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High rabies burden and low vaccination status among dogs inflicting bite in Addis Ababa: an urgent call for action

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Abstract

Introduction: Rabies remains a global threat, killing approximately 60,000 people every year. In Ethiopia, dogs are the main reservoir of the disease. Animals also estimate the burden of the disease.

Methodology: Data from 2016 to 2020 were extracted from a rabies cases recording book of the Ethiopian Public Health Institute. Proportions and trends over time were analyzed. Brain samples of dogs were diagnosed with a Fluorescent Anti Body test.

Results: A total of 6,001 dogs inflicting bites were brought to the laboratory. A high proportion of dogs 4,389 73.14% were not vaccinated. The total number of dogs brought to the laboratory was decreasing over the last five years. Among 1,216 dog brain samples examined 855 (70.3%) confirmed rabies. The proportion of rabies cases was increasing from 8.5% in 2016 and 32.6% in 2020. The highest rabies proportion (33.8%) was reported in 2018. Out of the total (2,156) dogs inflicting bites and observed for 10 days, only 468 (21.7%) of the observation report was tracked and reported.

Conclusions: There is a high proportion of rabies in dogs inflicting bites in Addis Ababa. The findings are alarming with seven out of ten dogs diagnosed being infected with rabies. Only two dogs were vaccinated out of ten dogs inflicting bites. Rabies became a serious public health problem in the city that needs urgent health action from all sectors including the city administration.

Key words: Dog bite; Ethiopia; operational research; rabies; SORT-IT.

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Introduction

Rabies is a viral infection that affects the central nervous system of all warm-blooded animals including humans. Globally, human mortality from canine rabies is estimated to be 60,000 annually [1]. It also causes about 3.7 million disability-adjusted life years (DALYs) burden and 8.6 billion USD economic losses per year in the world. In developing countries, domestic dogs are the major source of infection and responsible for about 99% of all human rabies cases [2].

Ethiopia has the highest rabies death rate in the world, estimated that 2,700 people died with the disease each year [3]. Domestic dogs are the major sources of infection [3,4]. The disease has for many years been left out of the national priority list of neglected tropical diseases (NTDs) [5]. Policies are not addressing

handling of stray dogs: poor management of owned dog's, limited supply of anti-rabies dogs' vaccine contributes to the high mortality rate [6]. Rabies is prevalent in Addis Ababa, a study conducted by Reta *et al.* 2014 among dogs diagnosed at the EPHI in Addis Ababa during 2008 to 2011 showed 78% (726) [7].

Another study by Lombamo *et al.* 2020 showed that 80% from the time 2012-2016, of 6392 canines brought for clinical examination were unvaccinated, and 61.7% of 1,638 animal brains examined were confirmed rabies positive [8]. Ethiopia has endorsed a national rabies control and elimination strategy that is scheduled to be completed by 2030 [6]. So after the strategy's permission in 2018, various activities are carried out, such as strengthening and integrating the surveillance system, expanding laboratories, implementing

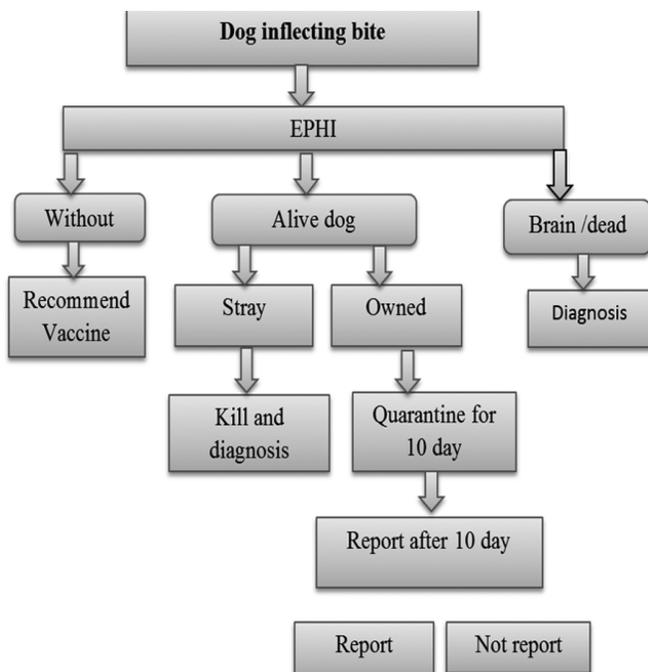
integrated dog bite management, vaccine production, mass dog vaccination, providing Post Exposure Prophylaxes (PEP) to exposed humans, and building capacity.

All dogs inflicting bite including laboratory analysis of rabies in and round Addis Ababa is managed thru EPHI. The rabies case management system recommends 10 days quarantine for those suspected brought alive and owned. However, the quarantine report outcome has remained un-captured by the management system and the reporting is dependent on the owner’s discretion to confirm the observation or not.

Thus, recent and reliable data on dog’s vaccination status, the magnitude of rabies had identifying gaps on the surveillance system especially on home quarantine report outcome is deemed, it necessary to support the national rabies control and elimination target as guidance for formulating effective strategy and interventions based on evidence. In addition, the only information is reported by a study that was conducted by Lombamo et al. 2020 6 years ago and status of the disease for the last six years have not been addressed [8].

The aim of this study is, to show the trend of rabies cases, related vaccination status and the gap on quarantine report outcome among dogs inflicting bite reported at the EPHI rabies management services in Addis Ababa, Ethiopia between 2016 and 2020.

Figure 1. Florescent Antibody Test (FAT) laboratory technique flow chart.



Methodology

Retrospective analysis of routine programme data obtained from EHPI rabies cases record book from 2016 to 2020.

General Setting

Ethiopia is a landlocked country in the horn of Africa with a population of 99.4 million. The country has one of the poorest health coverage (39%) and the current health expenditure per capita is 24 USD [9]. Ethiopia has the third highest number of NTD cases in Africa, 16 of the 20 NTDs in WHO list present [1].

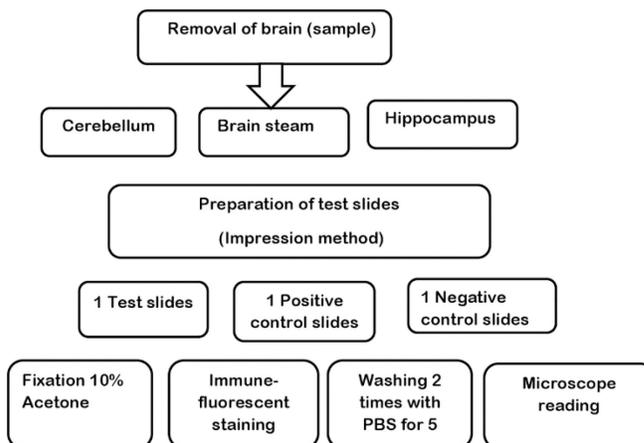
Specific Setting

Addis Ababa is the capital city of Ethiopia and covers an area of 530 km² with an estimated population of around 6.4 Million. The total dog population is estimated to be 370, 000 of which 250,000 are owned and 120,000 stray dogs [10].

Laboratory diagnosis and rabies case management services

EPHI is the only national rabies diagnostic and case management center. It supports the national surveillance data system by producing laboratory-based reports. People who have been exposed to bites by dogs present them to EPHI with dead or alive. In the case of dead dogs, a sample of the dog brain is tested for rabies using Florescent Antibody Test (FAT) (Figure1). Assessing vaccination status of dogs inflicting bites and provision of initiation PEP for exposed people, counseling services and home quarantine follow-up are the key activities conducted (Figure 2).

Figure 2. Flow of management services of dogs inflicting bite in EPHI.



Study population and data source

All dogs inflicting bite during 2016 to 2020 and recorded in the rabies cases recording book of EPHI were included in the study.

Data collection and validation

Data from the rabies cases recording book were extracted and double entered in Microsoft Excel sheet and two files were compared and discordances were resolved by cross checking with the original data source.

Data analysis

Data were analyzed using in the Microsoft excel 2013. Percentage and proportions calculated and tables and figures used for presenting the analysis findings.

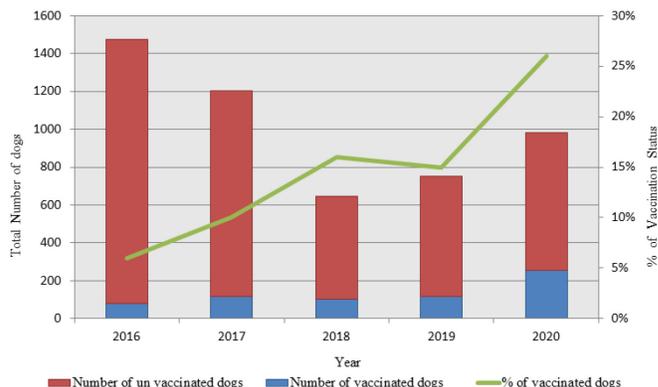
Ethics considerations

Local ethics approval was sought from the EPHI ethics scientific review board. International ethics approval was sought from the Union Ethics Advisory Group of the Center for Operational Research at the International Union against Tuberculosis and Lung Disease, Paris, France. Personal identifiers of the dog-owners were not extracted and only aggregate data were used for analysis. The electronic database was kept on a password protected computer of the principal investigator.

Results

A total number of 6,001 dogs inflicting bites were brought to EPHI rabies diagnostic and exposure management service from 2016 to 2020. Among all dogs, 3,840 (63.9 %) were brought alive, 1,216 (20.2 %) were dead and the rest were not recorded. The total number of dogs brought to EPHI during the study period has been decreasing (Table 1).

Figure 3. Vaccination status of dogs inflicting bite in Addis Ababa and brought to Ethiopian Public Health Institute, during 2016-2020.



The majority 4,389 (86.7%) of the dogs are not vaccinated. A very limited number of dogs 670/6,001 (11.2%) were found to be vaccinated. However, the vaccination status of dogs increased over the study period. There has been a decrease in the total number of unvaccinated dogs and an increase in vaccinated dogs brought to EPHI. The highest vaccination percentage was 253/981 (25.7%) reported in 2020 and 82/1,474 (5.5 %) was the least vaccination reported in 2016 (Figure 3).

Total numbers of 1,216 dog brain samples were examined for rabies and the proportion of rabies cases in dogs during the last five years was 855 (70.3%). Rabies cases increased exponentially over the study period from 122/1,431 (8.5 %) in 2016 to 181/554 (32.6 %) by the year 2020. During the study period, high rabies cases 206/609 (33.8%) were reported in 2018 (Figure 4).

More than half of the dogs inflicting bites and brought alive to EPHI for rabies examination were recommended to be quarantined at home and observed

Table 1. The observation report outcome among rabies suspected dogs and quarantined for 10 days, during 2016 to 2020, In Addis Ababa, Ethiopia.

Activities	2016		2017		2018		2019		2020	
	N	%	N	%	N	%	N	%	N	%
Status of dogs										
Total	1,749		1476		923		946		907	
Alive	978	56%	795	54%	670	73%	751	79%	646	71%
Dead	265	15%	262	18%	253	27%	178	19%	261	28%
Not record	506	29%	419	28%	0	0%	17	2%	0	0%
Required 10 Days observation										
Total	978		795		670		751		646	
No	460	47%	277	35%	280	42%	278	37	389	60%
Yes	518	53%	518	65%	390	58%	473	63	257	40%
Reported Observation Outcome										
Total	518		518		390		473		257	
No	415	80%	405	78%	305	78%	385	81	177	69%
Yes	103	20%	113	22%	85	22%	88	19	80	31%

for 10 days 2,156/3,840 (56.1%). However, the observation report outcome was only available for 469/2,156 (21.7 %). More than 1,687/2,156 (78.2%) of the quarantine observation reports were not tracked and reported to EPHI. The overall observation report outcome consistently decreased over the last five years. In 2020 the lowest observation report was registered. Of the total number of dogs brought to EPHI during the study period, the presentation status of 942/6,001 (15.6 %) dogs was not recorded (Table 1).

Discussion

This study shows an extended period in the trend of rabies cases and compares the vaccination status of dogs that are inflicting bites in Addis Ababa. The findings are alarming with seven out of ten dogs diagnosed found to be infected by rabies 855/1,216 (70.3%) and only two dogs are vaccinated out of ten dogs brought to EPHI for rabies examination. Rabies in dogs is prevalent in Addis Ababa and the trend has been increasing exponentially over time from 2016 to 2020. The high proportion of rabies cases in dogs is a significant risk for transmission to humans.

These findings are in line with other similar studies conducted in 2010 and 2016 that showed the highest proportion of rabies cases at 77.6% and 61.7 % reported in Addis Ababa respectively [8-13]. The persistently high proportion of rabies cases over a long time could indicate the high level of transmission of the disease in Addis Ababa. Some of the reasons for this observation are likely to be related to a large number of stray dogs, a lower level of vaccination coverage, poor management of owned dogs together with low community awareness, and lack of policy or inadequate implementation of guidelines. Reta *et al.* 2014 observed

that one of the reasons for the high rate of unvaccinated dogs includes the limited availability of the vaccine, the high cost of the vaccine, and lack of community awareness [7].

Other study findings by Lombamo *et al.* 2020 showed that out of a total of 6,100 dogs that inflicted a bite in Addis Ababa from 2012 to 2016, 4,880 (80%) were unvaccinated. In the current study, the unvaccinated status has increased by six percent 4,398/6,001 (86%) in comparison to the previous study [8]. Even though there is the high proportion of unvaccinated dogs, the vaccination showed an increasing and progressive trend from 2016 to 2020. This could be indicative of the activities conducted after the prioritization of rabies as the number one zoonotic flagship disease since 2017; in which integrating and decentralizing counseling services and bite management with sub-cities veterinary clinics and health centers was one of the priority intervention focus.

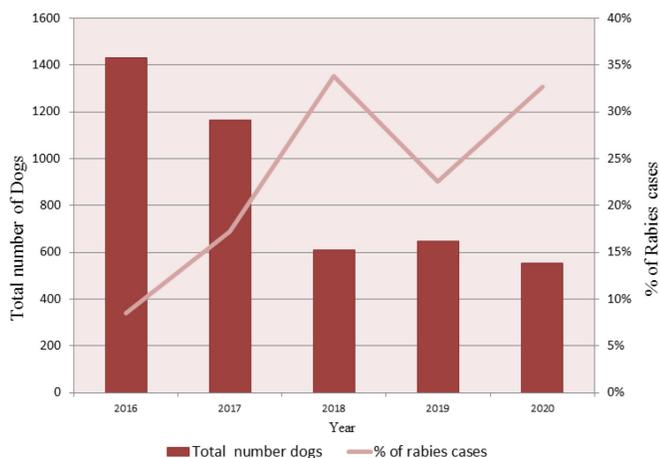
The study has identified a reporting gap on tracking dogs that are recommended to be observed for 10 days. Out of the total dogs quarantined from 2016 to 2020, only 469/2,156 (21.7%) were reported and the status described. The reason for this reporting gap is that the quarantine system is dependent on the dog owner’s willingness to report or not. This situation contributes to masking the real burden of the disease.

Our findings support the need for a dramatic paradigm shift in the prevention and control of rabies in dogs. An integrated and sustainable rabies control program should be established and consistently employed.

We recommend the following strategies. 1) All stakeholders including the Addis Ababa city administration need to be aware of the magnitude and potential impact of rabies in the city and integrated efforts for control. 2) The community needs to be aware that most of the dogs inflicting bites could be rabid and need to be reported immediately. 3) Mass vaccination of dogs including stray dogs need to be scaled up and conducted periodically 4) The quarantine observation surveillance system needs to be digitized and able to capture the observation report through home visit; which helps to determine the real burden of rabies in Addis Ababa.

Our study had a few limitations. Rabies case recording book was limited some of the records especially on the status of dogs were missing which made triangulation with other variables inadequate.

Figure 4. Annual trend of confirmed rabies cases in dogs diagnosed at Ethiopian Public Health Institute, during 2016-2020.



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