

## ORIGINAL RESEARCH ARTICLE

# Rabies in Greater Guwahati - A Five-Year Retrospective Study

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### ABSTRACT

Rabies is a dreadful and lethal zoonotic disease, commonly transmitted by dogs. To assess the incidence of dog-mediated rabies, a five-year retrospective study was undertaken in two major government hospitals in Greater Guwahati during 2013-2017. The cumulative incidence of dog-bite cases during the period was 33,778 with 27,195 in the GMCH and 6,583 in the MMCH. The month-wise incidence was highest during July (2,469; 9.08%) in the former, and during May (938; 14.25%) in the latter. Gender-wise, men (22,730; 67.3%) were two-fold susceptible than women (11,048; 32.7%). There was a higher influx of patients in the GMCH (80.5%) than in the MMCH (19.5%) but the proportion of male and female in both the hospitals were equivalent (GMCH: 67.1% M, 32.9% F; MMCH: 67.3% M, 32.7% F). The average age of the bite victims in the GMCH and MMCH were 27.99 (SD 15.907) and 28.74 (SD 16.802), respectively. Incidence of dog-bite cases showed an increased trend from 4787 to 6064 during the period. Clinical rabies cases reported in the GMCH during the period ranged from 0.2-0.5 per cent with highest mortality in the year 2014. While there was an incline in reporting of bite cases in both the hospitals, there was a decline in clinical rabies cases, attributed to an increased awareness about the importance of PEP and the availability of free anti-rabies vaccination facility at the government hospitals.

**Key words:** Dog-mediated rabies, retrospective study, dog-bite, mortality, Greater Guwahati

### INTRODUCTION

Rabies is one of the oldest and the most important diseases afflicting humankind since time immemorial, which finds mention in the ancient scriptures of Mesopotamian civilization, Vedas (1500-500 BCE) and the Old Testament. It is a very dreadful and lethal zoonotic disease commonly transmitted by the 'man's best friend' – dog (*Canis lupus familiaris*) via bite, licks or scratches. Dogs and man have evolved together through generations, the latter being dependent on the former on a number of counts.

Rabies has been recognized for millennia in India, long before Aristotle recognized the disease during the Greco-Roman era (c. f. Suraweera et al., 2012). The ancient Vedic text 'Sushruta Samhita' contains graphic descriptions of rabies in animals and humans. "If the patient becomes exceedingly frightened at the sight or mention of the very name of water, he should be understood to have been afflicted with Jala-trasa (hydrophobia) and be deemed to have been doomed (c. f. Suraweera et al. 2012). Invariably, rabies has been the most dreaded disease of human and animals, possibly the most lethal of all infectious diseases without a cure.

Rabies is caused by Rabies virus under the genus *Lyssavirus* in the family *Rhabdoviridae* (Murphy, 1999). The oddity of this disease is that it causes minimal target damage but lethal neurologic dysfunction. Most importantly, the virions multiply in the

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salivary glands and are released in high concentration into the saliva. Thus, at the time when viral replication within the central nervous system causes the infected animal to become furious and bite indiscriminately, the saliva is highly infectious (Murphy et al., 1999).

Rabies is primarily a disease of warm blooded animals. Of all biting animals, dogs have been identified as a major source of rabies transmission to livestock as well as human beings (WHO-APCRICON, 2004; WHO, 2005, Sudarshan et al. 2007). In India, dogs have been and still are the main reservoir of rabies (Sudarshan et al. 2007; Menezes, 2008).

Louis Pasteur developed the anti-rabies vaccine by emulsifying the brain and spinal cord of rabbits died of rabies and tested its efficacy in dogs. He later on not only vaccinated dogs but also applied on a number of people against much bitter opposition and criticism from his colleagues (Baldry, 1976) thereby beginning a modern era of preventing infectious diseases by vaccination (Murphy et al., 1999). The first successful vaccination was done on Joseph Meister of Alsace, a boy aged 9 on July 6, 1885 and the second case treated by Pasteur was that of Jean Baptiste Jupille, a fifteen-year-old shepherd. These two dramatic recoveries drew the attention of people subsequently, and over 20,000 people had received the vaccine following exposure to rabid/ rabies-suspected dogs (O'Niell, 2017). An English Commission was set up in 1888 that approved the validity of Pasteur's claim and thus the post-exposure prophylaxis against rabies became vogue (Baldry, 1976).

Post-exposure prophylactic vaccine has undergone a sea change since the time of Pasteur (Wilde, 1997). The WHO guideline currently stipulates that a course of five intra-muscular injections on 0, 3, 7, 14 and 28th day post-exposure ensured a hundred per cent protection against rabies both in animals and man (Anon, 2018).

The latest WHO recommendations for rabies immunization supersede the WHO, 2010 position on pre-exposure (PrEP) and post-exposure prophylaxis (PEP) for rabies. In October, 2017, the Strategic Advisory Group of Experts on rabies immunization (SAGE) endorsed: (i) dog vaccination to interrupt virus transmission to humans; and (ii) human vaccination as a series of vaccine administrations before an exposure or following an exposure. The WHO recommended that category II and III should receive PEP without delay.

#### **As per the new WHO recommendations, PEP consists of the following steps:**

- All bite wounds and scratches should be attended to as soon as possible after the exposure; thorough washing and flushing of the wound for approximately 15 minutes, with soap and water, is required. Where available, an iodine-containing, or similar virucidal, topical preparation should be applied to the wound.
- RIG should be administered for severe category III exposures. Wounds that require suturing should be sutured loosely and only after RIG infiltration into the wound.
- A series of rabies vaccine injections should be administered promptly after an exposure.

The WHO stipulates that human rabies immunoglobulin (HRIG) should be infiltrated around the site of bite as it provides rapid passive immune response. It also cautions that HRIG should not be given more than the recommended dose as it can partially suppress active production of antibody. It is advised that patients who have been previously vaccinated should not receive HRIG.

In a year-long epidemiological study, Chhabra et al., (2004) analyzed the human rabies cases admitted in the Infectious Diseases Hospital, Delhi and observed that 49.8 per cent of the cases came from Delhi and the rest belonged to the adjoining states of Uttar Pradesh (30.3%), Haryana (18.3%), Bihar (0.8%), Punjab (0.4%) and Madhya Pradesh (0.4%). Trivedi et al., (2015), reported that animal bite, especially dog bite continued to be a public health problem affecting urban males involved in outdoor activities as the study showed that out of the 406 victims, 76.3 per cent were males of productive age group.

During January-December, 2015, 5,312 victims attended the anti-rabies clinic in Mandya Institute of Medical Sciences, Karnataka, of which 78.3 per cent cases reported category III exposures. Only 24.1 per cent cases received immunoglobulin (Achuta et al. 2016). Wilde (1997) further stated that post-exposure treatment was not affordable by majority of the population in developing countries. They received no or incomplete treatment, occasionally with spurious vaccine products.

#### **HYPOTHESIS:**

There may be incidence of dog-bite cases in and around Guwahati. Knowing the number of dog-bite cases might be helpful to plan new strategies for policy makers, medics and veterinarians. Keeping in mind the necessity of coexistence, study on dog-bite incidence is useful in order to prevent the spread of rabies in the days to come.

#### **OBJECTIVES:**

**Retrospective data analysis of:**

- i. The incidence of dog-bite cases reported to the government hospitals, namely the Gauhati Medical College & Hospital (GMCH) and Mahendra Mohan Choudhury Hospital (MMCH).
- ii. Reported/recorded rabies mortality cases in the GMCH during 2013-2017.

## I. MATERIALS AND METHOD

### ETHICAL STATEMENT

The study was conducted after approval from Institutional Animal Ethics Committee (IAEC), AAU, Khanapara, vide Approval No.770/ac/CPCSEA/FVSc/AAU/ IAEC/17-18/526 Dated 09.08.2017

A written and informed consent was taken from the participants as per Indian Council of Medical Research (ICMR) ethical guidelines for biomedical research on human subjects and used the collected data for the study maintaining anonymity of the respondents.

### LOCATION OF WORK

The study was carried out under the Department of Veterinary Epidemiology & Preventive Medicine, College of Veterinary Science (CVSc), Assam Agricultural University (AAU), Khanapara, Guwahati - 781 022, in collaboration with:

- a) Department of Livestock Production & Management (Statistics and Data Analysis), CVSc, AAU, Khanapara, Guwahati-781 022
- b) Gauhati Medical College & Hospital (GMCH), and
- c) Mahendra Mohan Choudhury Hospital (MMCH)

### RESEARCH QUESTION

1. Are there any reported case(s) of dog-bite injury in Guwahati?
2. Is there any incidence of dog-mediated rabies cases in Greater Guwahati?

### SAMPLING STRATEGY

Data for the past five years (2013-2017) on dog-bite cases were collected from the Gauhati Medical College & Hospital (GMCH), Mahendra Mohan Choudhury Hospital (MMCH) as well as the reported clinical rabies cases from the GMCH for retrospective data analysis.

### STATISTICAL ANALYSIS PLAN

The collected data were fed in MS-Excel which served as the master table for the said study. Appropriate statistical analysis was done using software JMP 10 of SAS 9.3 (SAS Inc.) available at the Statistics and Data Analysis Unit in the Department of Livestock Production and Management, College of Veterinary Science, Khanapara, Guwahati – 781 022.

## II. EXPERIMENTAL FINDINGS

### DOG-BITE CASES REPORTED TO GMCH AND MMCH DURING 2013-2017: A RETROSPECTIVE ANALYSIS

On secondary data analysis, it was found that a total of 33,778 dog-bite cases were reported in the GMCH and MMCH during 2013-2017. In both the hospitals the highest bite cases reported were during the year 2016 followed by 2017. Whereas, the GMCH saw a higher reporting in the year 2015 (5266), the MMCH saw a higher reporting in 2014 (1620) (Table 1).

**Table 1: Frequency of dog-bite cases presented to the GMCH and MMCH (2013-17)**

			Hospitals		Total
			GMCH	MMCH	
Year	2013	Count	4787	43	4830
		% within Year	99.1	0.9	100.0
		% within Hospital	17.6	0.7	14.3
	2014	Count	4819	1620	6439
		% within Year	74.8	25.2	100.0
		% within Hospital	17.7	24.6	19.1
	2015	Count	5266	54	5320
		% within Year	99.0	1.0	100.0
		% within Hospital	19.4	0.8	15.7

			Hospitals		Total
			GMCH	MMCH	
Year	2016	Count	6259	2774	9033
		% within Year	69.3	30.7	100.0
		% within Hospital	23.0	42.1	26.7
	2017	Count	6064	2092	8156
		% within Year	74.4	25.6	100.0
		% within Hospital	22.3	31.8	24.1
Total	Count	27195	6583	33778	
	% within Year	80.5	19.5	100.0	
	% within Hospital	100.0	100.0	100.0	

A total 27,195 and 6583 bite cases were presented to the GMCH and to MMCH, respectively during the study period 2013-17.

**Table 2: Frequency of bite cases month-wise in gmch and mmch (2013-17)**

Month * Year * Hospital Cross-tabulation								
Hospital		Year					Total	
		2013	2014	2015	2016	2017		
GMCH	Month	January	458	402	447	405	565	2277
		February	408	334	348	439	408	1937
		March	591	354	436	546	508	2435
		April	408	391	415	554	450	2218
		May	403	487	481	497	545	2413
		June	372	342	520	466	492	2192
		July	380	452	459	602	576	2469
		August	417	368	455	566	519	2325
		September	363	419	510	485	583	2360
		October	303	394	396	524	512	2129
		November	316	422	384	490	476	2088
		December	368	454	415	685	430	2352
		Total		4787	4819	5266	6259	6064
MMCH	Month	January	0	0	54	0	0	54
		February	0	0	0	109	0	109
		March	0	82	0	335	303	720
		April	0	269	0	320	330	919
		May	0	136	0	411	391	938
		June	0	287	0	264	355	906
		July	0	132	0	13	410	555
		August	0	292	0	327	303	922
		September	0	283	0	345	0	628
		October	43	54	0	355	0	452
		November	0	60	0	295	0	355
		December	0	25	0	0	0	25
		Total		43	1620	54	2774	2092
Total	Month	January	458	402	501	405	565	2331
		February	408	334	348	548	408	2046
		March	591	436	436	881	811	3155
		April	408	660	415	874	780	3137
		May	403	623	481	908	936	3351
		June	372	629	520	730	847	3098
		July	380	584	459	615	986	3024
		August	417	660	455	893	822	3247
		September	363	702	510	830	583	2988
		October	346	448	396	879	512	2581
		November	316	482	384	785	476	2443
		December	368	479	415	685	430	2377
		Total		4830	6439	5320	9033	8156

The monthly reporting revealed that the average dog-bite cases in the GMCH were the highest in the months of July (2469) followed by March (2435) and May (2413), while in the MMCH it was in the months of May (938) followed by August (922) and April (919).

Table 2 depicts a clear picture of dog-bite cases reported to both the hospitals month-wise and year-wise. "0" (Zero) for the months and years represented that data were not available from the MMCH.

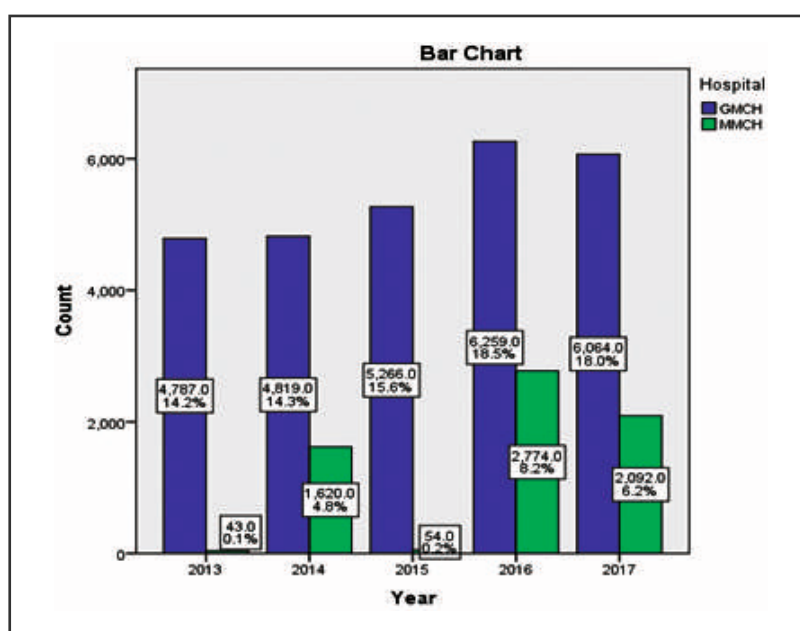
**Table 3: Frequency of dog-bite cases gender-wise in GMCH and MMCH (2013-17)**

Year	Gender	Hospitals		Total
		GMCH	MMCH	
2013	F	1546	8	1554
	M	3241	35	3276
	Total	4787	43	4830
2014	F	1537	468	2005
	M	3282	1152	4434
	Total	4819	1620	6439
2015	F	1716	14	1730
	M	3550	40	3590
	Total	5266	54	5320
2016	F	2124	885	3009
	M	4135	1889	6024
	Total	6259	2774	9033
2017	F	2012	738	2750
	M	4052	1354	5406
	Total	6064	2092	8156
<b>Total</b>		<b>27195</b>	<b>6583</b>	<b>33778</b>

The highest incidence of dog-bite cases were reported in 2016 in both the hospitals. There were 2,124 female and 4,135 male cases in GMCH, whereas, 885 female and 1,889 male cases in MMCH (Table 3). Gender susceptibility showed that males had almost a two-fold higher exposure to dog-bites than females.

Figure 1 shows year-wise bite cases presented to GMCH and MMCH, 2013: 14.2 and 0.1 per cent; 2014: 14.3 and 4.8 per cent; 2015: 15.6 and 0.2 per cent, 2016: 18.5 and 8.2 per cent and in 2017: 18.0 and 6.2 per cent, respectively.

**Fig 1: Number and percentage of victims presented to GMCH and MMCH (2013-17)**



**Table 4: gender-based frequency of dog-bite cases in GMCH and MMCH (2013-17)**

Gender * Hospital Cross-tabulation					
			Hospitals		Total
			GMCH	MMCH	
Year	F	Count	8935	2113	11048
		% within Year	80.9	19.1	100.0
		% within Hospital	32.9	32.1	32.7
	M	Count	18260	4470	22730
		% within Year	80.3	19.7	100.0
		% within Hospital	67.1	67.9	67.3
Total		Count	27195	6583	33778
		% within Year	80.5	19.5	100.0
		% within Hospital	100.0	100.0	100.0

Chi sq= 1.38 df=1, P=. 240 NS

Table 4 shows the frequency of male and female cases during the course of 5 years (2013-17). There were 8,935 (32.9%) and 2,113 (32.7%) females, and 18,260 (67.1%) and 4,470 (67.3%) males in the GMCH and MMCH, respectively. Although the cases presented to the GMCH (80.5%) were four-fold higher than that of the MMCH (19.5%), the proportion of female and male cases in both the hospitals were equivalent.

Figure 2 depicts a higher influx of dog-bite patients in the GMCH (26.45% F and 54.06% M) than in the MMCH (6.26% F and 13.23% M). However, the gender-wise proportions of dog-bite cases in the two hospitals were equivalent (Table 4).

The figure 3, depicts the average age of dog-bitten patients presented to the GMCH (n=27,192) and MMCH (n=6,583) were 27.99 and 28.74 with SD of 15.907 and 16.802, respectively.

**Fig 2: Frequency of female and male cases in GMCH and MMCH (2013-17)**

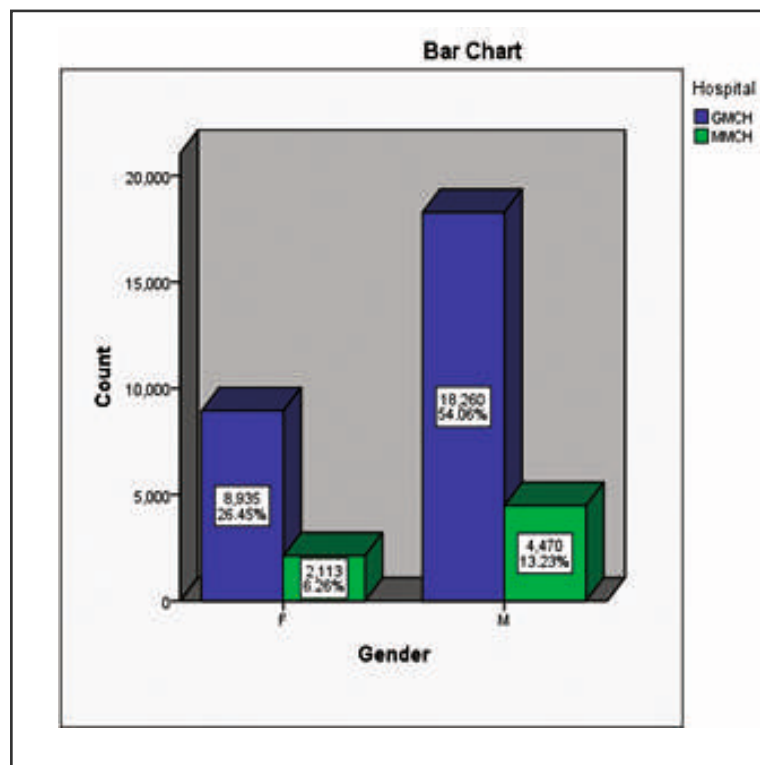


Fig 3: Average age of dog-bite patients presented to (A) GMCH and (B) MMCH

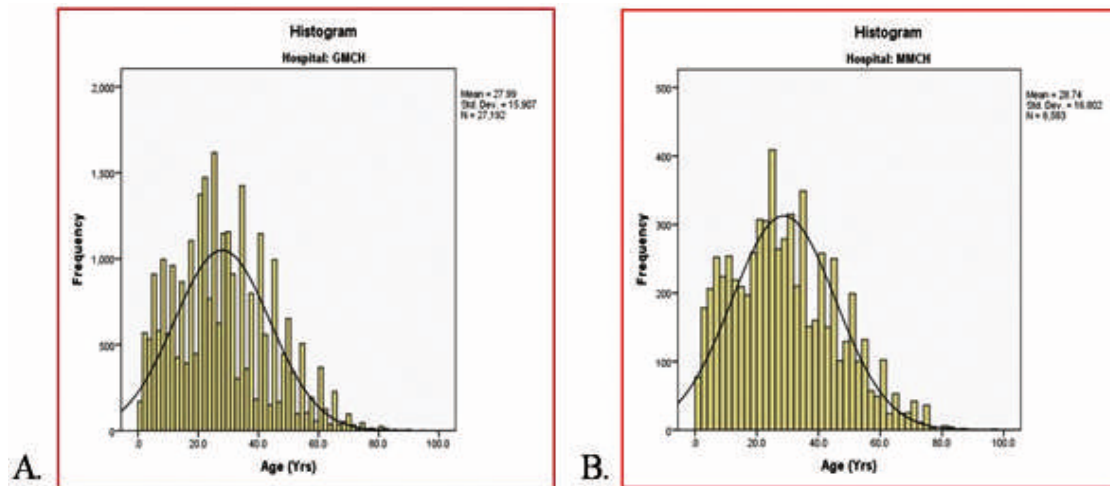
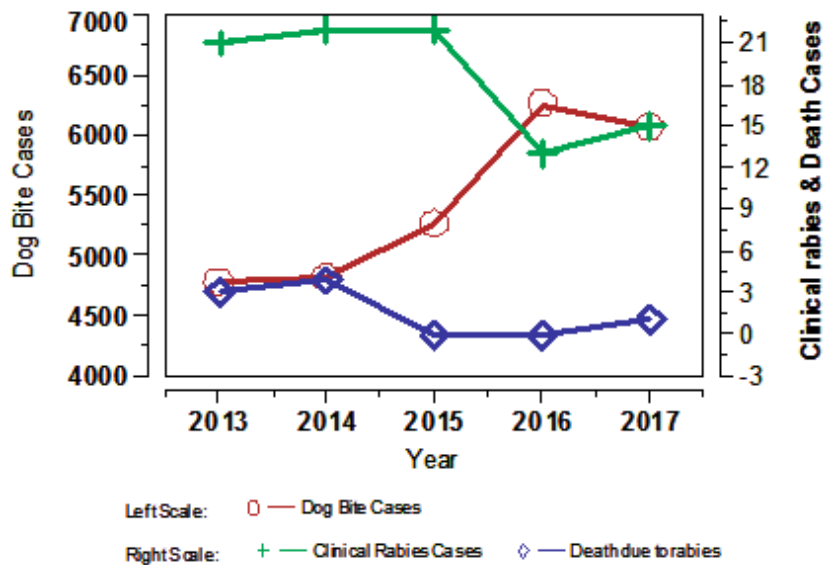


Table 5: Incidence of dog-bite cases with morb-mort percentage of rabies in GMCH (2013-17)

Year	Dog-bite cases	Reported clinical rabies cases	Reported death due to rabies
2013	4787	21 (0.4%)	3 (14.3%)
2014	4819	22 (0.5%)	4 (18.2%)
2015	5266	22 (0.5%)	0 (0.0%)
2016	6259	13 (0.2%)	0 (0.0%)
2017	6064	15 (0.2%)	1 (6.7%)

Table 5 and figure 4 shows the incidence of dog-bite cases with morbidity and mortality due to rabies in the GMCH for the period revealing an increasing trend (4787 to 6064). The morbidity was lowest in 2016 (0.2%) and 2017 (0.2%) and highest in 2014 (0.5%) and 2015 (0.5%). On the contrary the highest reported mortality was in 2014 (18.2%) followed by 2013 (14.3%) and 2017 (6.7%). There were no mortality reported during 2015 and 2016.

Fig 4: Dog-bite cases, clinical rabies cases and rabies deaths during 2013-2017 in GMCH



## DISCUSSION

A total of 33,778 dog-bite cases were recorded in the GMCH (27,195; 80.5%) and MMCH (6,583; 19.5%) during 2013-2017 (Table 1). Data not available from the MMCH during certain months are represented as '0' (Zero) cases (Table 2). Although many workers (Trivedi et al., 2015; Subhathra et al., 2016; Achuta et al., 2016; Thomas et al., 2016; Alalageri et al., 2016; Sindh, 2017) reported different levels of dog-bite incidences, the present finding is in agreement with Williams (2018) reporting 4.5 million cases annually.

The retrospective study of dog-bite cases in man during 2013-2017 revealed the highest dog-bite cases in 2016 in the GMCH (6259) and MMCH (2774). The dog-bite cases in man in that year might be attributed to a series of floods that started in July 2016 which was 60 percent heavier than the previous years, and affected more than 1.6 million human lives. People abandoned their homes and livestock and ran for safe shelter. The floods also affected the Pobitora Wildlife Sanctuary and Kaziranga National Park where around 300 wild animals were reported to have drowned (Anon, 2016). The rise in dog-bite cases might be implicated to the inundated fringe areas and submerged cultivation fields, resulting in loss or disturbance of the habitat of wild canidae (foxes and jackals) compelling them to encroach human settlement for survival. The free-roaming community-dogs in such areas might have come in contact with the displaced canidae while protecting their territory and such dogs in turn got bitten and most likely turned rabid and attacked other animals including livestock and human in the locality.

Gender-wise, the GMCH and MMCH received 80.5% and 19.5% cases, respectively during the period. Interestingly, the female-male proportion in both the hospitals were equivalent, viz. 8,935 (32.9%) and 2,113 (32.7%) female, and 18,260 (67.1%) and 4,470 (67.3%) were male, respectively (Table 3-4, figure 4.4-4.5). Evidently, there was a gender bias that concurred the findings of Sudarshan (2005), Trivedi et al., (2015), Gayatri (2016), Gaikwad and Mangulikar (2016), Kagne et al. (2016), Jamir (2016), Thomas et al. (2016) and Vaisakh et al. (2016).

Due to their occupational demand and outdoor activities, male members are more prone and have relatively a higher exposure to free-roaming dogs unlike most women. On the other hand, the average age of the patients presented to the GMCH and MMCH were almost equivalent viz. 27.99 years and 28.74 years, respectively (figure 4.6), in contrast to Sudarshan (2005), that most dog-bite victims were children. The males in the late twenties usually are the most productive age group in the society requiring them to venture outdoors depending on the occupation. Due to lack of uniformity in data the frequency of dog-bite and occupation could not be analyzed in the present study. Nonetheless, age and bite-susceptibility corroborated Sudarshan et al. (2006) who recorded a majority of the patients to be males, adults (71%), hailing from rural areas and were unvaccinated. The findings also corresponded to Hatam et al. (2013) who showed that mostly males (75.9%) were the victims and the average age was 25-29 (13.99%).

The data acquired from the GMCH revealed that there were 4738 (2013), 4819 (2014), 5266 (2015), 6259 (2016) and 6064 (2017) bite cases. Out of these, there were 21 (0.4%), 22 (0.5%), 22 (0.5%), 13 (0.2%) and 15 (0.2%) clinical rabies cases, correspondingly, admitted in the hospital. However, mortality reported during the period were 3 (14.3%), 4 (18.2%), 0 (0.0%), 0 (0.0%) and 1 (6.7%) (Table 5, figure 4). Clinical rabies being one hundred per cent fatal, the discrepancy in the mortality report is attributed to either shifting of the patients to other health care centers, or was discharged from the hospital considering the prognosis. Patients who left against medical advice (LAMA) is also attributable to the skewed mortality report in the present study.

The difference in the reported morbidity and mortality might be attributed to the role of the family members of the patients taken home in the terminal stages. Some also took the patients home due to high hospital charges realizing that the outcome will be grave even though the patient was being given supportive treatment till the end. In some cases the hospital advised the family members to take the patients home due to inadequate treatment facilities during the final stages of the disease (Sudarshan et al., 2006) where the total mortality did not add up to the total rabies morbidity and the difference was placed under LAMA (left against medical advice).

In the present study, there was an incline in the reporting of bite cases in both the hospitals, whilst a decline in the clinical rabies cases. This might be due to an increased awareness about the importance of PEP and the availability of free anti-rabies vaccination at the government hospitals. In most cases, people belonging to the lower economic strata were the victims of dog-bites due to the demand of occupation. Similar observations were made by Arvind, 2016 and Achuta et al., 2016.

India reports the highest casualty due rabies globally, complicated by absence of organized surveillance system, both in animals and man. The morbidity and mortality due to rabid dog-bite could not be ascertained from the GMCH and MMCH in the current study owing to various factors chiefly, unorganized maintenance of records. Menezes (2008) observed that facilities for the surveillance and diagnosis of animal rabies must be improved in quality and offer wider coverage, besides human rabies be made a mandatory reportable disease similar to the initiative taken by Government of Sikkim (Byrnes et al., 2017).



## CONCLUSIONS

1. Historical data for 5 years (2013-2017) from the GMCH and MMCH revealed that there were a total of 27,195 and 6,583 human dog-bite victims, respectively.
2. Most dog-bite cases occurred in the year 2016.
3. Male gender was mostly affected.
4. Owing to absence of standardized data recording and record-keeping system in both the hospitals, the actual number of rabid dog-bite cases, and morbidity and mortality could not be ascertained from the data obtained in the present study.
5. The retrospective analysis was done from the available data of reported cases in the GMCH and MMCH for the five year period. This is likely to be an underestimate.

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