regional Directorate of Health Services (RDHS), Jaffna, and Medical Officer of Health (MOH) offices in the Jaffna District.

Data was collected using data extraction sheets prepared in Microsoft Excel from notification registers, e-mail notifications, special surveillance forms (Surveillance

of Human Rabies- Case Investigation form of Epidemiology Unit, Sri Lanka), dog immunization registers/records, dog sterilization registers/records and monthly outpatient department (OPD) returns from the hospitals.

Triangulation of data was done to ensure data quality between data from notification registers, email notifications, and special investigation forms for rabies cases. The same procedures were done between data from PHI offices, MOH offices, and RDHS offices for dog immunization data and dog sterilization data. Administrative approval was obtained from RDHS Jaffna.

The collected data was analyzed using Microsoft Excel functions. Simple descriptive statistics was used to describe the distribution and comparison.

Results

This section covers the epidemiology (distribution and determinants) of human rabies during the period between 2019 and 2022.

Distribution and source of infection of Human Rabies cases in Jaffna District

Most of the cases (around 93%) have occurred among economically active adults and majority (around 64%) among males. Distribution of cases were mainly two land masses, namely Valikamam and Vadamaradchi in the peninsula which include Sandilipay, Kopay, Jaffna, Chankanai, Point Pedro and Maruthankerny Medical Officer of Health (MOH) areas. Among them Sandilipay MOH has experienced the highest incidence (around 36%). The cases have been increased over the years in post-COVID-19 period with the highest incidence in 2021. The primary source of infection (around 93%) was dog and the highest number of cases mainly due to stray dogs (around 64%). Though Sandilipay MOH has experienced the highest incidence, only 40% of the source of infection has been identified within its geographic boundaries (Table 1).

Table1: Background characteristics of Rabies Deaths from 2019 to 2022 in Jaffna District

Characteristics (n=14)	Number	Percentage
Age of the patients		
Less than 18 years	1	7.1
18 years and above	13	92.9
Sex of the patients		
Female	5	35.7
Male	9	64.3
MOH Area		
Chankanai	2	14.3
Jaffna	1	7.1
Kopay	3	21.4
Maruthankerny	2	14.3
Point Pedro	1	7.1
Sandilipay	5	35.7
Year of the death		
2019	1	7.1
2020	2	14.3
2021	6	42.9
2022	5	35.7
Source of Infection		
Stray Dog	9	64.3
Domestic Dog	3	21.4
Mongoose	1	7.1
Not identified	1	7.1
MOH Area of the Source		
Chankanai	3	21.4
Jaffna	1	7.1
Kopay	3	21.4
Maruthankerny	2	14.3
Point Pedro	1	7.1
Sandilipay	2	14.3
Unknown	2	14.3

Source: Special surveillance forms

Determinants of Human Rabies cases

As dogs are the primary source of infection of the reported cases, animal bites play a major role in the transmission of human rabies cases. It's observed that a substantial increase in number of animal bites during the COVID-19 period and significant rise in the proportion of bites among OPD attendants (from 6.9% in 2019 to 11.1% in 2020 and 17.6% in 2021). This is due to increased number of bites and decreased OPD attendants due to COVID-19 pandemic. Variations in

monthly bite incidences also have shown significant increases during the COVID-19 period compared to previous year (from minimum 4.1% to maximum 8.9% in 2019 to minimum 6.2% to maximum 17.2% in 2021 and minimum 12.0% to maximum 24.6% in 2022). A reduction was observed in 2022 compared to 2021 (table 3).

In order to prevent the animal bite incidences, dog-birth control measures are practiced as an intervention by ministry of health with the support of veterinary department and external partners Island wide. According to the intervention, dog sterilizations have been done in Jaffna District annually. As it depends on fund allocations for government private partnership, the number of sterilizations has been fluctuating over the years (table 2).

Table 2: Number of dog sterilizations performed over the years in Jaffna District

Year	Number of dog sterilizations
2019	1450
2020	1041
2021	2455
2022	1517

Source: ARC unit, RDHS office

Dog Vaccination

As animal bite is inevitable in current context of life, it's important to ensure the immunity against rabies virus among animals in human habitant areas in regular intervals. During the period involved in the review, the annual vaccination coverage in the district varied from 29.3% in 2019 to 86.2% in 2022. In 2019, it varied significantly in sub-district levels from 0% in MOH Chankanai, MOH Karainagar, MOH Kayts and MOH Kopay to 105.5% in MOH Chavakacheri. Similarly, in 2022, it varied from 46.3% in MOH Jaffna to 106.6% in MOH Thellipalai. And all MOH areas except Jaffna have shown more than 70% coverage. These coverages were based on estimated population of dogs (table 4).

Table 3: Incidence of animal bites over the years in Jaffna District

Month	2019			2020			2021			2022		
	OPD No	Bite No	Bite%	OPD No	Bite No	Bite%	OPD No	Bite No	Bite%	OPD No	Bite No	Bite%
January	143054	900	6.3	143507	895	6.2	78601	1098	14.0	91658	1070	11.7
February	120989	492	4.1	126943	923	7.3	82171	984	12.0	69490	943	13.6
March	125880	845	6.7	101552	925	9.1	81858	1021	12.5	81494	1274	15.6
April	115956	1033	8.9	73760	1043	14.1	61268	949	15.5	88623	1139	12.9
May	120710	1029	8.5	72824	1046	14.4	54411	987	18.1	89723	1137	12.7
June	105310	835	7.9	81042	1087	13.4	59850	1117	18.7	80301	587	7.3
July	119803	1051	8.8	90795	1060	11.7	58665	1422	24.2	82916	547	6.6
August	120303	959	8.0	96753	1217	12.6	52968	1305	24.6	98290	751	7.6
September	135704	1006	7.4	92757	1090	11.8	48419	1069	22.1	105326	436	4.1
October	153713	848	5.5	83515	946	11.3	47644	1151	24.2	112220	713	6.4
November	157003	802	5.1	66206	1138	17.2	56220	952	16.9	127048	790	6.2
December	133468	904	6.8	74552	1260	16.9	75987	1271	16.7	116942	903	7.7
Total	1551893	10704	6.9	1023748	11370	11.1	758062	13326	17.6	1144031	10290	9.0

Source: monthly OPD returns from all the hospitals in Jaffna except THJ.

Table 4: Dog vaccinations performed over the years in Jaffna District

MOH Area	Population		Number and % of dog ARV vaccination							
	Human*	Dog (est)	2019	%	2020	%	2021	%	2022	%
Chankanai	47,587	5948	0	0	5792	97.4	400	6.7	4,351	73.6
Chavakacheri	73,364	9171	9678	105.5	1547	16.9	8840	96.4	7,955	88.2
Jaffna	89,136	11142	5091	45.7	449	4	4410	39.6	4691	46.3
Karainagar	10,655	1332	0	0	1222	91.8	1418	106.5	1190	92.3
Karaveddy	45,504	5688	200	3.5	3761	66.1	4394	77.3	4880	85.1
Katys	10,417	1302	0	0	1138	87.4	1553	119.3	1101	84.1
Kopay	75,671	9459	0	0	8546	90.3	6328	66.9	9402	101.7
Maruthankeni	16,469	2059	90	4.4	1985	96.4	2053	99.7	2014	97.3
Nallur	38,809	4851	3340	68.9	617	12.7	3948	81.4	4092	81.3
Pointpedro	45,345	5668	3772	66.5	1053	18.6	5508	97.2	5707	99.2
Sandilipay	50,912	6364	200	3.1	4287	67.4	3151	49.5	6269	94.2
Tellippalai	44,442	5555	220	4	5126	92.3	1944	35	6117	106.6
Uduvil	52,680	6585	100	1.5	6410	97.3	7098	107.8	6117	92.3
Velanai	23,265	2908	200	6.9	2552	87.8	2659	91.4	2537	99.3
Total	624,256	78,032	22891	29.3	44485	57.0	53704	68.8	66,423	86.2

Source: Rabies Unit, RDHS office/Jaffna

It has been observed reduction in human rabies death following increased dog vaccination coverage (table 5) over the years.

Table 5: Rabies cases and Dog ARV coverage in Jaffna District

Year of the death	Dog ARV coverage	Number of human rabies
2019	29.3	1
2020	57.0	2
2021	68.8	6
2022	86.2	5
2023	74.9	2

Discussion

Most of the human rabies cases have occurred among economically active males during the study period. Distribution of cases has occurred in two main land masses, namely Valikamam and Vadamaradchi areas of the peninsula. The cases have been increased over the years in post-COVID-19 period with the highest incidence in 2021. The primary source of infection was dog and the highest number of cases mainly due to stray dogs. It's observed that a substantial increase in number of animal bites during the COVID-19 period and significant rise in the proportion of bites among OPD attendants. Number of dog sterilizations has been fluctuating over the years. The annual dog vaccination coverage in the district has varied from 29.3% in 2019 to 86.2% in 2022 with remarkable reduction during COVID-19 period. In 2022, it varied from 46.3% in MOH Jaffna to 106.6% in MOH Thellipalai.

One of the most effective measures to control rabies is the vaccination of dogs, which not only protects them but also serves as a critical tool in reducing the incidence of human rabies. The relationship between dog Anti-Rabies Vaccination (ARV) coverage and human rabies cases has been well-documented, with several studies highlighting how increasing vaccination coverage can significantly lower human rabies cases. The World Health Organization (WHO) recommends

achieving minimum dog vaccination coverage of 70% to interrupt rabies transmission within a dog population. Vaccinating dogs prevents them from contracting and transmitting the rabies virus to humans and other animals. Given that the majority of human rabies cases are caused by bites from infected dogs, increasing dog vaccination coverage is a direct method of preventing human rabies.

In tropical countries, where rabies remains endemic in certain areas, the challenge of controlling the disease is compounded by limited resources, lack of awareness, and the large population of stray dogs. However, studies have demonstrated that even modest increases in dog ARV coverage can result in a significant decline in human rabies cases. A study done in India, by Sudarshan and his team(7) showed that rabies vaccination programs targeting dogs in Indian states with high rabies incidence significantly reduced the number of human cases. India has one of the highest burdens of human rabies globally, primarily due to the large population of stray dogs. The implementation of mass vaccination campaigns in these areas, where over 70% of the dog population was vaccinated, was associated with a notable reduction in human rabies deaths.

In several sub-Saharan African countries, where rabies is also endemic, mass dog vaccination campaigns have been linked to reductions in human rabies cases. For example, a large-scale dog vaccination campaign in Tanzania led to a 70% reduction in human rabies cases over a period of three years, demonstrating the effectiveness of dog vaccination in preventing human deaths(8).

Accurate calculation of dog vaccination coverage as a percentage of the dog population remains challenging due to the lack of up-to-date dog survey data that can provide the exact number of dogs in a given area. A dog ecology study conducted in the 1980s reported a dog-to-human ratio of 1:8. However, a similar study in 1996 in Meerigama indicated a significant increase

in the dog population, with a ratio of 1:4. This study also noted that 20% of the dogs were ownerless. Further surveys conducted in 2009 and 2010 across Polonnaruwa, Kegalle, Gampaha, and Matara revealed a dog-to-human ratio of 1:6. Despite these updated findings, vaccination coverage is still commonly calculated using the ratio of 1:8(9). This practice may result in a significant number of dogs being missed during vaccination efforts. Moreover, available data suggest that a considerable portion of the dog population consists of stray or ownerless dogs. Therefore, it is essential to revisit and revise the methodology for estimating dog populations, taking into account the specific characteristics and ecological features of each locality to ensure more accurate planning and effective rabies control strategies.

Mass Dog Vaccination (MDV) campaigns are carried out every year in every MOH area in Sri Lanka. Six months after the main campaign, a “mopup” round is held to reach dogs missed in the initial drive. The primary approach is a *staticpoint* clinic: a series of preselected, welladvised sites where owners are expected to bring their dogs for rabies vaccination. Each clinic operates for only half a day (morning or evening). Both owned and freeroaming dogs are accepted, and a vaccination card is issued for every dog presented. When the static clinic closes, a separate team vaccinates the remaining freeroaming dogs using autoplunger injectors. Nonetheless, some strays inevitably evade capture and remain unvaccinated(9).

It's observed that remarkable reduction in key rabies control activities such as dog vaccination and sterilization in Jaffna District during the COVID-19 Pandemic. At the same time dog bite incidents were higher both in numbers and proportions (out of OPD attendants) during this period. Globally, though, the pandemic has not only brought with it human individuals staying at home, telecommuting, and the restriction of human transportation, but it also has led

to the creation of space or areas for dogs. This, in return, has led to an increase in stray dogs as the reproductive cycle of dogs is relatively short. It increased animal bites, with interrupted rabies surveillance, and rabies vaccine shortage, which ultimately has also led to an increase in the incidences of rabies infections(10). This was clearly shown in our data that both number and percentage of reported dog bite incidents were higher in Jaffna District even though there were gross under reporting from Teaching Hospital Jaffna.

There is enough evidence that rabies control activities had been reduced during COVID-19 period and resulted high incidence of animal bites and rabies cases in Jaffna District. Its recommended to improve dog vaccination programmes which are cost effective by provision of adequate human resources and other resources rather than government funded dog sterilization programmes which is a less effective intervention according to WHO experts(1). This will accelerate the achievement target “Zero By 2030” in Sri Lanka.

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References

1. World Health Organization. WHO Expert Consultation on rabies : third report (Internet). Vol. 1012, World Health Organization technical report series. World Health Organization; 2018. Available from: <https://apps.who.int/iris/handle/10665/272364>
2. Hudson EG, Brookes VJ, Dürr S, Ward MP. Targeted pre-emptive rabies vaccination strategies in a susceptible domestic dog population with heterogeneous roaming patterns. *Prev Vet Med.* 2019;172:1–15.

3. WHO, FAO, OIE. Zero by 30: the global strategic plan to end human deaths from dog-mediated rabies by 2030 (Internet). Geneva; 2018. Available from: <http://www.who.int/rabies/resources/9789241513838/en/>
4. Kanda K, Jayasinghe A, Jayasinghe C, Yoshida T. Public health implication towards rabies elimination in Sri Lanka: A systematic review. *Acta Trop* (Internet). 2021;223(May):106080. Available from: <https://doi.org/10.1016/j.actatropica.2021.106080>
5. Eckman SL. Rabies vaccination in dogs. *Today Vet Pract* (Internet). 2021;(January/February):30–5. Available from: <https://todaysveterinarypractice.com/preventive-medicine/rabies-vaccination-in-dogs/>
6. Ministry of Health. Statistical bulletin 2022. Public Health Veterinary Services. Colombo: Ministry of Health and Indigenous Medicine, Sri Lanka; 2023. p. 7.
7. Sudarshan MK, Madhusudana SN, Mahendra BJ, Rao NSN, Ashwath Narayana DH, Abdul Rahman S, et al. Assessing the burden of human rabies in India: results of a national multi-center epidemiological survey. *Int J Infect Dis*. 2007;11(1):29–35.
8. Cleaveland S, Thumbi SM, Sambo M, Lugelo A, Lushasi K, Hampson K. Europe PMC Funders Group Proof of concept of mass dog vaccination for the control and elimination of canine rabies. *Rev Sci Tech*. 2022;37(2):559–68.
9. Ministry Of Healthcare & Indigenous Medical Services Sri Lanka. Public Health Veterinary Services, Ministry Of Healthcare & Indigenous Medical Services Sri Lanka (Internet). 2025. Available from: <http://www.rabies.gov.lk/english/control.php>
10. Rasizadeh R, Baghi HB. Increase in rabies cases during COVID-19 pandemic : Is there a connection ? *J Infect Dev Ctries*. 2023;17(3):335–6.