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https://doi.org/10.47811/bhj.139

Impact of COVID-19 pandemic on the burden of dog bite cases at the National Referral Hospital in Bhutan

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ABSTRACT

Introduction: Dog bite is a public health problem in Bhutan incurring huge cost of treatment. The general objective of the study was to see the impact of COVID-19 pandemic on the burden of dog bite cases and the profile of patients, comparing with that of the year before the COVID-19 pandemic started (2019) at the National Referral Hospital. **Methods:** This is a retrospective record review of the dog bite cases in the year 2019 and 2020. The target population of the study were people living in Thimphu city. The dog bites that occurred outside Thimphu were excluded from the study. Proportion of dog bite according to demographic and clinical variables were calculated. Univariate and multivariate analysis were done to look for risk factors responsible for dog bite in 2020 compared to 2019. A statistically significant level was set at <0.01. **Results:** The dog bite cases in the year 2019 and 2020 were recorded at 3.3% and 2.4% respectively There was male predominance and highest incidence of the dog bite was in age group of 20-59 years. The commonest site of bite were lower limbs and stray dog bites were highest risk exposure. **Conclusion:** less dog bite cases reported in 2020 which may be due to the impact of pandemic. Majority of the cases were stray dog bites and high incidence of dog bites can be a major concern for health, social and economic wellbeing of the nation which needs urgent intervention.

Keywords: COVID-19 pandemic; Dog bite.

INTRODUCTION

Dog bite is a major public health concern throughout the world because it incurs a huge cost for the treatment and prophylaxis of rabies which is a fatal disease[1,2]. The incidence of dog bite is directly proportional to the population of the dog[3]. The population of dogs in the Thimphu was estimated at13000 in 2020 including 7292 registered pet dogs[4,5]. In the year 2019 and 2020 Bhutan reported total of 7083 and 6430 dog bites respectively[6,7]. Though rabies has been eliminated from the northern and central parts of Bhutan, there are risks of importing it from the south and eastern parts, as country shares border with India where several canine rabies outbreaks were reported in the past[8]. Thirteen human deaths were reported due to rabies following dog bites from 2009 to 2017[9].

A patient's profile is necessary to be assessed, so that the prevention strategies can focus on the high risk groups. The studies conducted in the past to evaluate the profile of the dog bite patients had focused on only southern districts, as it is more prone to the rabies outbreaks and they found that below the age of 18 years were affected mostly with male predominance[9]. Anatomical site of bite and risk exposure categorization are important for post-exposure rabies prophylaxis vaccination.

It was reported in the past by other studies on the dog bite cases and the inappropriate use of the anti-rabies vaccine (ARV) by the clinicians[9], however, there are no records of dog bite cases who received ARV in the National Referral Hospital. The rate of dog bites remain unaccounted and therefore the economic implications and the knowledge of true hospital burden are not known. After the outbreak of COVID-19 as a Public Health Emergency of International Concern, Bhutan had taken several measures including travel advisory from the beginning of the year 2020[10,11]. The country had first confirmed case of disease on March 5, 2020 and to curve the spread of disease, the travel restrictions and national lockdowns were imposed in August and end of December 2020[12-15]. These measures would have affected the incidence and the profile of dog bite cases reported in the Jigme Dorji Wangchuck National Referral Hospital (JDWNRH).

Therefore, the study was conducted to evaluate the impact of pandemic on the burden of dog bite cases at the National Referral hospital in Bhutan.

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METHODS

The study is retrospective record review of dog bite cases from electronic register for anti-rabies vaccine (ARV) for the year 2019 and 2020 at JDWNRH. The target population of the study were the people living in the Thimphu City (Thromdey), which is 114551. We used convenience sampling method for the purpose of the study by including all the patients visiting JDWNRH. The dog bites that occurred outside Thimphu city were excluded from the study. The demographic details such as age, gender, occupation and clinical details like the site of the bite, category of bite and details related to the type of dog as a pet or stray dog were collected. The age was categorized as pre-school age group (0 – 5 years), school-going age (6 – 19 years), post-school and working-age group (20 – 59 years) and old age group (60 years and above). The occupation was categorized as a student, monk, construction worker and others comprising of public & private employees, self-employed and unemployed groups. The site of a dog bite was categorized as lower limbs, upper limbs, trunk and head & neck. The severity of exposure to a potentially rabid dog was categorized as per the national guideline for the management of human rabies as licks on intact skin, feeding or touching the dog comprised no risk (category I), minor risk (category II) and major risk (category III).

Data were analyzed using RStudio (version 1.2.5033) software. A statistically significant level was set at $p<0.01$. The incidence of dog bite cases was calculated using the total population at risk for the years 2019 & 2020.

Descriptive data are presented as frequency and percentage and for quantitative variables, the mean and standard deviation are used as applicable. Univariate analysis was done to look for association between demographic and clinical variables and the outcome of being bitten by dog during the COVID-19 pandemic as compared to being bitten in 2019 as base year. Multivariate analysis was done using logistic regression to look for association with multiple risk factors. This study was conducted with the approval of the Research Ethics Board of Health, Ministry of Health, Thimphu, Bhutan (approval letter No. REBH/Approval/2021/027)

RESULTS

The total cases of dog bite in the year 2019 and 2020 from total city population (*n*=114551) was 3.3% (*n*=3810) and 2.4% (*n*=2723) respectively. In the year 2019, there were 2307 (60.6%) cases among males and 1503 (39.4%) females, with age range from 0 to 92 years (mean=26.81, SD=17.09). In 2020, there were 1676 (61.5%) cases among males 1047 (38.5 %) with females with age range from 1 to 94 years (mean=27.69, SD=16.56). The highest affected age group was 20 to 59 years (59.5% in 2019 and 64% in 2020). The monks were the least affected occupational group (1.8% in 2019 and 1.3% in 2020). The lower limbs were the commonest sites (78.9% in 2019 and 77% in 2020), stray dogs were the most common cause (83.6% in 2019 and 82.7% in 2020) and category II risk was the commonest risk exposure (93% in 2019 and 91% in 2020). In 2019, the highest cases of bites were reported in the month of April and lowest in November. However, in the year 2020, the highest was reported in January and the lowest in August (Figure 1). The details of number and proportion of all variables are shown in Table 1.

Table 1. Profile of dog bite cases of the year 2019 and 2020

Variables group	Variables	2019 *n* (%)	2020 *n*(%)
	Incidence	3810 (3.3)	2723 (2.4)
Gender	Male	2307 (60.6)	1676 (61.5)
	Female	1503 (39.4)	1047 (38.8)
Age Group	0-5	323 (8.5)	165 (6.0)
	6-19	983 (25.8)	660 (24.0)
	20-59	2266 (59.5)	1747 (64.0)
	>60	238 (6.2)	151(6.0)
Occupation	Student	1010 (26.7)	723 (26.8)
	Monk	67 (1.8)	35 (1.3)
	Construction worker	196 (5.2)	116 (4.3)
	Others	2508 (66.3)	1826 (67.6)
Bite Site	Lower limb	2993 (78.9)	2080 (77.0)
	Trunk	114 (3.0)	63 (2.0)
	Upper limb	611 (16.1)	486 (18.0)
	Head & neck	76 (2.0)	73 (3.0)
Dog Type	Stray dog	3071 (83.6)	2199 (82.7)
	Pet dog	602 (16.4)	461 (17.3)
Bite Category	Category I	166 (4.0)	77 (3.0)
	Category II	3526 (93.0)	2480 (91.0)
	Category III	111 (3.0)	164 (6.0)
Bite month	January	309 (8.0)	263 (9.7)
	February	303 (8.0)	256 (9.4)
	March	375 (10.0)	254 (9.3)
	April	404 (10.6)	211 (7.7)
	May	389 (10.2)	248 (9.1)
	June	357 (9.4)	229 (8.4)
	July	316 (8.3)	228 (8.3)
	August	289 (7.6)	143 (5.3)
	September	279 (7.3)	222 (8.1)
	October	257 (6.7)	210 (7.7)
	November	256 (6.7)	240 (9.0)
	December	276 (7.2)	219 (8.0)

Note: *Missing data for 2019: Occupation - 29 (0.8), Bite site - 16 (0.4), Dog Type - 137 (3.6), Bite category -7 (0.2)*

Missing data for 2020: Occupation – 23 (0.8), Bite site – 21 (0.8), Dog type – 63 (2.3), Bite category – 2 (0.1)

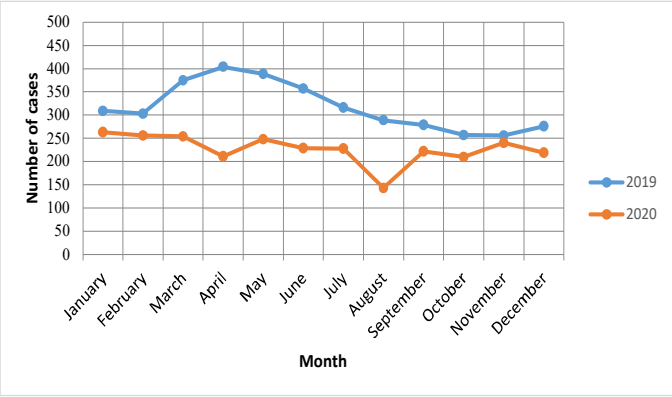

Figure 1. Monthly cases of dog bite who received ARV in 2019 and 2020

Table 2. Univariate analysis of factors associated with dog bite in Bhutan in 2019 and 2020

Variable group	Variables	OR	95% CI	*p*-value
Gender	Male			
	Female	1.04	0.94-1.15	0.41
Age Group	0-5			
	6-19			
	20-59			
	>60	1.12	1.05-1.20	<0.01
Occupation	Student			
	Monk			
	Construction worker			
	Others	1.01	0.97-1.04	0.62
Dog Type	Stray dog			
	Pet dog	1.07	0.94-1.22	0.32
Month of Bite	January			
	February			
	March			
	April			
	May			
	June			
	July			
	August			
	September			
	October			
	November			
	December	1.01	0.10-1.02	0.17

Table 3. Multivariate analysis of factors associated with dog bite in Bhutan in 2019 and 2020

Variables		Odds Ratio	95% CI	*p*-value
Year	2019			
	2020	0.65	0.49 – 0.87	<0.01
Age group	0 - 5			
	6 - 19	1.30	1.05 – 1.61	0.02
	20 - 59	1.52	1.24 – 1.85	<0.01
	≥ 60	1.26	0.95 – 1.66	0.11
Gender	Female			
	Male	0.95	0.86 – 1.05	0.34
Month	January			
	February	0.99	0.79 – 1.26	0.96
	March	0.79	0.63 -0.99	0.04
	April	0.60	0.48 – 0.76	<0.01
	May	0.75	0.59 – 0.94	0.01
	June	0.76	0.60 – 0.96	0.02
	July	0.85	0.67 – 1.08	0.18
	August	0.58	0.45 – 0.75	<0.01
	September	0.92	0.73 -1.18	0.52
	October	0.96	0.75 – 1.23	0.74
	November	1.10	0.87 – 1.40	0.43
	December	0.92	0.72 – 1.17	0.50

Risk factors for dog bite in 2020 (Year of COVID-19) compared to 2019

The odds of getting bitten by a dog was less in 2020 compared to 2019 (OR 0.65 (95% CI 0.49-0.87, $p<0.01$).

The odds of getting bitten by a dog in 2020 were associated with age while it was not associated with occupation, month of bite and dog type in univariate analysis (Table 2). On multivariate analysis, we saw that there was a significant decrease in odds of a dog bite in April and August in 2020. The age group of 20-59 (OR 1.52,95% CI 1.24-1.85, $p<0.01$) years had higher odds of getting bitten by a dog in 2020 compared to 2019. The details are shown in Table 3.

DISCUSSION

We were interested to see the incidence and pattern of dog bite cases that would have been affected by the school closure for physical presence and movement restrictions of people during Covid-19 pandemic by comparing it with the pre-pandemic year of 2019.

Incidence of dog bite cases and comparison between pre-pandemic year (2019) and pandemic year (2020)

The number of dog bite cases reported in the National Referral Hospital during the year 2020 (2723) was lesser than the year

2019 (3810). Therefore, the proportion of dog bite was 2.4% (24/1000/year) and 3.3% (33/1000/year) in 2020 and 2019 respectively. The odds of getting bitten by a dog in the year 2020 was less compared to 2019 (Table 3). This observation is comparable to the Annual Health Bulletin of Bhutan which reported fewer dog bite cases in 2020 and Mumbai city in India which reported a 50% reduction in dog bite cases in 2020[6,7,16]. The lowest case of dog bite was reported in the month of August 2020, when the country imposed nationwide lockdown. The year 2020 had many restrictions in place like lockdowns, closure of schools, movement of individuals to which the exposure was less compared to previous years resulting in lesser cases of dog bites[12,14,15]. The cases of dog bites were higher in the year 2019 compared with developed countries like United Kingdom (18.7/1000/year) and developing countries like India (25.2/1000/year)[3,17]. This higher incidence of dog bites may be associated with a huge dog population in Thimphu which was around 13000 dogs in 2020[3, 5].

Profile of the patients and comparison between pre-pandemic and pandemic years (2019 & 2020)

It was observed that more cases of dog bites were reported in males, amongst which post-school and working age groups (20-59) were affected most. However, earlier studies reported the pre-school and school-going age (<18 years) being affected more with male predominance[9,18,19]. The mean age of bites in both years was similar with 26.81 in 2019 and 27.69 in 2020 with a median age of 25 years in both years which is comparable to the mean age of 28.9 years reported in the United States[20]. The occupation categorized as "other" had the highest dog bite cases in both the years and it may be because the group comprised of many occupations. The students were the second most affected group in this study contrary to other studies, where students were reported to be more vulnerable to dog bites[9,18,19]. In both the years, the lower limbs were the most common site of dog bites contrary to the data analysis of the United States which reported the upper extremity as the most common anatomical site[20]. This may be because the dog bite cases are mostly by stray dogs in Bhutan and the lower limbs are the most accessible anatomical sites for dog bites, whereas, the dog bites in developed countries like the US are from domestic dogs resulting from dog handling.

We observed that most of the dog bites in both years had minor risk exposure (category II) comparable to a study in Pakistan which reported higher category II bites[21]. This study found that category I risk exposures were 4% and 3% in 2019 and 2020 respectively and those groups of patients received anti-rabies vaccines. The National guideline on management of human rabies highlights that category I exposure poses no risk of rabies and the patient need not receive an anti-rabies vaccine[22]. However, considering the 100% fatality when infected with the rabies virus, correct risk exposure analysis is important for clinicians to prescribe the anti-rabies vaccine.

In the risk factor category, study found out that compared to previous year, April and August month had less dog bite cases and this was statistically significant at *p*-value of less than 0.01. Although month did not show statistically significant association in univariate analysis, considered it as a continuous variable based on apriori knowledge for multivariate analysis. The study saw that being indoors was a significant protective factor for dog bite. This happened when Bhutan detected first COVID-19 case in March 2020, and because of the fear of contacting the disease, people avoided being outdoors frequently. Similarly, there was a nationwide lockdown in August which greatly reduced outdoor presence of people. On the other hand, the schools were closed, so compared to the smaller age groups or even the elderly, the age group of 20-59 had statistically significant risk of getting bitten by dog in 2020, likely because they had to continue going for work.

CONCLUSIONS

The National Referral Hospital treated almost half of the dog bite cases reported in the country in the years 2019 and 2020. The proportion of dog bites reported in 2020 and 2019 were 2.4% and 3.3% respectively which means 24/1000/year in 2020 and 33/1000/year in 2019 in Thimphu city. The post-school and working-age group of 20 – 59 years were most vulnerable to dog bites. Stray dogs were causative factors for the majority of the dog bite cases in both years despite people being indoors. The fact that individuals being indoors significantly reduced the cases of dog bites, there is urgent need for safety measures on the streets. Thus, high incidence of dog bite in the country is a major concern and calls for pressing measures to control the situation.

LIMITATIONS AND RECOMMENDATIONS

Since this study was a retrospective review of documented data, there were many missing data, that could have been improved by the prospective design of the study. Other health centers of Thimphu city were not included in the study and they accounted for less than 10% (4.4% in 2019 and 9.8% in 2020) dog bites. Future studies can focus on nationally representative samples to see the pattern and trend of dog bites cases in Bhutan.

ACKNOWLEDGEMENTS

Authors acknowledge the valuable contributions of the staff of the injection unit of JDWNRH, Thimphu

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AUTHORS CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

CLA: Concept, design, data collection and analysis, manuscript writing and review.

LMA: Concept, design, data collection and analysis, manuscript writing and review

SP: Concept, design, data collection, manuscript review

Author agree to be accountable for all respects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

None

GRANT SUPPORT AND FINANCIAL DISCLOSURE

None