

Rabies record review in Addis Ababa

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Abstract

Introduction: Rabies is a highly fatal viral disease of all warm blooded animals including human, globally. Around 59,000 people die due to rabies annually world-wide; In Ethiopia, there are an estimated 2700 deaths per year.

Objective: To describe the distribution and magnitude of rabies in Addis Ababa between the years 2012 – 2016.

Methods: Secondary data were reviewed from the Ethiopian Public Health Institute rabies case record book registered in the years 2012 to 2016. All humans and animals that came to the Institute of zoonoses research case team from each sub-cities of Addis Ababa with rabies exposures were considered for the cross-sectional study. Microsoft excel and SPSS version 20 were used for the data analysis.

Results: A total of 6927 human rabies exposures were reported at Ethiopian Public Health Institute during 2012-2016, giving a mean annual incidence of ~46 human rabies exposures per 100,000 (59% males, 41% females). Out of these, 6199 (89.5%) and 573 (8.27%) were exposed to suspected dogs and cats respectively. Out of 6392 dogs brought for clinical examination, 5162(80%) of the dogs were unvaccinated. Out of 1638 animal brains investigated in the laboratory with Fluorescent Antibody Technique, 1010 (61.7%) were confirmed rabies positive. Among the laboratory confirmed positive rabies cases; high percentage of the animals came from Yeka 210 (21%) and lower number from Kirkos subcity 35 (3.5%). There were 14 human deaths due to clinical rabies reported during the five years in the city.

Conclusion: There are high number of confirmed rabies cases in Addis Ababa. Effective rabies management and control based on confirmed cases, and mass-immunization and control of free roaming dog populations is recommended.

Keywords: Rabies, Addis Ababa, Exposure, Dog

Introduction

Rabies is a highly fatal viral disease of all warm blooded animals including human. It is widely distributed across the globe, with only a few countries (mainly island and peninsulas) being free of the disease (Ethiopian Public Health Institute 2015). In developing countries, dogs remain the principal host transmitting infection to human (Deressa 2010 and Reta et al. 2014). Dog is the main animal to transmit human Rabies in Ethiopia (Ethiopian Public Health Institute 2015; Deressa 2010; Reta et al. 2014 and World Health Organization 2013).

The rabies virus is released in the saliva of an infected animal (World Health Organization 2013). The animal usually contracts rabies from the bite of an infected animal. The virus may also enter the body if the mucous membranes (the wet part of the eyes, nose, or mouth) or a scratch or break in the skin have contact with saliva containing the rabies virus. Once the rabies virus enters the body, it begins to multiply in the area near the entry site. If the infection is not stopped at this point, the virus will eventually invade the nerve cells in the area. Once the virus is in nerve tissue, it travels along the nerve to the center of multiplication (the brain). The virus may then spread to the salivary glands or other parts of the body. This incubation

period can range from days to years, but the average length is 3-8 weeks. Though, rabies is one of the vaccine preventable diseases, it is practically difficult and irreversible for medical treatment after the on-set of clinical manifestation of the disease. In spite of the availability of safe and effective preventive tools in global market, the burden of the disease could not be reduced in developing countries (Deressa et al. 2010). The clinical signs of rabies in animals vary widely. The classical signs include abnormal behavior, altered vocalization, pica, hyper sexuality, drooling saliva, aimless wandering, 'fly-snapping', 'bone-in-the-throat' syndrome, aggression, in coordination, paralysis and convulsions (Deressa et al. 2015).

In Ethiopia the three sub cities namely, Yeka, Kolfe and Gullele showed significant number in post exposure treatment and animal quarantine and clinical observation analysis result according to a longitudinal retrospective study done in Addis Ababa (Deressa et al. 2015). Rabies, in Ethiopia, is identified as the first of the five prioritized zoonotic diseases based on the severity of disease in humans, proportion of human disease attributed to animal exposure, burden of animal disease, availability of interventions, and existing inter-sectoral collaboration (Pieracci et al. 2016). However, Communication and collaboration

between the public and animal health sector was poor to inexistent regarding reporting and control of rabies cases (Tschopp et al. 2016). The total dog population and number of stray dogs in Addis Ababa are estimated to be 250,000 and 120,000, respectively and More number of animal rabies cases was confirmed in June, July, August and September; seasonal increase starting in May and reaching a peak in July (Abraham et al. 2010 and Yibrah and Damtie 2015).

The Ethiopian Public Health Institute is the only organization responsible for production of Human Rabies vaccine in the country. In 2012, the Institute has produced and distributed about 31,357 doses of Nerve tissue vaccine (Fermi type) produced from sheep brain. The rabies preventive and curative strategies depend upon the existence and delivery of veterinary clinical and laboratory diagnostic, awareness promotion, public health counseling and treatment services. The objective of this paper was, therefore, to describe the distribution and magnitude of rabies in Addis Ababa between the years 2012 - 2016. This surveillance data analysis will help the stakeholders on rabies prevention and control to have background information on the prevalence of rabies in Addis Ababa. It will also show how the trend of rabies is in the city on timely basis for the years 2012 - 2016. Occurrence of rabies in each sub cities will also be analyzed.

Materials and Methods

Study area and period: The study was conducted in Ethiopian Public Health Institute and retrospective data from September 2012 to August 2016 were taken for the study. Animal species and People coming to the institute from each sub cities of Addis Ababa were taken as the study population. The study was conducted from July to September, 2017.

Study Design: Descriptive cross sectional study design was used to describe the status of rabies by person, place and time variables. Retrospective data was collected from record books of rabies in animals and humans at the EPHI. Animal rabies data, human post exposure prophylaxis data and the laboratory investigation data for rabies in Addis Ababa in the years 2012 – 2016 collected from the annual report of Zoonoses research team of the Ethiopian Public Health Institute were used for analysis. The brain samples of animals biting humans have been submitted to the diagnostic laboratory of EPHI and were tested using the Fluorescent Antibody Test (FAT). Those dogs that were available for quarantine or killed after bite were tested.

Suspected dogs, human rabies exposure and population at risk: A decision was made on suspect

dogs which inflicted unprovoked bites through quarantine and follow up for 10 days, usually at the owner's premise and sometimes at the EPHI. The dogs were diagnosed clinically as stated in the Standard Treatment Guidelines for General Hospitals (Food, Medicine and Health Care Administration and Control Authority of Ethiopia 2014) that unvaccinated dogs which cause unprovoked bites must be suspected to be rabid. 'Suspected' refers to a case that is compatible with a clinical case definition (Rupprecht 2002). The human populations at risk (for the respective years, 2012–2016) of this study were estimated by projecting the results of the National Population and Housing Census of Ethiopia conducted in May 2007 (Central Statistical Agency of Ethiopia 2013).

Data analysis: The data collected were entered in a Microsoft excel sheet and analyzed with SPSS version 20. Quantum GIS was used to sketch a map showing the distribution of human population seeking PEP in Addis Ababa city. Descriptive statistics such as frequency were used where determined necessary. The incidence of human rabies exposure was calculated using Microsoft excel and scientific calculator. Ethical clearance was taken from Saint Paul's Hospital Millennium Medical College, Department of Public Health. Permission was also sought from Ethiopian Public Health Institute.

Results

Administration of post-exposure prophylaxis in humans: During 2012-2016, a total of 6927 humans from Addis Ababa were advised to take post exposure prophylaxis. The incidence of human rabies exposure cases as it was calculated from the mid-year population was 55, 49, 46, 43 and 37 per 100,000 populations for the five respective study years, giving a mean annual incidence of ~46 human rabies exposures per 100,000 (59% males, 41% females). Males were more exposed to rabies, comprising 4118(59%) of the total, in all the five years in which the study took place. Most of them were greater than 15 years old, 4082(58.9%). Under five children accounted the least 623(9%) seeking PEP from EPHI in the year.

The greater proportion, 89.5% (6199/6927), of post-exposure prophylaxis was given to humans exposed to rabid or rabies suspected dogs. The majority, 57.4% (3976/6927), of the post-exposure prophylaxis was given to humans bitten by animals with an unknown rabies status. Some of the PEP vaccines were prescribed while the dogs were under quarantine and observation for the development of clinical rabies.

Nerve tissue vaccine (NTV), the Fermi type, produced from rabies virus infected brain of sheep was the most

common, 78.5 % (5438/6927), vaccine type used for PEP in Addis Ababa. This vaccine is locally produced at Ethiopian public Health Institute. The use of cell culture vaccine for PEP was limited, 21.5 % (1489/6927). No immunoglobulin has been available for use in treating rabies in the country to my knowledge. Among the people coming from the ten sub cities of Addis Ababa to EPHI seeking PEP, high percentages of PEP was provided for people coming from Kolfe (16.02%), Yeka (14.63) and Bole (14.45%). However, lower percentages of human rabies PEP provision were also reported in Akaki-Kality (4.04%), Kirkos (4.61%) & Lideta (5.31%) sub cities (figure 1).

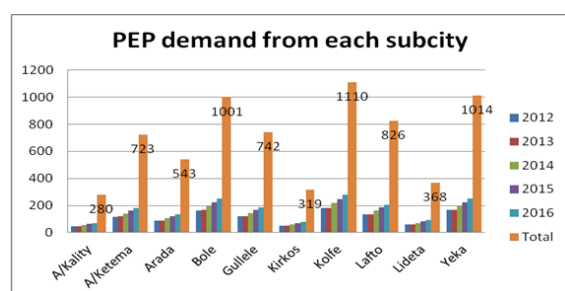


Figure 1: People visiting EPHI seeking PEP from each sub city, 2012-2016, Addis Ababa

But based on the population at risk in each sub cities, Bole, Addis Ketema and Gullele have the highest mean annual incidence (54, 47 and 46 per 100000 population, respectively) of human rabies exposures. In contrary, Kirkos and Akaki Kaliti have relatively

lower mean annual incidence (24 and 25 human rabies exposures per 100,000 population respectively). Anatomically, out of the 6927 people who came to EPHI seeking PEP, 8% (554/6927) were bitten on the head, 1524(22%) on the upper extremities (hand and arm), 623(9%) on the trunk, 3810(55%) on the lower extremities and the remaining 416(6%) were bitten on body parts involving different anatomical sites. There were 14 human deaths due to clinical rabies reported during the five years in the city. Half of them were females. The fatal case reports were from 5 subcities; Kolfe, Lafto, Yeka, Bole and Kirkos (4, 3, 3, 2, 2 cases) respectively. All of them had history of bite by dog. Face was the site of exposure for 3 of the cases. Only 1 of the biting dog was tested by FAT and was found positive. Among the 14 reports, 2 of them were given PEP (1 was given NTV and the other was given cell culture vaccine).

Rabies Diagnosis: A total of 6392 animal species were brought to EPHI for possible rabies examination. Out of these, 6100(95%) were dogs. Among these, 4880 (80%) of the dogs were unvaccinated. The vaccination status of 509(7.96%) dogs was unknown. Number of examined animals range from 1040 in 2016 to 1672 in 2012. Among the dogs brought for clinical examination 329 (5.4%) dogs were freely roaming.

High percentages of FAT confirmed animals for rabies came from Kolfe-Karaniyo, Nifas Silk Lafto and Yeka (16.95%, 16.65% and 16.25%) respectively but lower numbers from Kirkos, Addis-Ketema and Lideta and (3.86%, 5.05% and 5.55% respectively) sub cities (Figure2).

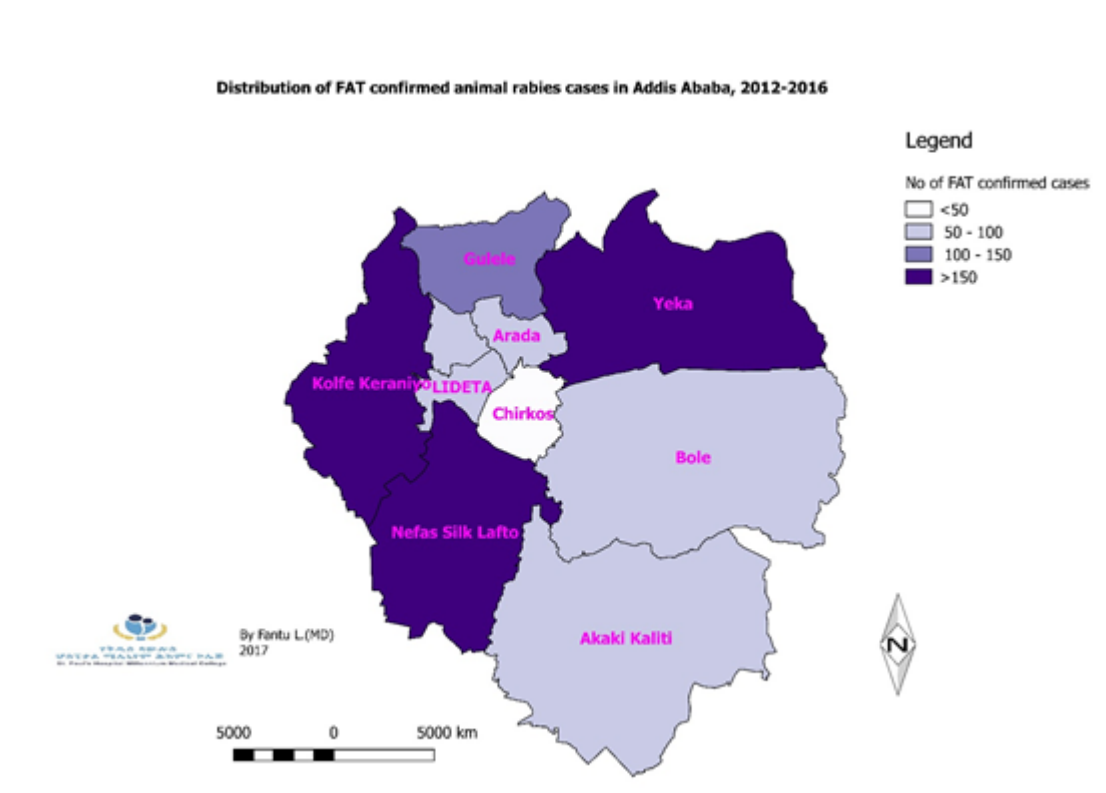


Figure 2: Map showing the distribution of FAT confirmed rabies cases in Addis Ababa, 2012-2016

One thousand and six hundred thirty eight brain samples were tested using FAT. Out of these, 1010 (61.7%) were found to be positive for rabies. The canine incorporates the highest percentage of the animal species (90.3%) among FAT confirmed brain samples followed by feline (5.25%). Bovines, simian, equine, vulpine, ovine, caprines and hyenine, all comprising (4.5%), were other animal species encountered in the institute (Table 1). Dogs, 87.24 %

(1429/1638) and cats, 7 % (114/1638) constitutes the major part of the animals brought for laboratory investigation of brain samples. The other animals include fox, monkey, cows, donkeys; goats, hyena and sheep (Table 2).

When we see the time trend of the rabies cases, highest significance figures were reported in the months July to September in the years 2012-2016 (Figure 3).

Table 1: Species of animal examined for rabies using FAT from each sub city, Addis Ababa, 2012-2016

Animal species	A/kality	A/kerema	Arada	Bole	Gullele	Kirkos	Kolfe	Lafto	Lideta	Yeka	Total
Canine	64	46	68	90	103	35	154	152	51	148	911
Feline	4	3	4	5	6	2	9	9	3	8	53
Simian (Ape, monkey)	0	0	0	1	1	0	2	1	0	1	6
Bovine	1	1	2	1	0	1	2	1	2	2	13
Equine	0	0	1	1	0	1	0	1	0	2	6
Vulpine (Fox)	1	0	0	0	2	0	2	2	0	2	9
Ovine (sheep)	0	1	0	1	1	0	1	1	0	0	5
Caprine (goat)	1	1	0	1	0	0	1	1	0	1	6
Hyenine (hyena)	0	0	0	0	1	0	0	0	0	0	1
Total FAT positive samples	71	52	75	100	114	39	171	168	56	164	1010

Table 2: Species of animal examined for rabies using FAT, Addis Ababa, 2012-2016

Year	Dog		Cat		Others	
	Brain Examined	No (%) Positive	Brain examined	No (%) Positive	Brain examined	No (%) positive
2012	394	281(71.3)	27	17(63)	26	14(53.8)

2013	185	108(58.4)	20	7(35)	11	4(36.4)
2014	272	160(58.8)	15	4(26.7)	9	3(33.3)
2015	294	191(65)	37	20(54)	36	20(55.6)
2016	284	171(60.2)	15	5(33.3)	13	4(30.8)
Total	1429	911(63.75)	114	53(46.5)	95	45(47.4)

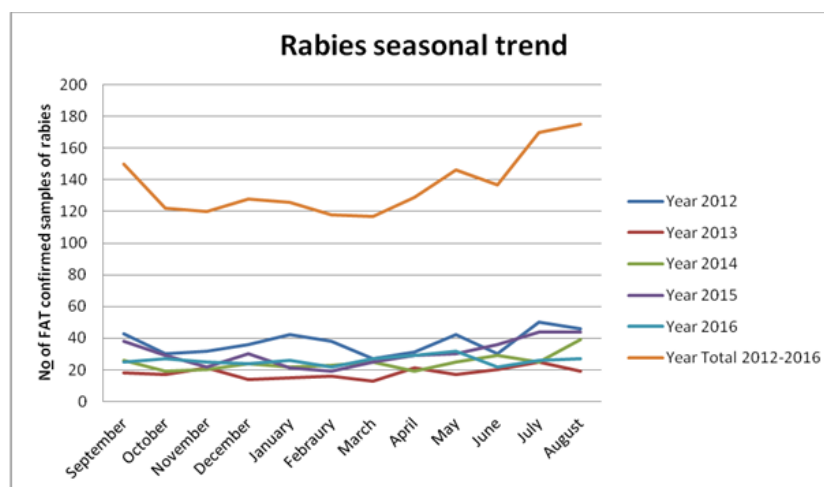


Figure 3: Time trend of laboratory confirmed rabies in the months of the year 2012-2016 in Addis Ababa

Discussion

This study was a longitudinal study aimed to assess the incidence of rabies in Addis Ababa and its public health impact in the years 2012-2016, retrieving the data recorded at Ethiopian Public Health Institute. Based on this study there is a mean annual incidence of ~46 human rabies exposures per 100,000 which is much higher than the incidence found in North Gondar with annual rabies exposure incidence of 2.33 per 100, 000 (Yibrah and Damtie 2015). This increased number of incidence in Addis Ababa may be described by the high number of freely roaming dogs and relatively high health seeking behavior of the community in Addis Ababa city.

The number of humans who visited EPHI seeking post exposure treatment against rabies during the year 2012-2016 varies between sub cities. This result revealed with high percentages of PEP was provided for people coming from Kolfe (16.02%), Yeka (14.63%) and Bole (14.45%). However, lower percentages of human rabies PEP provision were also reported in Akaki-Kality (4.04%), Kirkos (4.61%) & Lideta (5.31%) sub cities. The finding of frequencies of the sub cities is almost the same in percent with result of suspected animals under quarantine and clinical observation in all sub cities and this is due to the high percentage of animal population, mainly dogs, in the specific sub cities (Deressa et al, 2015). But based on the population at risk in each sub cities, Bole, Addis Ketema and Gullele have the highest mean annual incidence (54, 47 and 46 per 10000 population, respectively) of human rabies exposures. In contrary, Kirkos and Akaki Kaliti have relatively lower mean annual incidence (24 and 25 human rabies exposures per 100,000 population respectively).

Based on this study the overall percentage of laboratory confirmed positive animal rabies case in Addis Ababa is 61.7% which is similar to the findings of Abraham (Abraham et al. 2010). Domestic carnivores were the principal animals responsible for maintenance and transmission of rabies in the area even though several animal species were involved. This shows that no emphasis has been given to rabies by the relevant veterinary, medical and public authorities.

Among the total of 6392 animal species brought to EPHI for clinical observation and quarantine only 15.8% (1010/6392) were found to be positive in laboratory confirmation by FAT. This clinical observation shows that all biting dogs are not infected by rabies. The aggressive behavioral change of male dogs during mating and breeding season can also contribute for biting due to physiological reaction

without rabies clinical manifestation (Deressa et al. 2010). Based on the 10 days clinical observation at the Ethiopian Public Health Institute, dogs were the first most important sources of rabies and cats are next to dogs in Ethiopia. This was evident from the 1429 total dog brain samples collected in the years 2012-2016 out of which 911 (63.75%) were positive cases.

Among 114 cat brains examined 53 (46.5%) were positive for the same years. The laboratory confirmed rabies cases in other wild (hyenas, fox and monkey) and domestic (cow, donkey, sheep and goat) animals showed 45/95 (47.4%) positive cases. Hence, the interface of wild and domestic animals in grazing areas, water points and backyard waste disposal areas can facilitate the circulation of the virus in the country. This report is supported with previous records by Deressa (Deressa et al. 2010) and other studies (Fekadu 1993) which showed that dogs are primary cause and cats are secondary for fatal human rabies cases and responsible in maintaining as well as dissemination of rabies in Ethiopia. The highest number of cases were reported in the months July to September. This finding is similar to the one done by Mekonnen Fekadu, that reported rabies outbreak occur annually between July and September (Fekadu 1993). Other authors also reported the seasonality of rabies and highest incidence in cold season; which coincide with the mating season of dogs that may allow the greater contact between animals (Deressa et al. 2010).

The clinical observation and laboratory results across the origin of animals in each sub city of Addis Ababa showed High percentages of FAT confirmed animals for rabies came from Kolfe-Karaniyo, Nifas Silk lafto and Yeka (16.95%, 16.65% and 16.25%) respectively but lower numbers from Kirkos, Addis-Ketema and Lideta and (3.86%, 5.05% and 5.55% respectively) sub cities. This is in agreement to the finding of a study done by Deressa et al in the retrospective study in the city (Deressa et al. 2015).

Conclusions and Recommendations

The study shows that there is high incidence of human rabies exposure in Addis Ababa. Most of the people were bitten on lower extremities and males were found highly exposed than females. The principal vectors of rabies in the city are dogs and most of them were found unvaccinated. Seasonal increments for positive results in animals were reported during July to September. Mass-immunization and control of stray dog populations should be strengthened. There is also need for further

research on public awareness of rabies in Addis Ababa and nation-wide.

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References

- Abraham A, Fasil M, Kedir H, Garoma G, Asefa D, Eshetu Y, et al. (2010). Overview of rabies in and around Addis Ababa, in animals examined in EHNRI Zoonoses Laboratory Between, 2003 and 2009. *Ethiopia Veterinary Journal*, 14 (2): 91-101.
- Beyene TJ, Monique CM, Mourits & Henk H (2017). Dog rabies data reported to multinational organizations from Southern and Eastern African countries. *Bio Medical Centre Research Notes*, 10:199.
- Central Statistical Agency of Ethiopia (2013): Population Projection of Ethiopia for All Regions at Woreda Level from 2014–2017. August 2013, Addis Ababa.
- Deressa A, Ali A, Beyene M, Selassie BN, Yimer E & Hussen K (2010). The status of rabies in Ethiopia: A retrospective record review. *Ethiopian Journal of Health Development*, 24(2): 127-132.
- Deressa A, Getahun G, Bogale A, Sefir D, Haile A, Aklilu M, et al. (2015). Longitudinal Study of Animal and Human Rabies Incidence in Addis Ababa during 2010-2012. *Journal of Veterinary Advances*, 5(11): 1153-1162
- Ethiopian Public Health Institute (2015). Human Rabies Surveillance and Outbreak Management Guideline. June 2015.
- Fekadu M (1993). Canine rabies. *Onderstepoort Journal of Veterinary Research*, 60:421-427
- Food, Medicine and Health Care Administration and Control Authority of Ethiopia (2014). Standard Treatment Guidelines for General Hospitals. Third Edition. Addis Ababa, Ethiopia, 182–7.
- Nel L H (2013). Discrepancies in data reporting for rabies, Africa. *Emerging infectious diseases*, 19(4): 529.
- Pieracci EG, Hall AJ, Gharpure R, Haile A, Walelign E, Deressa A, et al (2016). Prioritizing zoonotic diseases in Ethiopia using a one health approach. *One Health*, 2:131–135.
- Reta T, Teshale S, Deresa A, Ali A, Mengistu F, Sifer D, et al. (2014). Rabies in animals and humans in and around Addis Ababa, the capital city of Ethiopia: A retrospective and questionnaire based study. *Journal of veterinary medicine*, 179-186.
- Rupprecht CE, Hanlon CA & Hemachudha T (2002). Rabies re-examined. *Lancet Infect Dis*, 2:327–43.
- Schopp R, Bekele S & Aseffa A (2016). Dog Demography, Animal Bite Management and Rabies Knowledge-Attitude and Practices in the Awash Basin, Eastern Ethiopia. *PLoS Neglected Tropical Diseases*, 10(2).
- World Health Organization Expert Consultation on Rabies (2013). World Health Organization Technical Report Series No. 982. Second report. World Health Organization.
- Yibrah M & Damtie D (2015). Incidence of human rabies exposure and associated factors at the Gondar Health Center, Ethiopia: a three-year retrospective study. *Infectious Diseases of Poverty*, 4:3.

