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Awareness level of human African trypanosomiasis (HAT) and animal African trypanosomiasis (AAT) among farmers in Talek, Narok County, Kenya

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Abstract
African Trypanosomiasis is a neglected tropical disease that affects both humans and livestock across the continent of Africa, whose primary vector is the tsetsefly (Allsopp, 2001). Based on both their morphological and ecological specifics, there are 31 tsetse (Glossina) species which fall in three subgenera (Cecchi *et al.,* 2008). African animal trypanosomiasis (AAT) or Nagana disease is caused by *Trypanosoma congolense*, T. vivax and T. *brucei brucei*. In wild animals, these parasites cause relatively mild infections while in domestic animals they cause a severe, often fatal disease (Steverding, 2008). In livestock, trypanosomiasis which causes anaemia, emaciation, production loss and death, is arguably the most important constraint to livestock development in Sub-Saharan Africa (Seyoum *et al.,* 2013). Transmission occurs by fly feeding on blood of an infected mammalian host, after which the parasites enter the digestive tract, followed by a complex process of establishment in the midgut and maturation in the salivary glands before finding an uninfected host (Brun *et al.,* 2010). Human African trypanosomiasis (HAT) or sleeping sickness is caused by two subspecies of *T. brucei; T. brucei gambiense and T. brucei rhodesiense.* In East and Southern *Africa, T. b. rhodesiense* gives rise to the acute form of HAT (Steverding, 2008) which has two stages with the first characterized by general malaise, headache, and fever of an undulating type and the second stage occurs when the parasites invade internal organs and the central nervous system (Barrett *et al.,* 2003). The disease is fatal and if not timely and appropriately treated results in death. This paper presents the awareness status of human African Trypanosomiasis and African animal Trypanosomiasis among pastoralist farmers in Talek area of Mara division, Narok County.

Keywords: awareness, tsetse, African animal trypanosomiasis, human African trypanosomiasis

Introduction
Tsetse flies in the family Glosssinidae transmit Trypanosomiasis, a disease that affects humans and livestock. They feed exclusively on blood. This study was carried out in Talek area which encompass two conservancies and an area within the Maasai Mara Game Reserve in 2015. Trypanosomiasis impoverishes livestock farmers and threatens food security.

In the early decades of the 20th Century, severe epidemics of human African Trypanosomiasis affected many African countries. The then colonial authorities attempted to combat these epidemics primarily by the development of trypanocidal drugs and their use in surveillance and treatment campaigns. Because of the specialized nature of the techniques employed, the control of the disease became, in many countries, the responsibility of specialized units, usually within the Departments of Veterinary Services (Jordan, 2009) [8]. Mara area in Narok County is part of the arid and semi-arid lands (ASALs) that comprise 80 per cent of Kenya's landmass, including rangelands that support extensive livestock operations and wildlife. These areas are home to pastoralists who form 20 per cent of the Kenyan population. Pastoralists occupy 74 per cent of the ASALs and own 60 per cent of cattle and 80 per cent of sheep and goats (Nyariki, 2009) [11]. Livestock production is a major component of the Maasai economy and indeed the Kenyan economy, and goes well beyond direct food production. It contributes about 10 per cent of the gross domestic product (GDP) (Nyariki, 2009) [11].

In Kenya, eight species of tsetse fly exist and live in diverse habitats, with their populations concentrated in six distinct zones (De Visser & Messina, 2009; McCord *et al*., 2012). They are *Glossina brevipalpis*, *G. fuscipleuris*, *G. longipennis*, *G. fuscipes*, *G. austeni*, *G. morsitans*, *G. swynnertoni*, and *G. pallidipes.* (Pollock, 1982a). About 8% of Kenyan land mass is protected area for wildlife conservation (KWS, 2015). These areas provide a unique ecological niche that allows for a favorable interplay between wildlife reservoir hosts and vector tsetse flies (Munang'andu *et al*., 2012). One of the National reserves is Maasai Mara National Reserve (MMNR), where wildlife and Maasai community who are pastoralists live side-by-side. It has traditionally been used by the community as grazing area for livestock, with frequent movements depending on climate variation and the presence of disease bearing tsetse flies (Seno & Shaw, 2002; Lamprey & Reid, 2004) [12].

The presence of tsetse and Trypanosomiasis in an area directly affects the tourism industry, because tourists shun infested areas due to the pain and discomfort associated with a tsetse bite and the risk of contracting sleeping sickness.

Tourism industry accounts for 21% of total foreign exchange earnings and up to 12% of the Country's GDP while wildlife contributes 70% of tourism earning. The threat to wildlife and unwillingness of tourists to visit tsetse infested areas contributes

to loss in tourism earning. To attain the tourism goals in the Vision 2030, T &T eradication will be paramount (Tsetse and Trypanosomiasis Eradication Strategy-2011 MoLD Vol. 12, 2011).

The conservation areas are home to large populations of wildlife which are free ranging and act as source of blood meal to tsetse flies and carriers of pathogenic trypanosome species. Most of the conservation areas are tsetse infested but there is no tsetse control or monitoring activities in most of these areas. Trypanosomiasis is therefore a threat to livestock production in the areas immediately surrounding the conservation areas. Migratory corridors and common grazing areas of both livestock and wildlife is also a problem in tsetse and Trypanosomiasis management. Cases of human Trypanosomiasis (*T. brucei rhodesiense)* occur in some parts of northern Tanzania bordering Mara game reserve posing a threat to tourism (Tsetse and Trypanosomiasis Eradication Strategy-2011 MoLD 12)

Materials and Methods

Study Area

The study was conducted at Talek area of Mara Division, Narok County (Fig. 1). Talek consists of a small number of villages located on the northern boundary of Kenya's famous Maasai Mara National Reserve, which is 120 km south east of Narok. With latitude °25'S and longitude 35° 22'E, Talek is part of the Mara Division, Koiyaki location whose group ranches cover Koiyaki and Aitong areas. Most of the settlements extend along the Talek River and include Irban, Ntipilikwani, Ole Kasoe, Talek, Ndoniyo and Kolong.

Communities exist further inland to the north and west and are all part of the Maasai ethnic group which has retained most of their traditional culture. Talek lies in a semi-arid area, where the main economic activity for the local community is traditional pastoral livestock husbandry. The study area borders the Maasai Mara National Reserve and is represented by areas both within and outside the Maasai Mara Park (protected area). It included OlareOrok conservancy, Naboisho conservancy and along Talek River. Tsetse habitats are forested areas along the rivers and in clusters of vegetation of *Croton megalocarpus* found as isolated patches within the Conservancies. The selection of the study area was purposive as it represents rural Kenya affected by tsetse fly menace. According to Mugenda and Mugenda (1999), purposive sampling is a sampling technique that allows the researcher to use cases that have the required information with respect to the objectives of the study. Figure 1 presents the study area map.

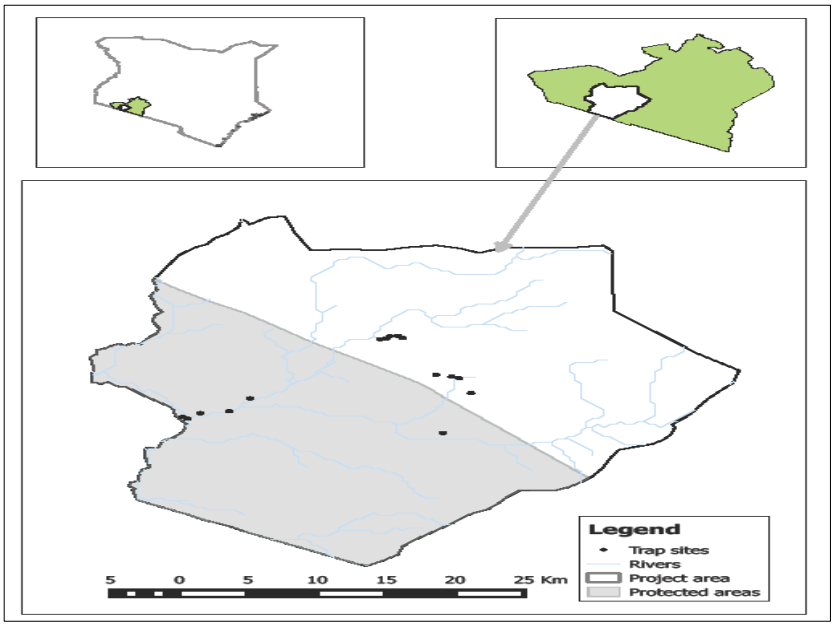

Fig 1: Study area

This study used both probability and non-probability sampling. The study area was sampled purposively, the divisions were done systematically, and the respondents were chosen using simple and proportionate random sampling methods. 50 respondents were selected from the area. The following formula was employed to come up an appropriate sample for the study (Kothari, 2004) [9].

$$n = \frac{z^2 . \delta^2}{e^2}$$

Where *n* is the sample size, z = standard variation at a given confidence level (α = 95%), e = acceptable error (precision) and δ= standard deviation of the population Z = 1.96, e = 0.05, δ=0.18. Standard deviation is estimated from previous studies. This gives a sample of 49.7 which is rounded to 50 cases. The data was collected in each case by the researcher or a research assistant. The breakdown of the total sampling frame is presented in Table 1.

Table 1: Human population size and density

Division	Area (km²)	Population	Number of people sampled
OlareOrok	167.9	273	17
Naboisho	127.7	552	33
Total	295.6	825	50

Data for the study were collected through a questionnaire and direct observation. The awareness index was designed to range from 0-1. The questions relating to AAT & HAT awareness in the questionnaire were scored and every respondent's total score

was tabulated. Out of the total sampled population, there were 3 ranges, that is 0- 0.3, 0.3- 0.6 and 0.6- 1.00. The 3 ranges of score are further illustrated in Table 2.

Table 2: Awareness Index on HAT and AAT

Range	Interpretation
0.0 – 0.3	Very little or no knowledge of AAT & HAT
0.31 – 0.6	Little knowledge of AAT & HAT
0.61 – 1.0	Moderate knowledge of AAT & HAT

The consideration of the above parameters is that the questions were not structured to prove that there is evidence of people or animals infected by trypanosomes, it was to gauge awareness levels of farmers for the two diseases.

Results

Gender Distribution of respondents

A deliberate effort was made to give consideration to gender in the sampling process. This was based on the understanding that gender roles in Maasai community and the associated challenges are different. For example, the study observed that women were reluctant to respond on issues touching on livestock health citing culture. The study managed to capture the views of 23 women and 27 men.

Respondents' Age in Years

Majority of the respondents (38%) were aged between 30-39 years, 14% were between 40 to 49 years, and 8% were aged between 50-59 years while older persons aged above 60 years were the minority. Person's below 29 years of age constituted 36%. Fig 2 below summarizes age categories sampled.

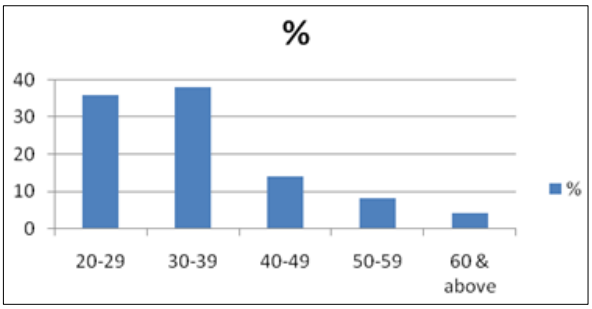

Fig 2: Respondent's age in years

Respondents' Level of Education

Majority of the respondents (48%) had no formal education; 24% had primary education while 18% had secondary education. About 8.0% had attended college education while 2% had attained university education (Fig.3)

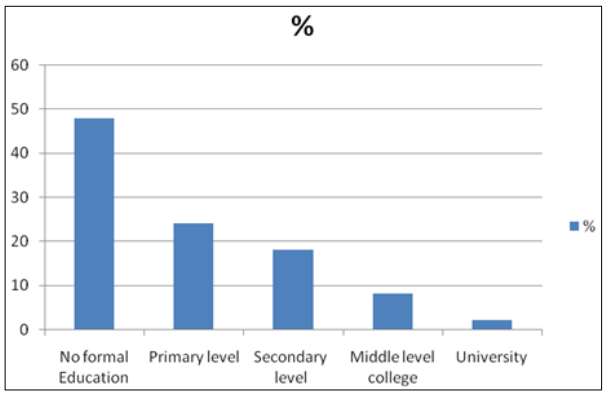

Fig 3: Respondent's level of education

Respondents Knowledge about Tsetse Fly

Majority of those that know it (72.2%) described tsetse fly as an insect resembling house fly. Other descriptions about tsetse fly were reported as biting fly (9.3%), bee-like fly (6.3%), mosquito-like fly (5.6%) and tick-like fly (4.4%). The least (2.2%) respondents could not describe the fly (Fig 4).

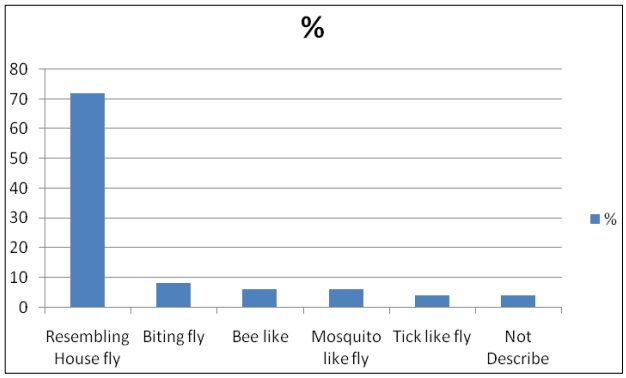

Fig 4: Respondents Knowledge about tsetse Fly

Respondent's level of Awareness about HAT and AAT

From a scale of 0 to 1, the researcher assessed their level of awareness where 0 to 0.3 means Low awareness status, 0.4 to 0.7 means Moderate awareness and 0.8 to 1 means High awareness. Results from analysis shows that majority of the respondents (72.0%) had moderate level of awareness followed by (18.0%) that had low awareness status while a small percentage had High awareness (Figure 4).

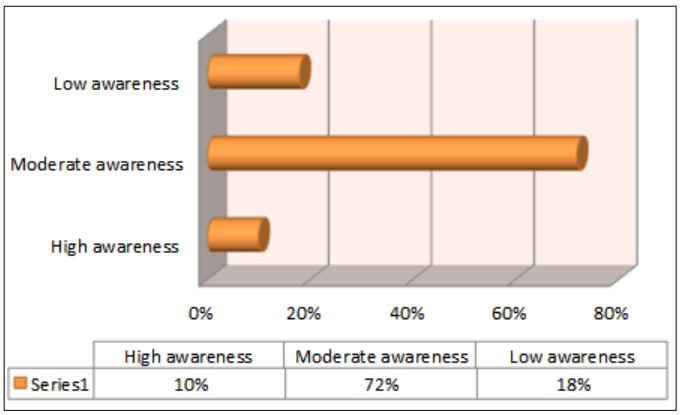

Fig 5: Level of awareness about HAT and AAT

Cases of Human African Trypanosomiasis (HAT) and African Animal Trypanosomiasis (AAT)

Results from questionnaire analysis show that about 14% reported that they and some members of their families had fallen sick as a result of being bitten by tsetse fly. About 82% cases were reported to have occurred among various types of livestock, as shown in Table 3.

Table 3: Percentage of cases of human African Trypanosomiasis (HAT) and African Animal Trypanosomiasis (AAT)

Type of items	Has been sick as a result of tsetse fly	Has not fallen sick as a result of tsetse fly
Human	14	86
Animals	82	18

Relationship between gender of respondent and Awareness of Human African Trypanosomiasis and Animal African Trypanosomiasis

There was a statistical significant relationship between the gender of respondent and level of awareness of Human African Trypanosomiasis and Animal African Trypanosomiasis (R^2 = 0.246, $P < 0.05$). This is depicted in Table 4.

Table 4: Model summary of awareness of HAT

Model	*R*	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics				
					R^2 Change	F Change	df1	df2	Sig. F Change
1	.496[a]	.246	.170	.45915	.246	3.211	6	59	.009

Relationship between education level of farmers and their level of awareness on Human African Trypanosomiasis and Animal African Trypanosomiasis

The results from analysis showed that there is a statistical significant relationship between farmers level of education and their awareness status of Human African Trypanosomiasis and Animal African Trypanosomiasis (R^2 = 0.364, P < 0.05. Results showed that those who are educated were likely to be more informed about the tsetse fly. The hypothesis (H1) that farmer's level of education does not improve their level of awareness of HAT was rejected meaning education influenced their level of awareness and knowledge. This is depicted in Table 5.

Table 5: Model summary showing how the level of education of the people of Talek improve their level of awareness of HAT/AAT

Model	*R*	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics				
					R^2 Change	F Change	df1	df2	*P*-Value
1	.603[a]	.364	.299	.38770	.364	5.623	6	59	.000

Discussion

Findings of this study show that communities in Talek have low to moderate knowledge of HAT and AAT. The community is also aware of the activities that expose an individual to tsetse bites and therefore the risk of contracting HAT and AAT. Of the respondents who knew tsetse fly, the majority reported to have experienced at least a tsetse bite in their lifetime. The frequently mentioned health risks associated with tsetse bite in humans were said to be sleeping sickness, fever, malaria and headache. Majority of them stated that their livestock get emaciated, have starring coat, decumbency and low milk production. The study showed that there was a significant correlation between the level of education of the respondent and knowledge of HAT and AAT and its control. Discussions with farmers revealed that the main source of HAT and AAT information to the community was reported to be victims in previous attacks and the kind of information frequently received was the symptoms or signs.

Before communities are engaged in active programmes for controlling tsetse and HAT, it is important that their knowledge, attitudes and practices are understood and awareness process be done. Even in situations where the communities are sufficiently aware of Trypanosomiasis and its consequences, there may still be a need to increase community's awareness about known control techniques to facilitate their participation in future tsetse fly and HAT, AAT control activities. According to the community the challenges facing them in controlling tsetse flies and Trypanosomiasis were high prices of drugs coupled with high tsetse fly density hence leading to re-infection and re infestation after treatment.

Knowledge did not coincide with application of control measures. Despite the level of awareness, only a small proportion of cattle owners use synthetic pyrethroid applications. Of the few who use them, an even smaller percentage uses them correctly. This disparity between knowledge and its application is an important observation in the context of knowledge versus application of knowledge for extension and change in behavior.

Conclusion

Before communities are engaged in active programmes for controlling AAT and HAT, it is important that their knowledge, attitudes and practices are understood and awareness process be done. Even in situations where the communities are sufficiently aware of Trypanosomiasis and its consequences, there may still be a need to increase community's awareness about known control techniques to facilitate their participation in future tsetse fly and HAT, AAT control activities.

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