

# Two year prevalence of suspected rabid dog bites and the cost implications at Entebbe grade a referral hospital, Uganda

T. Mulindwa, S. A. Baluka\*

Department of Biosecurity, Ecosystems and Veterinary Public Health, College of Veterinary Medicine, Animal Resources and Biosecurity, Makerere University, Kampala

\*Corresponding author: *sbaluka3@gmail.com*

(Received 13 December 2017, Accepted 4 April 2018)

## Summary

Rabies remains an important but neglected disease in Africa and Asia. Disparities in the affordability and accessibility of post-exposure treatment and the risks of exposure to rabid dogs result in a skewed distribution of the disease burden across society; with the major impact falling on the rural poor particularly children. Dog bites are the main source of human and animal rabies in Africa, Asia, and South America, and are economically significant. A dog bite victim pays for the mandatory PEP plus incidental costs including transport, food and accommodation making it very expensive. The study established the two-year hospital-based prevalence for dog bites and estimated the economic costs incurred to access PEP at Grade A. Secondary data were obtained from the dog bite victims' records captured during PEP treatment. The records included the patient's address, the region of origin or residence, age, sex, incriminated animal species; and whether domestic or stray. A total of 3600 people reported animal bites in the two years; 90.5%, 7.8%, and 1.7% were bitten by dogs, cats and wild animals respectively. Majority of dog bite victims were males below 18 years. A dog bite victim spends USD 91.177 - 288.234 to receive complete PEP treatment. Young males were at the highest risk of being bitten by dogs. High costs were incurred by the victims' households. Mass dog vaccination must be intensified throughout the country to prevent human exposure to rabies. Public awareness and education should be prioritized.

**Key words:** Cost, dog bites, PEP, prevalence, rabies.

## Introduction

Rabies is a highly fatal zoonotic disease caused by a virus from the genus *Lyssavirus* and family *Rhabdoviridae*, associated with 100% mortality rate; infected animals and humans die within a week after the first neurological signs appear (Taylor, 2009; Depani et al., 2012, Dietzgen and Kuzmin, 2012). It is endemic in Uganda like many

African countries, mainly transmitted and maintained through bites of infected animals to other animals and humans (Jemberu et al., 2013). Dogs are the main source of rabies through their bites especially in the developing countries of Africa, Asia and South America (Overall and Love, 2001; Ozanne-Smith et al., 2001; Meslin and Briggs, 2013).

Rabies is an important but underreported and neglected disease of low income countries in Africa and Asia (Knobel et al., 2005; Hampson et al., 2015) associated with poverty affecting vulnerable populations with most deaths occurring in children between 5-15 years and the lowest socio-economic sectors who account for about 40% of people exposed to dog bites in rabies endemic areas (Gongal and Wright, 2011; Meslin and Briggs, 2013).

Disparities in the affordability and accessibility of post-exposure treatment and the risks of exposure to rabid dogs result in a skewed distribution of the disease burden across society; with the major impact falling on the rural poor particularly children (Knobel et al., 2005). Highly educated people know more about rabies (Palamar et al., 2013) while uneducated people know less about rabies (Herbert et al., 2012). Even fewer people are aware of the transmission and prevention of rabies (Fielding et al., 2012). Obstacles to progress against canine rabies in Africa include; a high population of stray dogs, the inability of owners to bring dogs for vaccination annually, lack of canine rabies surveillance and diagnostic capabilities besides insufficient resources for veterinary services delivery (Anderson and Shwiff, 2015).

Consequences of dog bites include direct physical injury, psychological trauma and post-traumatic stress in addition to the risk of contracting rabies (Gilchrist et al., 2008) besides high financial costs for

treatment, emergency hospitalization and anti-rabies post-exposure prophylaxis (Overall and Love, 2001). The global burden of canine rabies is approximately \$124 billion annually (Anderson and Shwiff, 2015). In developing countries, availability of post-exposure prophylaxis (PEP) is limited to a few referral hospitals and health centers implying that dog bite victims must travel long distances associated with incidental costs including transport, feeding, and accommodation to access PEP. Globally over 15 million people receive the rabies PEP treatment annually following dog bite injuries (Cox, 2012).

When dogs bite and transmit rabies to cattle, goats, sheep, working animals like camels and donkeys (Hampson et al., 2015; Anderson and Shwiff, 2015), they undermine livelihoods of the households who depend on livestock. If these animals die of rabies following dog bites, the livestock farmers suffer severe economic losses. The number of animals and people dying of rabies annually in Uganda are not known since there is neither systematic reporting nor effective surveillance systems to capture all the victims of dog bites or who die of rabies in all districts. Hence, the study was done to estimate the dog bite victims who received PEP from Entebbe Grade A national rabies referral hospital and economic costs involved.

## Materials and Methods

The study was conducted at Entebbe Grade A National Rabies Referral Hospital (Grade A) which is located in Katabi sub-county, Busiuro county, Entebbe municipality, Wakiso district in central Uganda. This is a government public hospital offering medical services ranging from surgery, orthopedics, antenatal care, maternity, and immunization against several diseases including rabies. It is approximately 37 kilometers (23 miles) by road from Kampala, southwest of Mulago National Referral Hospital located between coordinates 0°03'50.0"N and 32°28'18.0"E.

The study was retrospective using secondary data from case records of people who reported animal bites at Entebbe Grade A National Rabies Referral Hospital. Data were manually retrieved from the rabies archives. The records indicated the patient's names, home region i.e. central, western, eastern and northern Uganda where he/she came from to access PEP at the hospital. The patient's age and sex; the species of the biting animal (dog, cat or wild species e.g. fox), domestic or stray and the date of the bite were extracted from the records. Information about the cost and length of treatment, whether there was an accompanying adult in case of children and the region where they came from were factored in to estimate the financial costs incurred by the victims.

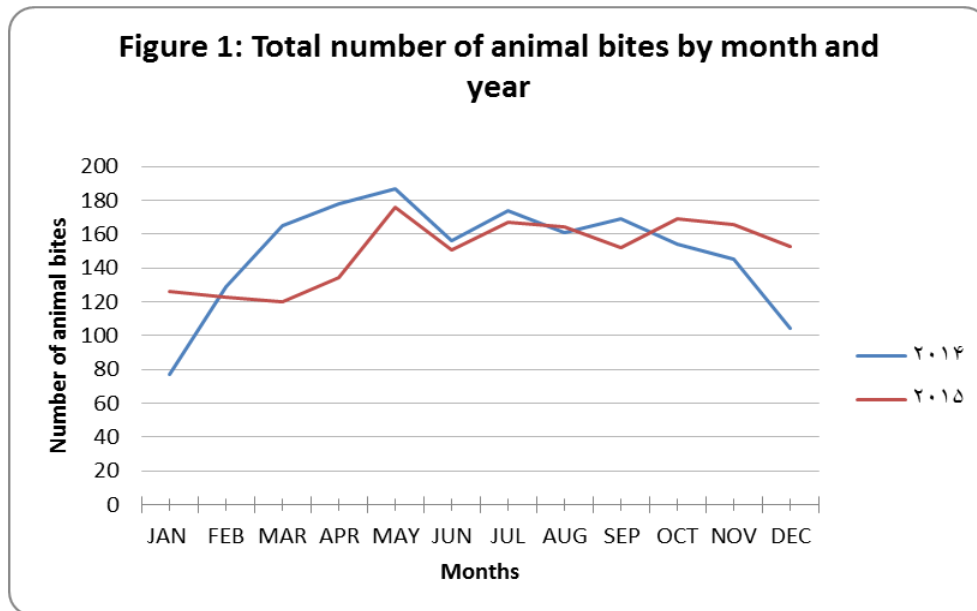
The costs incurred by dog bite victims to access PEP included direct and indirect costs and were estimated according to the approach adopted by (Knobel et al., 2005). The direct costs included the medical costs for the complete PEP treatment and indirect costs such as transport costs for the victim and parents or attendants, food, airtime or communication costs and accommodation costs for people from rural areas. The human PEP administered to dog bite victims in Uganda is a five-dose regimen treatment given at 0, 3, 7, 28 and 90 days intervals. The data were entered into MS Excel and analyzed using descriptive statistics including percentages and frequencies.

## Results

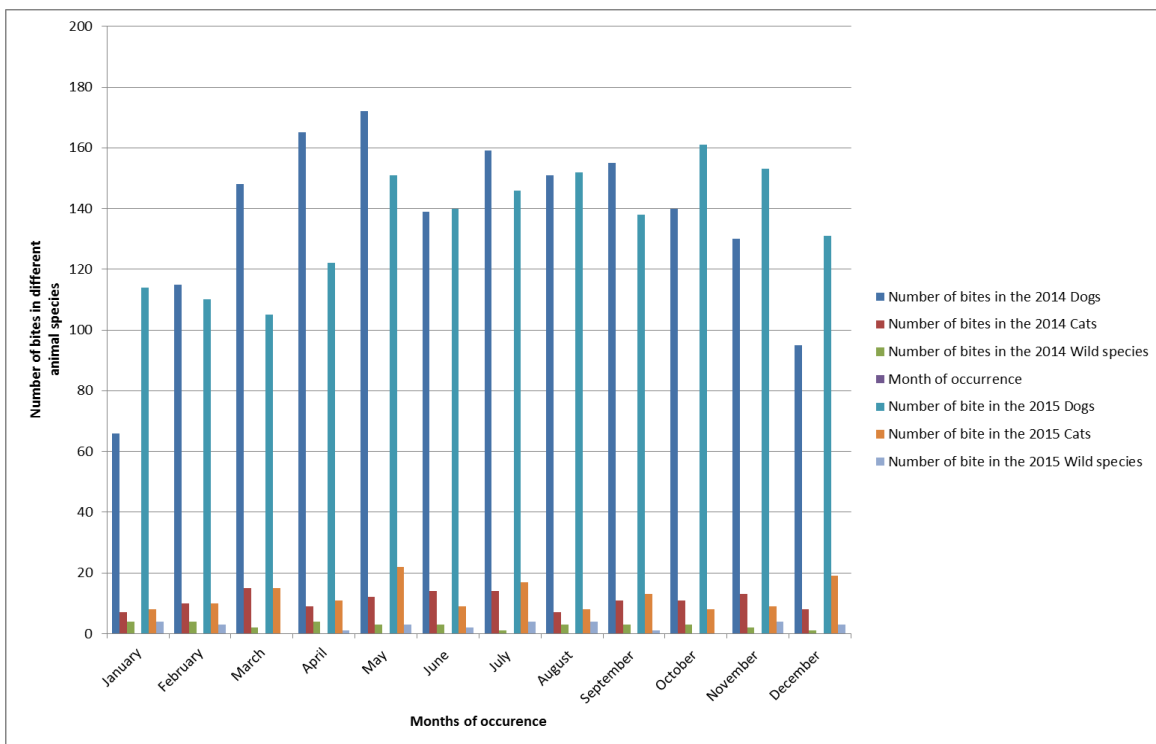
The number of animal bites was relatively constant throughout the two years under study, with a slight peak from March to May in 2014 and April to June in 2015 (Figure 1 and Figure 2). Animal bites were reported among all age groups, although the age bracket below eighteen years was most affected (Table 1). Prevalence of animal (dog) bites in Uganda by region is as shown in Figure 3.

**Table 1.** Prevalence of dog bites by age group of the victim

Age group	Number	Prevalence %
< 18 years	1677	46.58
18 – 35 years	1266	35.17
> 35 years	657	18.25
<b>Total</b>	<b>3600</b>	



**Fig. 1.** Total number of animal bites in different months and years in Uganda.



**Fig. 2.** Two-year prevalence of suspected rabid animal bites at Entebbe National Rabies Referral Hospital

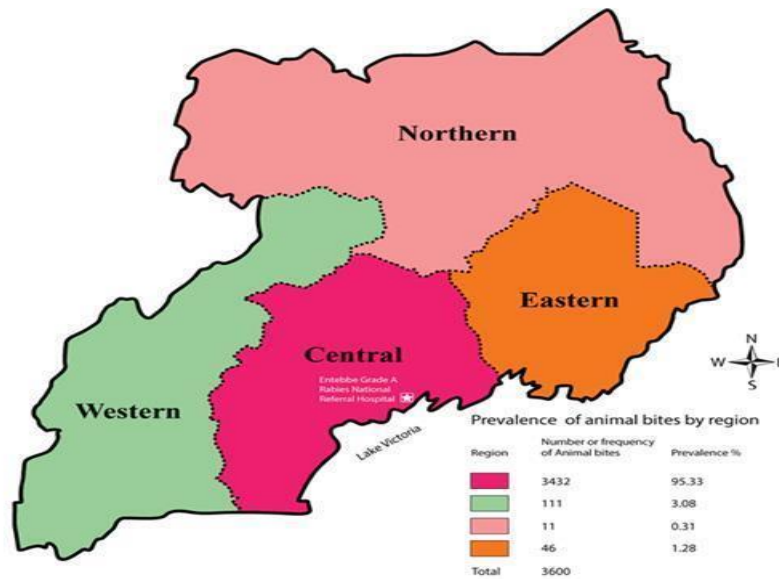


Fig. 3. The prevalence of animal bites by geographical distribution

The prevalence of dog bites reported at Entebbe Grade A Hospital in the two years 2014 and 2015 was highest for central Uganda (Figure 3). More males were bitten by animals including dogs than females (Table 2).

Table 2. Prevalence of animal bites by the sex of the victims

Sex	Number	Prevalence %
Female	1572	43.67
Male	2028	56.33
Total	3600	100

Dog bites have economic implications. They are costly to treat and involve substantial monetary expenses to access PEP. A person from Arua district (one of the farthest districts) spends an estimated 980,000 Ugandan shillings (288.234 USD) to receive a full dose of the five regimens PEP at Entebbe Grade A Hospital (Table 3).

Table 3. A person coming from Arua district to receive the five regimen full dose of anti-rabies (PEP) incurs the following expenses

Type of cost	Amount (UGX)	Amount (USD)
Direct		
First dose	50,000	14.705
4 Subsequent doses	180,000	52.941
Indirect		
Transport	300,000	88.235
Feeding	200,000	58.824
Accommodation	250,000	73.529
<b>Total</b>	<b>980,000</b>	<b>288.234</b>

Table 4. A person from Kampala, central Uganda to receive the five regimen full dose of anti-rabies (PEP) incurs the following expenses

Type of cost	Amount (UGX)	Amount (USD)
Direct (PEP)		
First dose	50,000	14.706
4 Subsequent doses	180,000	52.941
Indirect		
Transport	30,000	8.824
Feeding	50,000	4.706
<b>Total</b>		<b>91.177</b>
		<b>310,000</b>
		<b>(Ughanda Shillings)</b>

A dog bite victim from Kampala in central Uganda spends approximately 310,000 Ugandan shillings (91.177 USD) get the same PEP treatment at Entebbe Grade A (Table 4). So the person spends between 91.177 USD to 288.234 USD to receive the PEP at Entebbe Grade A referral hospital depending on one's place of residence. The exchange rate of 1 USD = 3400 Ugandan Shillings was used.

## Discussion

The high prevalence of dog bites reported from the central region as compared to the eastern, northern and western regions (Figure 3) is probably due to the proximity to the referral hospital which is located within this region close to Uganda's international airport and 40Km from the capital city Kampala. This is too far and too expensive for the poor victims and or their parents from the distant northern, eastern, western and southern regions of the country. Hence, many dog bite victims from the rural areas do not report to the referral hospital and are thus excluded.

Dog bites prevalence of was very high and accounted for the majority (90.5%) of animal bites reported at the referral hospital, a picture similar to Knobel et al., (2005) despite under-reporting of dog bites in Uganda given that the country lacks an active surveillance system for dog bites and rabies. This finding is consistent with

previous studies (Meslin and Briggs, 2013) that have indicated that dogs account for most animal bites and rabies cases. Hence, the most effective means of preventing human rabies is achieving 75% coverage of rabies vaccination for dog populations. It is possible to prevent a person from becoming ill with rabies after a dog bite by neutralizing the virus with antibodies vaccination and or use of immunoglobulin (post-exposure prophylaxis) before the virus invades the nervous tissue (Nilsson, 2014).

Majority of dog bite victims were males below 18 years which is in agreement with (Meslin and Briggs, 2013) who stated that most victims of dog bites and who suffer from rabies are children. Rabies affects the vulnerable groups most and children are among the most vulnerable people in our communities. Young boys below 18 years were most affected probably due to the fact that boys participate in outdoor activities such as herding and hunting more than young girls. Young boys also stay out of home longer and later than girls of the same age. Hence education of the general public particularly the vulnerable groups including children, youths, women and elderly about dog behavior and how to avoid attacks from stray dogs is very important in preventing dog bites (Lakestani et al., 2011).

The cost of complete PEP treatment for dog bite victims at Entebbe Grade A hospital ranged from USD 91.177 to USD 288.234. The variance is attributed to the incidental costs such as transport, food and

accommodation which depend on the region, and district of origin where the victims come from to access PEP at Grade A.

### Conclusions

Mass dog vaccination must be intensified throughout the country since it is the cheapest and most effective means for preventing exposure of people to rabies. Public awareness and education should be stepped up to highlight the risk of contracting rabies from dog bites as well as encourage responsible dog ownership and communities to ensure that dog bite victims are taken to health facilities for PEP within the first 24 hours.

### Ethical statement

The researchers obtained an introductory letter from the Dean School of Veterinary Medicine, Animal Resources and Biosecurity, College of Veterinary Medicine, Animal Resources and Biosecurity Makerere University which they used to approach the Department of Veterinary Public Health in the Ministry of Health (MOH).

The researchers obtained an introductory letter from the Assistant Commissioner Veterinary Public Health in the MOH to the District Health Officer (DHO) Wakiso district who then gave an authorization letter to conduct the study in Entebbe Grade A Hospital. We took the authorization letter from DHO to the Medical Superintendent of the Hospital and

were granted access to the rabies victims' records for the two years 2014 and 2015.

### Acknowledgments

The authors acknowledge support from the following individuals and or institutions:

1. The College of Veterinary Medicine, Animal Resources and Biosecurity, Makerere University for the introductory letter to the Ministry of Health.
2. Ministry of Health for the support and introduction letter to Wakiso District Health Officer.
3. District Health Officer, Wakiso for permitting this study to take place and providing a support and introduction letter to the Medical Superintendent Entebbe Grade A Hospital.
4. Medical Superintendent, Entebbe Grade A Hospital for permitting the authors to conduct this study at the hospital and granting access to the Hospital archives for the dog bite victims treated at the hospital from 2014 to 2015.
5. The Staff of Entebbe Grade A Hospital for the cooperation and assistance to the authors to access the secondary data for dog bite victims handled at the Hospital from 2014 to 2015.

### References

- Anderson A. and Shwiff S. (2015). The cost of canine rabies on four continents. *Transboundary and Emerging Diseases*, 62(4), pp. 446-452.

- Chomel B.B. and Trotignon J. (1992). Epidemiologic surveys of dogs and cat bites in the Lyon area, France. *European Journal of Epidemiology*, 8(4), pp. 619-624.
- Cox M.M. (2012). Recombinant protein vaccines produced in insect cells. *Vaccine*, 30(10), pp. 1759-1766.
- Depani S., Kennedy N., Mallewa M. and Molyneux E. (2012). Evidence of rise in rabies cases in southern Malawi – better preventive measures are urgently required. *Malawi Medical Journal*, 24(3), pp. 61-64.
- Dietzgen, R.G. and Kuzmin, I.V. (2012). Rhabdoviruses: molecular taxonomy, evolution, genomics, ecology, host-vector interactions, cytopathology and control: Horizon Scientific Press.
- Fielding W. J., Gall, M., Green, D. and Eller W.S. (2012). Care of dogs and attitudes of dog owners in Port-au-Prince, the Republic of Haiti. *Journal of Applied Animal Welfare Science*, 15(3), pp. 236-253.
- Gilchrist J., Sacks J., White, D. and Kresnow M. (2008). Dog bites: still a problem? *Injury Prevention*, 14(5), pp. 296-301.
- Gongal G. and Wright A. E. (2011). Human rabies in the World Health Organization South East Asia region: Forward steps for elimination. *Advances in Preventive Medicine*, 2011(383870), pp.5
- Hampson K., Coudeville L., Lembo T., Sambo M., Kieffer A., Attlan M., Cleaveland S. (2015). Estimating the global burden of endemic canine rabies. *Public Library of Science Neglected Tropical Diseases* 9(4), e0003709.
- Herbert M., Basha R., and Thangaraj S. (2012). Community perception regarding rabies prevention and stray dog control in urban slums in India. *Journal of Infection and Public Health*, 5(6), pp. 374-380.
- Jemberu W.T., Molla W., Almwaw G. and Alemu S. (2013). Incidence of rabies in humans and domestic animals and people's awareness in North Gondar Zone, Ethiopia. *Public Library of Science Neglected Tropical Diseases*, 7(5), e2216.
- Knobel D. L., Cleaveland S., Coleman P. G., Fèvre E. M., Meltzer M. I., Miranda M. E. G., Meslin F.X. (2005). Re-evaluating the burden of rabies in Africa and Asia. *Bulletin of the World Health Organization*, 83(5), pp. 360-368.
- Lakestani N., Donaldson M. L., Verga M., and Waran N. (2011). Attitudes of children and adults to dogs in Italy, Spain, and the United Kingdom. *Journal of Veterinary Behavior: Clinical Applications and Research*, 6(2), pp. 121-129.
- Meslin F.X., and Briggs D. (2013). Eliminating canine rabies, the principal source of human infection: what will it take? *Antiviral Research*, 98(2), pp. 291-296.
- Nilsson M. (2014). Effect of rabies education programs on rabies awareness,



- attitudes towards dogs and animal welfare among children in Lilongwe, Malawi.
- Overall K. L. and Love M. (2001). Dog bites to humans—demography, epidemiology, injury, and risk. *Journal of the American Veterinary Medical Association*, 218(12), pp. 1923-1934.
- Ozanne-Smith J., Ashby, K. and Stathakis V. (2001). Dog bite and injury prevention—analysis, critical review, and research agenda. *Injury Prevention*, 7(4), pp. 321-326.
- Palamar M.B., Peterson M.N., Deperno C.S., and Correa M.T. (2013). Assessing rabies knowledge and perceptions among ethnic minorities in Greensboro, North Carolina. *The Journal of Wildlife Management*, 77(7), pp. 1321-1326.
- Quinlan K. and Sacks J. (1999). Hospitalizations for Dog Bite Injuries. Centers for Disease Control website.
- Taylor S. (2009). Encephalitis, myelitis and meningitis. *Small Animal Internal Medicine*. 4th ed. St. Louis, Missouri: Mosby Elsevier, pp. 1059-1062.
- Weiss H.B., Friedman D.I. and Coben J.H. (1998). Incidence of dog bite injuries treated in emergency departments. *Jama*, 279(1), pp. 51-53.