

Analysis of Reported Rabies Suspects in Lemu-Bilbilo, Ethiopia: A One-Year Retrospective Study

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ABSTRACT

Objective: This study aimed to assess the frequency of animal bite incidents, analyze their characteristics, and determine risk factors for dog bites in Lemu-Bilbilo District, Arsi Zone, and Oromia Regional State, Ethiopia. A retrospective review was conducted on suspected rabies cases (dog bites) reported in the district during 2013/2014 (a one-year period).

Findings: A total of 316 animal bite cases were recorded, resulting in an estimated annual incidence of approximately 137 cases per 100,000 people. Males (56.6%) were more frequently affected than females (43.4%), and children (ages 0–19) were bitten at a higher rate than adults. Neighbor-owned dogs were responsible for 34.2% of the bites, while domestic dogs accounted for 95% of all cases. Other animals, including monkeys (1.9%), donkeys (1.6%), cattle (0.9%), wild animals (0.3%), and horses (0.3%), were less involved. Nearly all victims (94.3%) reported that the biting dogs showed signs of rabies.

Children, especially those aged 1–19.9 years, were the most affected group, with the majority of bites (67.4%) occurring on the lower limbs, regardless of age. Among those who sought medical care, 38% received the rabies vaccine, 15.8% were given both rabies and tetanus vaccines, and only 1% received just the tetanus vaccine. Most bite incidents occurred between August and October each year.

Conclusion: The study highlights that dog bites, particularly from rabies-suspected animals, are a significant concern in Lemu-Bilbilo, disproportionately affecting children and peaking in autumn. To address this issue, enhanced rabies surveillance, public education on bite prevention (especially for children), and improved rabies control policies are essential. Recommended interventions include community awareness programs on dog behavior, child-dog interactions, bite risks, and proper wound management.

Keywords: Ethiopia, Human Animal Bites, Lemu-Bilbilo, Oromia, Rabies

Introduction

Rabies is a deadly zoonotic disease that attacks the central nervous system, leading to severe neurological damage and almost certain fatality in infected mammals. In humans, the primary mode of transmission is through bites from rabid animals, with domestic dogs (*Canis familiaris*) serving as the main reservoir and vector for the virus [1].

Rabies remains a persistent public health threat in many developing nations, particularly in Africa and Asia, where the majority of global human rabies fatalities occur [2]. An estimated 24,000 to 70,000 people die from the disease annually in these regions [2,3]. Canine rabies alone accounts for approximately 55,000 human deaths each year, contributing to 1.74 million disability-adjusted life years (DALYs) lost annually. The economic burden is substantial, with Africa and Asia incurring around US\$ 583.5 million per year in rabies-related costs—primarily driven by post-exposure prophylaxis (PEP) expenses [4].

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Ethiopia, like many developing nations, faces a severe rabies burden, with an estimated 10,000 human deaths annually—one of the highest rates globally [5]. Most cases occur in rural areas, driven by multiple factors: low dog vaccination rates (due to limited awareness and financial constraints), poor canine management (e.g., unrestricted dog movement increasing wildlife exposure), and insufficient policy prioritization despite cost-effective control measures [4]. Bogel & Meslin, [6].

In Ethiopia, cultural reliance on traditional healers for rabies management often delays access to life-saving post-exposure prophylaxis (PEP), with many rural victims seeking modern treatment only after tragic fatalities occur. Dogs—the primary rabies vector—are ubiquitous (estimated at 1 dog per 5 households) yet poorly managed, with minimal vaccination limited to urban areas. This fuels endemic canine rabies, posing dual threats to human and livestock health, with significant economic consequences [7].

Globally, dog bites drive rabies-related morbidity, particularly in endemic regions. While developed nations have eliminated canine rabies through mass vaccination and legislation, Ethiopia's control efforts lag due to socioeconomic barriers and limited disease awareness. Proactive measures, including dog population management and public education, are critical for sustainable prevention—proven more cost-effective than reactive PEP reliance [8,9]. Children remain disproportionately vulnerable to bites, which serve as key transmission routes for rabies, responsible for 99% of human cases globally via infected dog saliva (WHO, 2013). Strategic epidemiological insights and community engagement are thus essential to design effective control programs in high-risk regions.

Systematically analyzing animal bite injury reports can provide region-specific insights into rabies burden, enabling targeted surveillance and control efforts. Hospital records of bite victims offer valuable data on patient demographics (age, sex), high-risk areas, animal species involved, and seasonal trends, which can inform strategies to mitigate rabies transmission by understanding dog population dynamics, movement patterns, and habitat interactions. Additionally, such data highlights the financial burden of post-exposure prophylaxis [10]. Epidemiological assessments of retrospective and current rabies cases are critical for gauging disease trends and guiding interventions, yet Ethiopia lacks accurate quantitative data on rabies in humans and animals, as well as public awareness levels, hindering effective control measures. With limited studies on rabies incidence and rising dog bite cases, this study aimed to estimate human dog bite incidence, characterize bite patterns, and identify risk factors in Lemu-Bilbilo district to address these gaps.

Methodology

Study Area

This study was carried out in Lemu-Bilbilo District, situated in the Arsi Zone of Ethiopia's Oromia Regional State. Geographically positioned at 7°31'60" N latitude and 39°15'0" E longitude, the district lies approximately 235 km southeast of Addis Ababa along the highway to Bale Zone. With an elevation of 2,809 meters above sea level, the area features a mixed crop-

livestock farming system. The region experiences an annual rainfall of 1,100 mm, with over 85% occurring during the main rainy season from June to November. According to the 2013/14 national census, the district had a total population of 231,795 residents, comprising 114,149 males and 117,646 females (CSA, 2014).

Study Design

To study dog bite epidemiology and victims' rabies knowledge, researchers compiled lists of suspected rabies cases from health centers. Health extension workers then located all bite victims in villages - including those who visited health centers, traditional healers, or received no treatment - between September 2013 and September 2014. Using a structured questionnaire, they collected data on bite circumstances and the biting animals. From November 2014 to February 2015, the survey gathered detailed information including: Victim demographics (age, sex, address), Bite details (date, time, season, wound severity/location), Treatment received (medical/traditional), Animal information (species, ownership status, origin).

Ethical Issues

The study was ethically approved by Oromia Regional-Health-Bureau (ORHB).

Data Analysis

Data were entered into Microsoft Excel 2007, cleaned for completeness and consistency, with corrections made where possible or removal of irreparable entries. Descriptive statistics and chi-square tests were applied to analyze the cleaned data. Human rabies incidence was calculated as cases per 100,000 population per year by dividing bite victims/probable cases by at-risk population. For statistical analysis, SPSS version 21 was used to: Compute frequencies, rates and proportions (descriptive statistics) and compare proportional differences (chi-square tests) across: gender, age groups and other relevant variables

Result

After conducting interviews with 319 patients, three suspected duplicate cases were excluded from the dataset. The final analysis included 316 validated dog bite cases.

Bite Incidence

From 2013 to 2014, surveillance data from Lemu-Bilbilo district documented 316 animal bite incidents involving suspected rabid animals. This translated to an annual incidence rate of approximately 137 cases per 100,000 population, with a higher proportion of male victims (56.6%) compared to females (43.4%).

Demographic distribution of victims

The study revealed a predominance of male victims (56.6%), with children and young adults (0-29 years) representing the most affected age group (55.4%). Incidence rates showed a clear age-dependent decline, with peak vulnerability observed among children aged 0-19.9 years (Figure 1). Notably, males consistently outnumbered females across all age categories (Table 1).

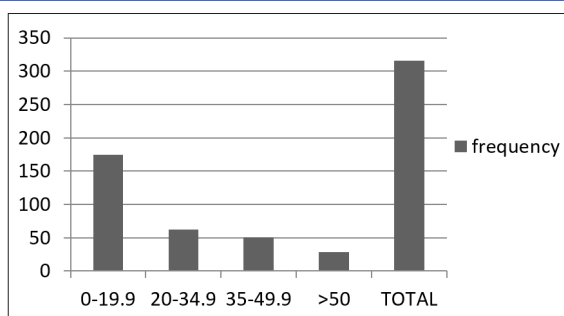


Figure 1: Age distribution of victims

Table 1: age and gender distribution of dog bites

		Age				Total
		0-19.9	20-34.5	35-49.9	Above 50	
Sex	Male	93 (29.4%)	37 (11.7%)	31 (9.8%)	18 (5.69%)	179 (56.6%)
	Female	82 (25.9%)	25 (7.9%)	20 (6.3%)	10 (5.69%)	137 (43.4)
Total		175 (55.3%)	62 (19.6%)	51 (1.1%)	28 (8.8%)	316 (100%)

Seasonal Patterns of Dog Bite Incidents

Dog bite cases occurred year-round but showed distinct seasonal variation. The highest incidence was observed during summer (June-August), accounting for 25.3% (80/316) of cases, followed by winter (December-February; 19.9%, 63/316) and autumn (September-November; 19.4%, 61/316). Spring months (March-May) had the lowest reported cases (12.9%, 41/316) (Figure 2).

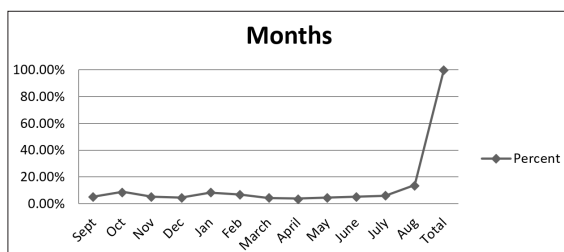


Figure 2: Seasonal distribution of bite victims

Animal Species Involved in Bite Incidents

Domestic dogs were responsible for the vast majority (95%) of reported bite injuries (Table 2). The remaining cases involved other species, including cattle, wild animals (hyenas and foxes), equines (horses and donkeys), and human bites.

Table 2: Species of biting animals

Species of animals	Frequency	Percent
Cattle	3	0.9%
Dog	300	95%
Donkey	5	1.6%
Wild animals	1	0.3%
Horse	1	0.3%
Man	6	1.9%
Total	316	100%

Status of dogs involved in the bite

Among 316 reported cases, 94.3% (n=298) of biting dogs exhibited clinical signs consistent with rabies based on standardized diagnostic criteria [11]. These criteria included at least two characteristic neurological symptoms observed in the final disease stages. Only 5.7% (n=18) of cases involved dogs reported as clinically normal at the time of biting (Table 3).

status	Frequency	Percent (%)
Not rabid	18	5.7%
Rabid	298	94.3%
Total	316	100%

Ownership Of Biting Animals

The study revealed that neighbor-owned dogs were responsible for the highest proportion of bites (34.2%, 108/316), followed closely by victims' own dogs (32.0%, 101/316). Stray dogs accounted for 23.4% (74/316) of incidents, while known but non-local dogs represented 10.4% (33/316) of cases

Anatomical Site of Bite

The findings reveal that lower extremities were the most frequent site of dog bites, accounting for 67.4% of cases. Overall, 91.7% of injuries occurred on the extremities, comprising: lower limbs (legs), 67.4%, upper limbs (arms/hands), 21.5% and multiple limbs (2.8%).

Severity of Bite

Based on WHO criteria, the study revealed that 316 bite cases were categorized as follows: Category I (35.8%): Exposure through touching/feeding animals or licks on intact skin, Category II (42.7%): Minor wounds including nibbling of uncovered skin or superficial scratches without bleeding and Category III (21.5%): Severe exposures involving single or multiple penetrating bites

Post-Exposure Prophylaxis and Wound Care Practices

Among patients seeking medical care

- Vaccination status: 38% received rabies vaccine alone, 15.8% received both rabies and tetanus vaccines, while only 1% received tetanus vaccine exclusively
- Treatment adherence: 72.2% (123/170) of initiated rabies vaccine regimens were completed
- Treatment discontinuation reasons: Included perceived wound healing (4.7%), skepticism about PEP efficacy (0.6%), and preference for traditional medicine (0.6%)
- Only 3.8% of patients reported proper wound cleansing with soap before medical consultation, as recommended by WHO guidelines
- Additional preventive measures included tetanus toxoid administration (16.1%) and basic water/soap washing (3.8%).

Discussions

Ethiopia remains one of the world's most rabies-endemic countries, with historical estimates indicating approximately 10,000 human rabies deaths annually (18.6 cases/100,000 population) [5]. Our study reveals an even more alarming situation in Lemu-Bilbilo district, documenting an annual bite incidence of 137/100,000 population based on 316 animal bite cases reported within one year.

The breeding season of dogs may cause the seasonal difference in dog bite prevalence in many countries. In Ethiopia, the breeding season for dogs is August to October. In this study, the incidences of bites were found higher in summer and autumn months. This is in line with the findings of [12], that they estimated that the highest incidence of bites occurred during the summer months. It is during these months that dogs are breeding and hence male dogs in a group are following a bitch for mating. Provocative actions and interference made by people, especially children during this time might be contributing for higher bite.

The risk factors for dog bites identified in this study align with findings from another research. Our results show males were significantly more likely to be bitten than females, consistent with multiple epidemiological studies on dog bites [13-15]. This likely relates to boys being more prone to risky behaviors around dogs. Children aged 1-19.9 years were particularly vulnerable to bites, with most injuries (67.4%) occurring on the lower limbs - a finding that differs from some studies reporting more facial/head injuries. While bites occurred across all ages, rates were highest among 0-19-year-olds, with males predominating, likely because they spend more time outdoors [16]. The higher reporting of child bites may reflect greater parental concern about injuries in children compared to adults.

Most children aged 1-19.9 years suffered leg bites, while those under 19.9 more commonly experienced bites to the head/neck, torso, and arms/hands. Approximately half of all dog bites involve pets belonging to either the victim's family or neighbors, with most attacks occurring near the dog's home - consistent with previous research. In developed countries, children represent most dog bite victims, typically bitten on the head, neck or face by familiar pets. This pattern likely results from children's shorter stature and tendency for close interactions like hugging or petting [17]. Additionally, children may provoke bites by teasing dogs or intervening in dog fights, leading to more limb injuries [18]. Notably, rabid dog bites to the upper body and limbs pose greater health risks than lower extremity bites.

Consistent with global patterns, particularly in Africa and Asia, this study confirms domestic dogs as the primary source of animal bite injuries and rabies transmission [4,13]. Our findings align with previous Ethiopian studies showing animal bites remain a significant public health concern, with dogs responsible for 63-80% of cases nationally. In the current study, dogs accounted for 95% of bites requiring post-exposure prophylaxis, matching patterns observed in both Ethiopia [19,20] and India. The anatomical distribution of bites showed similar patterns to other studies, with lower limbs (67.4%) being most frequently affected [21,22] followed by upper limbs, with no significant correlation between bite location and severity. Children represented the highest-risk group for dog bites, primarily from domestic dogs. Since over 95% of human rabies deaths result from domestic dog bites [23], understanding canine rabies dynamics is crucial for developing effective control strategies.

Assessing community knowledge about dog bites and rabies transmission is essential for designing effective awareness programs. Preventing human rabies requires prompt action after exposure, including proper wound care and timely post-exposure prophylaxis (PEP) when necessary. Additionally,

robust surveillance systems for human and animal cases, along with integrated prevention and control strategies, are critical. However, only 3.8% of victims in this study washed wounds with soap and water before seeking medical care—a crucial first-aid measure strongly recommended by the WHO [24].

A concerning 34.8% of respondents relied on traditional treatments, which lack scientific validation. Observed that many fatal rabies cases in Ethiopia involved prolonged traditional healing attempts. This highlights the urgent need for public education on rabies risks and improved access to PEP. While some Ethiopian traditional herbs are preliminarily reported to have anti-rabies properties, their efficacy remains unproven.

A sustainable solution requires increased dog vaccination to curb rabies spread. Mass dog vaccination campaigns, combined with accessible and affordable PEP, would enhance prevention efforts. However, challenges such as poor infrastructure, limited funding, low awareness, and weak community engagement hinder vaccination coverage [20]. Addressing these barriers through coordinated efforts is vital for effective rabies elimination.

Concussion and recommendations

This study highlights critical insights into animal bite incidents, their risk factors, and gaps in healthcare responses in Ethiopia. Dog bites remain the primary cause of injuries, posing a significant rabies risk, particularly among children and males. Low public awareness and reliance on ineffective traditional treatments further delay proper medical care [25-29].

Based on the above conclusion, the following points were forwarded

- Implement education programs to reduce bite incidents and promote proper wound management (e.g., immediate soap-and-water cleaning). Special focus should be given to children, who are most vulnerable.
- Beyond dog vaccination and population management, enhance surveillance through laboratory testing of suspected rabid animals.
- Teach safe dog-child interactions, bite prevention, and first-aid measures to minimize risks.
- Emphasize the public health burden of animal bites, particularly the dangers to young children, to guide policy and intervention strategies.

Consent to publish declaration: not applicable

Conflict of Interest: None to Declare

Clinical trial: Not applicable

Availability of data and materials: no data sets were generated and analyzed during the current study

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