

A Multicentric Community Survey on Animal Exposures among Humans in India

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Abstract:

Background: Rabies is a 100% fatal disease. There are inadequate data on animal exposures and rabies postexposure prophylaxis (PEP) from community-based field surveys in India. **Objectives:** The main objective of the study is to estimate the incidence of animal exposures (bite, scratch, or lick) in the study population and to describe the rabies PEP among the cases. **Methods:** A descriptive survey was conducted in seven states of India between July and November, 2017. In each state, multistage sampling methodology was followed for selection of district, taluka/tehsil, block, and clusters within the block. The primary sampling unit was a household (HH). A case was a patient with animal exposure (bite, scratch, or lick) in the last 1 year from the date of survey. The animal exposure was categorized based on the WHO guidelines (Category-I, Category-II, and Category-III). The patients with the history of multiple animal exposures any time during the survey period was considered as a single case. **Results:** A total of 1012 HHs were surveyed covering a population of 4294. 3016 (70.2%) participants were from rural settings and 1278 (29.8%) were living in urban settings. 2181 (50.8%) participants were male and 2113 (49.2%) were female. The annual incidence of animal exposure was 1.26% (confidence interval [CI]: 0.93%–1.59%). The annual incidence in urban setting was 1.33% (0.70 - 1.96) and rural settings were 1.23% (CI: 0.84 - 1.62). Majority (68.5%) of the cases were from rural settings, 61.2% of the cases were in the age group of 15–60 years. Among the 43 cases who had received PEP, 21 had Category-II exposures, of whom 66.7% had completed vaccination with either five doses intramuscular or four doses intradermal route. Similarly, 22 had Category-III exposures and only 4 (18.2%) cases had received rabies immunoglobulin and completed rabies vaccination. Six (11.1%) cases did not receive PEP. There was no report of human rabies case. **Conclusion:** The incidence of animal exposure was 1.26%. Rabies PEP in the cases was not satisfactory.

Key words: Animal exposure, human rabies, India, postexposure prophylaxis

INTRODUCTION

Rabies is an acute progressive encephalitis caused by RNA viruses in the Genus *Lyssavirus*. The major global reservoir is the dog. Rabies has a case fatality ratio approaching 100%, the highest of any conventional infectious disease.^[1] An estimated 20,000 human rabies death and 17.4 million animal bites were reported from India in 2004.^[2]

Surveillance for human and animal rabies has been inadequate throughout the world, which has contributed to minimal awareness, public health prioritization, and resource allocation for rabies prevention and control.^[3-7] The WHO states that information on the frequency of animal bite cases associated with dog/animal bite injuries are needed for more effective risk modeling assessments and inform about strategies for rabies prevention and control.^[6] Domestic dogs

are the principal reservoir and vector of rabies. There has been no systematic evaluation of animal bites in the entire country.

A lot of changes have taken place since the Indian Rabies Survey of 2004, such as availability of modern rabies postexposure prophylaxis (PEP), introduction of intradermal rabies vaccination, withdrawal of nerve tissue vaccines, Animal Birth Control Programme, and implementation of National Rabies Control Programme. More and more people have access to modern rabies PEP (rabies immunoglobulin [RIG] and rabies vaccination).

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By evaluating the health-seeking practices of persons exposed to dog/animal bites, we hope to discover possible weaknesses in rabies PEP in local communities. The availability of medical care personnel, facilities, and appropriate medicines for PEP administration can also be known. This data will be used to develop effective risk communication materials.

In this background, an estimation on the dog/animal bite injuries in selected states of India was done with the objectives, to estimate the incidence of animal exposure (Bite, scratch or lick) in the study population along with coverage of rabies PEP among them.

MATERIALS AND METHODS

A descriptive epidemiological study was conducted across seven representative states (Himachal Pradesh, Bihar, West Bengal, Manipur, Kerala, Madhya Pradesh, and Gujarat) in India between July and November, 2017. In each state, multistage sampling methodology was followed for selection of district, taluka/tehsil, block, and clusters within the block. The primary sampling unit was a household (HH). The Census of India, 2011 database was used as sampling frame for clusters selection and clusters were defined as villages for rural areas and wards for urban areas.^[8]

Sample size calculation

The incidence of animal/dog bites was considered to be around 0.9%.^[9] Precision taken was 0.4%.^[6,9] Design effect considered for the study was 2. The final sample size was 4282 persons. Assuming a nonresponse rate of about 15%, net sample size calculated was 4924 persons. The number of individuals in

each state = 4924/7 states = 703 persons/state. The number of HHs to be surveyed in each state (703/5) = 141 HH (average of 5 persons per HH) and number of HHs to be surveyed in each cluster = 141 HH/6 cluster = 24 HH per cluster.

Random numbers were generated using the “Randbetween” function of Microsoft Excel software for selecting one district within the state, one taluka/tehsil, or block within the selected district and within each block, a minimum of 6 clusters were selected randomly. The number of rural and urban clusters selected was based on the rural–urban demography of that particular state (probability proportional to size sampling).

Selection of households for community survey

The WHO-EPI cluster evaluation survey methodology was followed.^[10] The teams surveyed every adjacent HH in a counting series along mapped routes until 24 HHs per cluster were covered. The head of HH was the preferred respondent, but any adult responsible respondent living in the HH, female or male, was also considered as an alternative. Inclusion criteria consisted of: (i) respondent should have been a resident of the HH for a minimum of 6 months in the last 1 year and (ii) respondents who gave informed consent for participation.

Data collection

Data were collected by a community survey team from the respective states. The faculty of the Department of Community Medicine of a Medical College situated in the selected district or the nearest Medical College in the neighboring district within the state formed the community survey team. The surveyors in selected states were trained for 1 day on the survey methodology. Surveyors conducting fieldwork used a handheld

Table 1: Sociodemographic characteristics of the cases (n=4294)

Characteristics	Details	Urban (n=1278), n (%)	Rural (n=3016), n (%)	Total (n=4294), n (%)
Total number of cases		17 (1.33)	37 (1.23)	54 (1.26)
Age (years)	≤14 (children)	4/256 (1.56)	13/704 (1.84)	17/960 (1.77)
	15-60	13/919 (1.41)	20/2066 (0.96)	33/2985 (1.10)
	>60	-/103	4/246 (1.62)	4/349 (1.14)
Gender	Male	9/645 (1.39)	28/1537 (1.82)	37/2182 (1.69)
	Female	8/633 (1.26)	9/1479 (0.61)	17/2112 (0.80)
Religion	Hindu	10/780 (1.28)	29/2266 (1.28)	39/3046 (1.28)
	Christian	7/307 (2.28)	5/524 (0.95)	12/831 (1.44)
	Muslim	-/191	3/226 (1.33)	3/417 (0.72)
Education	Illiterate	1/176 (0.57)	9/828 (1.09)	10/1004 (0.99)
	Primary/middle/high school/preuniversity college	13/831 (1.56)	25/1891 (1.32)	38/2722 (1.39)
	Degree/diploma/postgraduation	3/271 (1.11)	3/297 (1.01)	6/568 (1.06)
Occupation	Cultivator/laborer (agricultural/nonagricultural)	4/62 (6.45)	10/674 (1.48)	14/736 (1.90)
	Salaried employment/business	5/386 (1.29)	6/483 (1.24)	11/869 (1.27)
	Housework	3/356 (0.84)	5/835 (0.59)	8/1191 (0.67)
	Unemployed	-/98	2/126 (1.59)	2/224 (0.89)
	Student	5/376 (1.33)	14/898 (1.56)	19/1274 (1.49)
Marital Status	Currently married	10/712 (1.40)	21/1666 (1.26)	31/2378 (1.30)
	Never married	6/496 (1.21)	16/1211 (1.32)	22/1707 (1.29)
	Divorced/separated/widowed	1/70 (1.43)	-/139	1/209 (0.48)

personal digital assistance/device (PDA) that included a GPS receiver or a smartphone (Android) and software application specially developed by WHO India office, New Delhi, for the survey.

The study tool consisted of details on sociodemographic characteristics of populations surveyed. A case was a subject with animal exposure (bite, scratch, or lick) in the last 1 year from the date of survey. The animal exposure was categorized based on the WHO guidelines (Category-I, Category-II, and Category-III). The patients with the history of multiple animal exposures any time during the survey period was considered as a single case. Rabies PEP consisted of wound wash, administration of RIG, and rabies vaccination. Suspect, probable, and confirmed rabid animal bites were classified as per the WHO guidelines.^[11] Bites from dogs, cat, cow, and monkeys were considered as domestic animal bites; bites from fox and jackal were considered as wild animal bites.

Information was collected from the respondents of the surveyed population on any deaths due to rabies that they may have come across as an additional information and was not part of the main study. A case presenting with one or more than one of the following symptoms: hydrophobia, aerophobia, and photophobia during the study period of 1 year was defined as human rabies case for the purpose of the survey.

Statistical analysis

Data were entered into the PDA at the place of data collection using the digital platform developed for the study. The excel sheet was imported from the digital platform and analyzed. Appropriate descriptive statistics, such as frequencies and proportions were generated.

Ethical aspects

Ethics committee reference number and date of approval was KIMS/IEC/S15-2016. Informed signed consent (or thumb impression from the illiterates with witness) was obtained from all respondents. Confidentiality of the data was maintained.

RESULTS

A total of 1012 HHs were surveyed covering a population of 4294. 3016 (70.2%) persons were from rural settings and 1278 (29.8%) were living in urban settings. The median age with interquartile range was 30 (16,45) years. 2181 (50.8%) persons were male and 2113 (49.2%) were female.

Animal exposure incidence

The annual incidence of animal exposure was 1.26% (confidence interval [CI]: 0.93%–1.59%), i.e., 54 cases out of 4294 population surveyed. The annual incidence in urban and rural settings were 1.33% (CI: 0.70 - 1.96), i.e., 17 cases out of 1278 and 1.23% (CI: 0.84 - 1.62), i.e., 37 cases out of 3016, respectively [Table 1].

Sociodemographic characteristic of the cases

Among the 54 cases, majority (37 [68.5%]) of the cases were from rural settings. 61.2% cases were in the age group of

15–60 years. The youngest case was 3 years old and oldest case was 82 years old. The median age with interquartile range of the cases was 35 (12, 48) years. 72.2% cases were Hindu by religion, 70.4% cases were school and preuniversity educated, 25.9% cases were laborer (agricultural/nonagricultural) by occupation, and 19 (35.2%) cases were students [Table 1]. The median income with interquartile range was Rs. 78,000 (1217\$) (Rs. 32,250–Rs. 240,000). The minimum and maximum income of the cases was Rs. 5000 (78\$) and Rs. 500,000 (7808\$) per annum.

Cases exposure details

Out of the 54 cases, 59.3% exposures had occurred outside home. Majority (44 [81.5%]) of the cases had single wound. The median number of bite wounds with interquartile range was 1 (1, 3). One case had a maximum of >10 bite wounds. In 61.1% cases, site of bite was the leg and feet, followed by the arms, forearms, and hand. Majority (57.4%) of the cases had abrasion, 29 (53.7%) cases had Category-II bites and 25 (46.3%) cases had Category-III bites [Table 2].

Biting animal and vaccination

Dog (74.1%) was the main biting animal followed by cats 12 (22.3%), monkey (1.8%), and Ox (1.8%). Among dogs, 55.0% exposures were by pet dogs, 47.5% dogs were unvaccinated, and 65.0% dogs were available for 10 days observation. Five (45.4%) dogs in urban and 9 (31.0%) dogs in rural areas were classified as suspected rabid animals.^[12] Thirty-one (57.4%) cases mentioned that the animal had not bitten anyone else besides them, whereas 10 (25.0%) of the cases had mentioned that in addition to them, others were also bitten by the same animal and the remaining did not know.

Postexposure prophylaxis of cases

Among 54 cases, 19 (35.2%) had washed the wounds with water and soap and 8 (14.8%) had applied irritants [Table 3]. Forty-eight (88.9%) cases had sought PEP at the health centre. Six (11.1%) cases had not taken PEP and the common reasons attributed were 3(50.0%) were not aware/do not know and 2(33.3%) gave reasons such as no need to go to hospital. Among the cases who had sought PEP at the health facility, 5 (10.4%) were not advised PEP by the health-care provider and for calculation of PEP coverage, $n = 43$ was considered.

Among the 43 (79.6%) cases, 21 had Category-II exposures, of whom 14 (66.7%) had completed with either five doses intramuscular or four doses intradermal vaccination. Majority (40 [93.0%]) had taken vaccine in the deltoid region [Table 3]. The median duration (interquartile range) in days between bite and rabies vaccination was 2 (2, 3).

Similarly, 22 cases had Category-III exposures, only 4 (18.2%) had received both RIG and completed the rabies vaccination. Three (75.0%) had received equine RIG and one (25.0%) had received human RIG.

Health-care accessibility

About 53.5% cases had to travel 0–5 km to seek rabies PEP and 12.9% had to travel >15 km. The median distance traveled

Table 2: Details of exposure of the bite victims

Characteristics	Details	Urban (n=17), n (%)	Rural (n=37), n (%)	Total (n=54), n (%)
Place of bite	Home	9 (52.9)	13 (35.1)	22 (40.7)
	Outside home	8 (47.1)	24 (64.9)	32 (59.3)
Nature of bite	Provoked bite	10 (58.8)	17 (45.9)	27 (50.0)
	Unprovoked bite	7 (41.2)	20 (54.1)	27 (50.0)
Number of bite wounds	One	11 (64.7)	33 (89.2)	44 (81.5)
	Two	5 (29.4)	2 (5.4)	7 (13.0)
	More than two	1 (5.9)	2 (5.4)	3 (5.5)
Site of bite*	Leg/feet	9 (52.9)	24 (64.9)	33 (61.1)
	Arm/forearm/hand	8 (47.1)	12 (32.4)	20 (37.0)
	Head/face	-	1 (2.7)	1 (1.8)
	Buttock	-	1 (2.7)	1 (1.8)
Type of wound*	Abrasion	11 (64.7)	20 (54.0)	31 (57.4)
	Puncture wound	4 (23.5)	12 (32.4)	16 (29.6)
	Laceration	2 (11.8)	7 (18.9)	9 (16.7)
Category of bites	Category-II	11 (64.7)	18 (48.6)	29 (53.7)
	Category-III	6 (35.3)	19 (51.4)	25 (46.3)

*Multiple response possible

Table 3: Postexposure prophylaxis of the cases

Characteristic	Details	Urban (n=17), n (%)	Rural (n=37), n (%)	Total (n=54), n (%)
Wound care*	Water and soap	9 (52.9)	10 (27)	19 (35.2)
	Water	3 (17.6)	5 (13.5)	8 (14.8)
	Nothing	1 (5.9)	7 (18.9)	8 (14.8)
	Applied irritants/consulted traditional healer	1 (5.9)	7 (18.9)	8 (14.8)
Sought PEP at health facility	Yes	15 (88.2)	33 (89.2)	48 (88.9)
	No	2 (11.8)	4 (10.8)	6 (11.1)
Time gap for PEP (n=48) (days)	<1	13/15 (86.6)	24/33 (72.8)	37 (77.1)
	1-2	2/15 (13.4)	5/33 (15.1)	7 (14.6)
	3+	-	4/33 (12.1)	4 (8.3)
Rabies Vaccination (n=43)	Yes	13	30	43
Site of vaccination	Deltoid	13 (100.0)	27 (90.0)	40 (93.0)
	Gluteal	-	3 (10.0)	3 (7.0)
Number of doses	1	-	4 (13.3)	4 (9.3)
	3	2 (15.4)	6 (20.0)	8 (18.6)
	4	6 (46.1)	12 (40.0)	18 (41.9)
	5	5 (38.5)	8 (26.7)	13 (30.2)
Health facility visited	Government	9 (69.2)	26 (86.7)	35 (81.4)
	Private	4 (30.8)	4 (13.3)	8 (18.6)
Category-III wounds (n=22)		6	16	22
Rabies immunoglobulin (n=4)	Administered	1 (16.7)	3 (18.7)	4 (18.2)
	ERIG	1 (100.0)	2 (66.7)	3 (75.0)
	HRIG	-	1 (33.3)	1 (25.0)
Site of administration (n=4)	Into the wound	1 (100.0)	1 (33.3)	2 (50.0)
	Deltoid	-	2 (66.7)	2 (50.0)

*Multiple response possible and nonresponders, ERIG: Equine rabies immunoglobulin, HRIG: Human rabies immunoglobulin

was 5 (2, 12) km, urban area was 1 (1, 2) km, and rural area was 7 (3, 15) km. 45.4% cases, mode of transport was by bike/car/jeep/auto-rickshaw, etc., 35.8% traveled by bus, 18.4% mentioned by walk, and least 0.3% said ambulance. There was no mention of having come across a human rabies case by the surveyed respondents during the study period of 1 year.

DISCUSSION

A cross-sectional survey on the incidence of animal exposure was conducted in seven states of India in 2017. The animal exposures were categorized based on the WHO guidelines. The annual incidence of animal exposure was 1.26% (CI: 0.93%–1.59%). Majority of the cases were from rural settings, 15–60 years of age, 14 (66.7%) cases had completed

PEP in Category-II exposures and 4 (18.2%) had received RIG and completed the rabies vaccination schedule in Category-III exposures.

Survey coverage

In the present study, 7 states (28 rural and 14 urban communities) were covered compared to the Indian rabies survey 2004, where 18 states (21 urban and 63 rural communities) were covered.^[12] Hence, the comparison between the two studies is not ideal, and the results cannot be generalized to the entire country.

Incidence of animal exposure

The annual incidence of animal exposure was lower in the present study compared to 1.74% (CI: 1.63%–1.85%) observed in the Indian Rabies Survey.^[2] Studies from other urban and rural settings had observed the incidence of animal exposure varied from 1.6% to 2.6%.^[12,13]

Profile of cases

The mean age of the cases in Bhutan was 21.2 years and Babol, Iran, was 33.68 ± 17.23 similar to the present study.^[14,15] The incidence of animal exposure was nearly twice in children than adults in 2004 study, 47.5% in multicentric study of 2008, 65% in Haiti, and 45% in a region endemic to rabies in difference to the observation of the present findings.^[15-18] From studies across different settings, it was observed that majority of cases were male (68%–82%) similar to the findings of the present study.^[13-15,17] Females had the highest rate of cat bites.^[5] In the multicentric study of 2008, 63% had Category-III exposure, when compared to the present study, where Category-II exposures were more in number.^[16]

Body part involved

In the studies done in Bhutan and Babol, 73% had exposure on the legs and 18% on the hand/arms, 46.9% on the shoulder and upper organs, and 41% lower extremities similar to the observation of the present study.^[14,15]

Biting animal

In the Indian Rabies Survey, the biting animals were mainly dogs (91%), stray (63%) compared to the 22% exposures due to cats in the present study.^[12] Low- and middle-income country data reveal that dogs account for 76%–94% of animal bite injuries. Worldwide, cat bites account for 2%–50% of injuries and monkey bites account for 2%–21% of animal bite injuries.^[5] A small proportion of transmission was via wildlife.^[19]

Surveillance status of animals

On the basis of descriptive case histories, 48.1% of animals were noncases and 51.9% were suspect rabies in the current study compared to 60% suspect rabies in regions endemic to rabies.^[19] In Bhutan, majority (59%) of the victims mentioned that the rabies status was unknown, 32% mentioned normal and 9% suspect rabies.^[15]

Wound wash

In the Indian Rabies Survey and multicentric study of 2008 about 39% and 58% had washed wounds with soap and water in concordance to findings observed in the present study.^[12,16]

Antirabies vaccination and rabies immunoglobulin administration

88.2% had received three doses of rabies vaccine and 2.8% had received five doses of rabies vaccine in Babol similar to the present study.^[15] The interesting observation was that the coverage of ARV in rural area was better compared to urban areas. The cases usage of RIG was 18.4% compared to 2.1% usage in 2004.^[12] However, the RIG usage continues to be poor and needs to be strengthened along with introduction and scaling up of human rabies monoclonal antibodies. In a region endemic to rabies, it was observed that the cost of PEP varied depending on the health facility and the date of presentation.^[17] Majority preferred government hospitals (59%) for rabies PEP than private hospitals (36%) similar to the present study.^[11]

CONCLUSION

The incidence of animal exposure was 1.26% in the surveyed population. Postexposure rabies vaccination and RIG coverage were not satisfactory.

Limitation of the study

The sample size of 4924 was calculated based on the assumption of five persons per HH with 1008 HHs to be surveyed. However, a total of 1012 HHs were surveyed and only 4294 persons were available (4.24 persons per HHs). Resurvey was done in 50 HHs. (Gujarat [$n = 2$], Madhya Pradesh [$n = 34$], Himachal Pradesh [$n = 6$], and Kerala [$n = 8$]), as there was technical error in uploading data on to PDA. The study involved only selected states in India and generalization of the results for the country was not attempted.

Recall Bias – There may be a possibility of recall bias in remembering the bite/exposure, time taken between bite and wound wash, wound wash and vaccination. The information bias in the categorization of animal exposure and rabies PEP was minimized by prior training of surveyors, in data collection and asking leading questions to verify the type of exposures.

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Conflicts of interest

There are no conflicts of interest.

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Fellowship Award to Life Members

Nominations are invited from Life Members of Indian Public Health Association for the Award of Fellowship.

The prescribed Fellowship application form is available at the IPHA website www.iphaonline.org
The nominations should reach the IPHA HQ Office, at 110, C.R. Avenue, Kolkata – 700073 by 30th September 2019.

Nominations should be accompanied by relevant supporting documents (details available at website – www.iphaonline.org)

Sd/- Dr Sanghamitra Ghosh
Secretary General, IPHA