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Research Article

Geospatial Distribution and Sociodemographic Profile of Animal Bite Cases attending Anti-rabies Clinic of a Tertiary Care Hospital in Southern Odisha

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I N F O

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A B S T R A C T

Background: Ninety-six per cent of human rabies cases are caused by dog bites. Among these cases, stray dog contributes nearly 63% of the caseload. Their demographic information is not much studied.

Objective: To study the geographical distribution of animal bite cases and demarcate the hotspot areas to stop future rabies outbreaks by Quantum Geographic Information System (QGIS).

Methods: An observational cross-sectional study was carried out between 13th May 2022 and 12th Jun 2022. Data on 676 rabies vaccination OPD cases involving category 3 animal bites were collected using a review of records. Data were analyzed using SPSS and a spot map was prepared using QGIS 3.28.2.

Results: The majority of cases were dog bites (499, 73.82%) followed by monkey bites (103, 15.24%) and cat bite cases (65, 9.62%). The victims were mostly males (67.01%) and females were 32.99%. Maximum cases were due to unprovoked (82.84%) and stray animal (85.50%) bites. There was not much difference in the number of animal bite cases between the rural (48.6%) and urban areas (51.4%). However, dog bites were seen more in the urban areas, and wild animal bites like those of a fox, jackal, etc., were from the rural areas. The proportion of stray animal bites was higher in the rural areas and the proportion of pet animal bites was higher in the urban areas. These differences were found to be statistically significant.

Conclusion: Geographical mapping of animal bite cases gives a clear insight into the distribution of animal bite cases and helps in planning control measures to deal with the increasing number of cases in particular areas so as to prevent an outbreak.

Keywords: Animal Bite, Spot Map, Dog Bite, Category 3 Bites, Geographic Information System

Introduction

Rabies refers to an acute central nervous system viral infection that is caused by Lyssavirus type 1. Primarily, it is a zoonotic disease affecting warm-blooded animals like dogs, cats, jackals, wolves, etc.[1] It is invariably fatal once the symptoms are developed. There are two epidemiological cycles of rabies infection, one urban and one sylvatic. Dogs are the primary reservoir host in the urban rabies cycle, which is prevalent in regions of Africa, Asia, and Central to South America. In the northern hemisphere, the predominant cycle is the sylvatic, or wildlife cycle. It can at the same time be exhibited with the urban cycle in certain regions of the world.[1]

Being an invariably fatal disease, rabies is vaccine-preventable. Prevention of rabies in humans includes the provision of the following: a) Prophylaxis after exposure (PEP) for exposed victims, b) Immunization prior to exposure to high-risk individuals, c) Infection control in animal reservoirs, and d) Control of the dog population.

Among the 11 member states of WHO SEARO, rabies is endemic in eight states. A total of over 1.4 billion individuals in the world are in danger of rabies contamination, and around 45% of overall rabies deaths happen in Asia. Human rabies cases dues to dog bites constitute 96% of the total cases.[2]

In India, an expected 20,000 deaths occur annually because of rabies with practically 17.4 million individuals being exposed to animal bites consistently.[3] Among the dog bite cases, stray dog contributes nearly 63% of the caseload.[2]

It is widely believed that this number may be underestimated due to the fact that rabies is not a disease that must be notified in India and the majority of deaths occur in rural areas due to inadequate surveillance.[2]

Interventions to reduce the number of cases of animal bites are among the most important methods for controlling rabies.

The current study was conducted considering the lack of mapping of animal bite cases in the Ganjam district of Odisha. The purpose of this study was to determine whether Quantum Geographic Information System (QGIS) can be used for demarcating the hotspot areas to prevent future outbreaks of rabies. The spot maps created using QGIS may help in planning control measures leading to proper management of animal bite cases in particular areas. QGIS provides us with a visual sense of how the rabies outbreak occurred over time. This study was conducted focusing on the problems faced in the control of animal bite cases by policymakers.

In this study, the objectives were: a) to study the geospatial distribution of cases of animal bites at the Anti-rabies Clinic of MKCG Medical College & Hospital, using QGIS 3.28.2, and b) to describe the sociodemographic profile of cases of animal bites seen at the MKCG Anti-rabies Clinic.

Material and Methods

Study Design: A hospital-based observational cross-sectional study design has been used in this study.

Place of Study: Anti-rabies Vaccination Clinic of MKCG Medical College and Hospital, Berhampur, Odisha

Period of Study: 13th May 2022–12th June 2022

Ethical Approval: Ethical approval was obtained from the Institutional Ethics Committee of MKCG Medical College and Hospital, Berhampur, Odisha.

Study Population: Victims of animal bites visiting the Anti-rabies Vaccination Clinic of MKCG Medical College and Hospital, Berhampur, Odisha

Inclusion Criteria: All animal bite cases

Exclusion Criteria: Re-exposure cases, bites not requiring anti-rabies vaccine (rodent bites, human bites, etc., and those who did not give consent

Sampling Procedure: The participants were chosen using the convenience sampling method.

Sample Size: A sample of 676 consecutive animal bite victims was selected.

Data Collection Tool: The current study utilized a semi-structured, pre-designed, and pre-tested questionnaire.

Collection of Data and Analysis: For the collection of data, MS Excel was used and for analysis of the results, MS Excel and SPSS version 17 were used. The spot map was prepared using QGIS 3.28.2.

Results

The sociodemographic profile showed that out of 676 animal bite cases, 453 were male (67.01%) whereas, female victims were only 223 (32.9%). 560 bites were unprovoked (82.8%) while provoked bites were only 116 (17.2%). Among the total cases, stray animal bites were 578 (85.5%) whereas, pet animal bites were only 98 (14.5%) (Table 1).

Table 2 suggests that the majority of cases were dog bites (499, 73.82%), of which stray bites were 403 and 96 were pet dog bites. Monkey bite cases were 103 (15.24%). There were 65 (9.62%) cat bite cases, of which, 63 were stray cats and only 2 were pet cats. Cases of bites of wild animals like foxes, jackals, etc. were only 9 (0.013%).

The map suggests that the percentage of bites caused by wild animals like foxes, jackals, etc. increased as the distance from the center or urban area increased (Figure 1). Figures 2-5 show the geographical distribution of cases of dog bite, monkey bite, cat bite, and fox bite respectively.

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Table 1.Sociodemographic Profile of Victims of Animal Bites

Variables	Number (N = 676)	Percentage
Gender		
Male	453	67.01
Female	223	32.99
Type of animal		
Stray	578	85.50
Pet	98	14.50
Type of bite		
Provoked	116	17.16
Unprovoked	560	82.84

Table 2.Distribution of Victims of Animal Bite on the basis of Animal

Animal	Number (N = 676)	Percentage	Stray	Pet
Dog	499	73.82	403	96
Cat	65	9.62	63	02
Monkey	103	15.24	103	0
Wild animals (foxes, jackals, etc.)	09	0.01	09	0

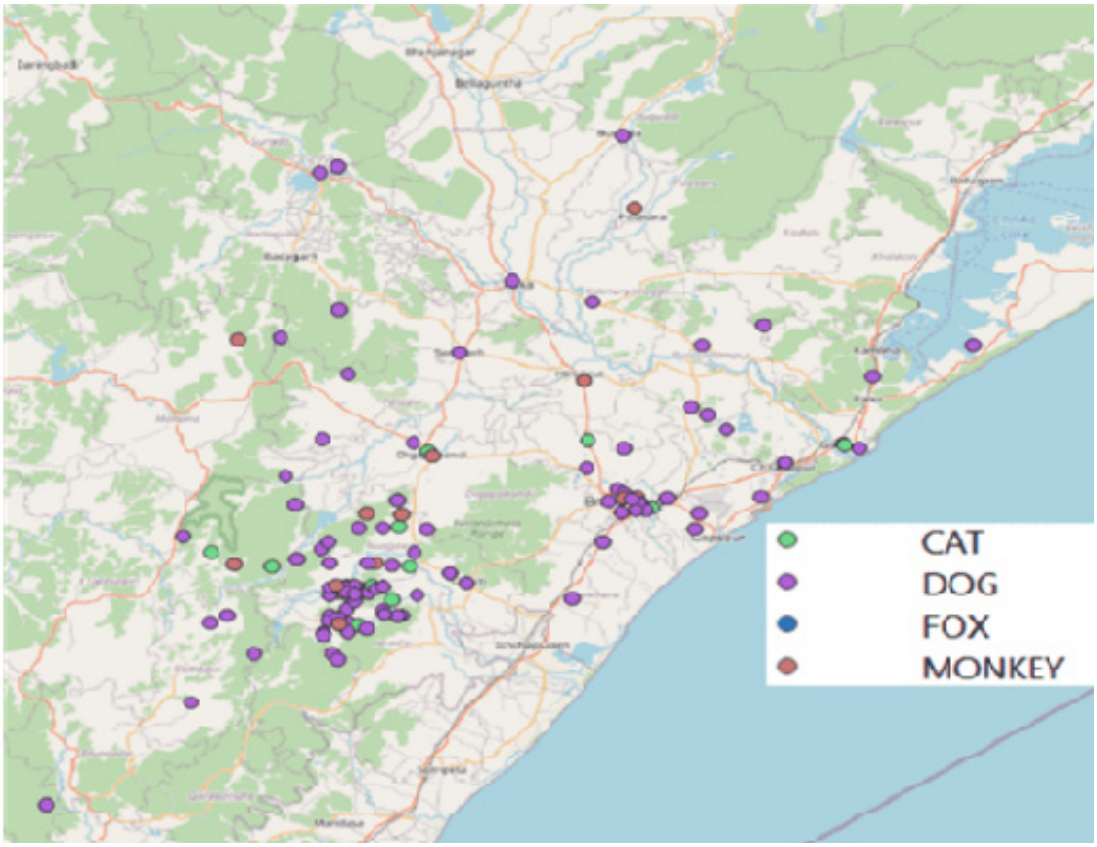

Figure 1.Spot Map showing Geographical Distribution of Animal Bite Cases in Ganjam District

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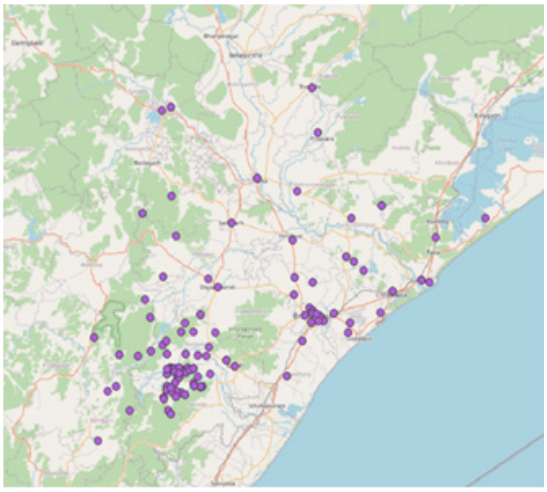

Figure 2.Spot Map showing Geographical Distribution of Dog Bite Cases in Ganjam District

Figure 3.Spot Map showing Geographical Distribution of Monkey Bite Cases in Ganjam District

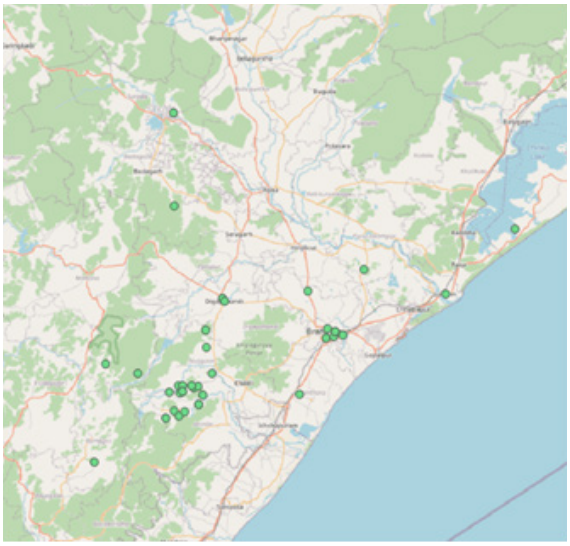

Figure 4.Spot Map showing Geographical Distribution of Cat Bite Cases in Ganjam District

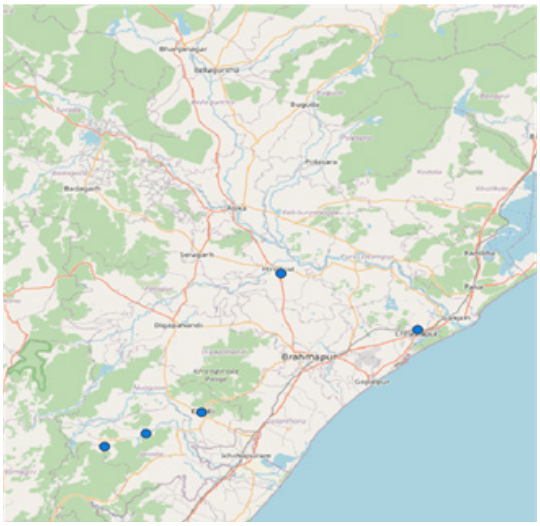

Figure 5.Spot Map showing Geographical Distribution of Fox Bite Cases in Ganjam District

Comparison between Rural and Urban Areas

There was not much difference in the number of animal bites cases between the rural (n_1 = 329, 48.6%) and urban areas (n_2 = 347, 51.4%). However, dog bites were seen more in the urban areas (263) than in the rural areas (236). Bites of wild animals such as foxes, jackals, etc. were from the rural areas (9) and it was determined that this difference was statistically significant (p = 0.018). Rural areas had a higher proportion (292) of stray animal bites than urban areas (286) and pet animal bites (61) were more common in urban areas than in rural areas (37) which was determined to be statistically significant (p = 0.019) (Table 3).

Table 3.Demographic Comparison

Animal Bites	Rural (n_1 = 329)	Urban (n_2 = 347)	Values after Analysis
Dogs	236	**263**	Chi-sq = 10.0139, **p value = 0.018**
Cats	32	**33**	
Monkeys	52	51	
Wild animals	**9**	0	
Total	329 (48.6%)	347 (51.4%)	
Category			
Stray	**292**	286	Chi-sq = 5644, **p value = 0.019**
Pet	37	**61**	
Total	329 (48.6%)	347 (51.4%)	

The statistical significance was determined using the Chi-square test. The p values were determined using a confidence interval of 95%. A statistically significant association between the variables was one with a p value of less than 0.05.

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Discussion

At a global rabies conference in Geneva, Switzerland, in 2015, the World Health Organization (WHO) called for the eradication of human rabies transmitted by dogs by 2030 and suggested the "one health approach," which involves medical, veterinary, and other related industries working together and effectively coordinating. According to Sudarshan et al.,[3] 20,000 people died annually in India in 2015 from rabies which adds to 33% of the worldwide rabies burden. Ironically, rabies is still not a notifiable disease in India, so very few cases are reported. As a result, the prevalence of rabies is underestimated.

The present study which included 676 animal bite cases reported that the number of male cases of animal bites is more than females and stray animal bites are more than pet animal bites. In a study carried out by Saurabha and Kembhavi,[4] majority of victims were male (83.3%) and stray animal bite (75.9%) was more common than pet animal bite, which were comparable to our study's findings. A study conducted by Rani and Kumar[5] which also coordinated with the results of the current study, reported that 67% of the cases were male and 67% were dog bites, out of which, 60% were due to stray dogs.

Contrary to our study, a study done by Deepa,[6] showed that pet animals were engaged in 73% of category III animal bites.

Similar to the findings of the study carried out by Ghosh and Pal,[7] the findings of the study by Deepa[6] also revealed that more than half (55%) of the victims were male and the majority of them were bitten by dogs (78%) followed by cats (20%). The findings of the present study were supported by these studies.

The current study showed that dog bites were more prevalent in urban areas than in rural areas. A study by Kinje and Supe[8] produced similar findings, which showed that about 89.4% of animal bites were from urban areas which were far more than those from rural areas (10.6%). Similar to our findings, a study by Sharma et al.[9] reported that the study population had a dog bite incidence rate of 25.2/1000, with higher rates in urban (30.1/1000) than rural (19.6/1000) slums, which coincides with the findings of the current study.

The present study shows that the percentage of wild animal bites increases with distance from the center. Similarly, according to the research carried out by Saurabha and Kembhavi[4], 81% of the time, the location of occurrence of the bite and the place of residence were the same.

Use of QGIS

In our study, we used QGIS (Quantum Geographic Information System) for the preparation of spot maps for geographical mapping of the animal bite cases. A study by Deepa[6] also used QGIS to create point maps displaying the geographical distribution of animal bite cases of category III in the Palakkad district in Kerela, India, from May-Aug 2018. Similarly, a study by Hosseini et al.,[10] also used Arc GIS software to draw the geographical map of the cases in Iran. A study by Castillo-Neyra et al.,[11] could assist in determining the reason for the return of rabies and its steady spread to Arequipa, Peru involving a geographic information system. In a study by Gibson et al.[12] involving GIS innovation in Ranchi, India, the practicality of immunizing a large number of dogs in a brief period was illustrated. All the studies showed that there is a need and scope for increasing the surveillance for animal bite cases.

Limitations

The study was based on ARC OPD in the urban area, therefore more cases being reported from the urban areas could be due to this location of OPD. So, the external validity of the study is being compromised.

Conclusion and Recommendation

In India, still there is a lack of an active surveillance system for the control of animal bite cases. Geographical mapping of animal bite cases gives a clear insight into the distribution of animal bite cases and helps in planning control measures to deal with the increasing number of cases in particular areas so as to prevent an outbreak. GIS should be included in the surveillance system. Using QGIS, location can be captured from the OPD ticket itself, and by weekly reviews, heat maps can be generated. Then animal control services can be informed about the hot spot areas to take appropriate actions. Thus, QGIS along with a proper surveillance system may help in the control of future rabies outbreaks.

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Conflicts of Interest: None

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