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Hunting Practices and the Risk of Rabies Transmission from the Wild to Humans in Sierra Leone

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ABSTRACTS

Rabies is a fatal zoonotic disease caused by a virus of the genus Lyssavirus with local wildlife such as bats, wild dogs and foxes as natural reservoirs of the disease. People most at risk or are likely to die from the disease live in rural areas in rabies endemic countries. The aim of this study was to examine hunting practices that predisposes local hunters and their farm families in Sierra Leone to rabies infection from the wild as well as the animal species harvested that could serve as reservoir of the disease.

The study was conducted in Moyamba district which comprises of fourteen chiefdoms with a heterogeneous ethnic population. The study population comprised of adults, youths and adolescence males in eight selected chiefdoms within the district. A total of 400 males, 50 from each of the 8 selected Chiefdoms from different sections and villages were purposely selected in a random manner and interviewed between the months of January to December 2017. Data was collected through the administration of questionnaires, key informant interviews and direct participation in hunting drives and trap inspections in a bid to gather more information on the hunting practices and data analyzed using appropriate tools.

Demographic findings revealed 91.25% of respondents to be married, 4.75 widower, 3.75 single and 0.25% divorced. Based on religious belief, 52.5% of respondents were recorded to be Muslims, 45% Christians and those of traditional religious beliefs 2.5%. The Mende and Sherbro tribes ranked 66% and 20% respectively, Temne 9.5%, with other ethnic groups (Fulahs Krio etc.) making up 4.5%. 64% of participants recorded not to have acquired formal education. Participants involved in farming made up 66.5% of the study populationliving in non-coastal areas and the primary ones involved in various hunting drives.

The hunting practices recorded in the study were trapping, gang or communal hunting with dogs and nets, single/two man hunting party with dogs, burrow tunnel hunting, poison baits, intentional fire and hunting with short guns. A variety of animal species that have been implicated in either the transmission or can act as reservoirs of the rabies virus were recorded to be the harvest from the various hunting drives; notable species such as Mongoose, Squirrel, Monkey, Duiker's, Deer (rear cases) grass cutters and porcupine (suspect).

In conclusion, findings in the study suggest, the use of dogs in traditional hunting practices may serve as a source of contamination of wild meat captured by dogs that maybe incubating Rabies virus/ diseases as well as get infected by animals harbouring the virus during the hunting process. The preparation of harvests from these hunting drives is yet another predisposing factor (unprotected hand in direct contact with blood and other body fluids and secretions while dressing harvest (carcasses). Furthermore, the possibility of a salient transmission of the Rabies virus through these catches may not be ruled out and requires further research to establish the presence of the virus in these species in the wild in Sierra Leone.

Key works: Rabies, Hunting practices, Zoonoses, Bushmeat

Introduction

Traditional hunting practices in the wild and natural forests is a key characteristic feature of the native cultural setting,in rural Sierra Leone and involves mainly young and adult males. This tradition is viewed as acultural heritage and serves as a major source of livelihood for many resource-poor rural dwellersusingvarious hunting skills inheritedfrom adults to the young in many generations. Human population surge in West Africa has resulted tohigher demands for a variety and alternative protein sourceslike livestock's are unavailable (Bowen-Jones and Pendry 1999). Mounting pressure and challenges for food security (Fuwape and Onyekwelu 2010).

Most Sierra Leoneans mainly rely on fish as the major source of protein owing to the rich Atlantic Oceanflowing along its coastal areas as well as several inland fresh waters that inhabits valuable fish species and other aquatic animals.Comparatively, harvests from these sources have a

comparatively affordablelocal market price for the average man than the price of meat (beef, pork, mutton, goat meat and poultry) which is often very expensive. In rural resource poor communities, bush meat from the wild serve as an important protein substitute when household income cannot afford other protein sources (Brashares *et. al.*, 2004). This in turn leads to the depletion of valuable species as was pictured by (Fa *et. al.*,2003)

To compound the problem, little investment has been done over the years in improving the domestic livestock production sector. This in turn have led to the increase in demand for alternative meat protein source from the wild which are harvested through hunting and trapping techniques that may not necessary be selective for the type of animal that it is intended for. A practice that has grave implication to public health in terms of emerging zoonotic diseases (Fa *et. al.*, 2006; Fichet-Calvet, *et. al.*, 2009; Le Guenno, *et. al.*, 1999; Knoblovh, *et al*., 1982; Schoepp, *et. al.*, 2014) as well as the survival of endangered species. This poses a public health risk as 75% of human emerging and re-emerging infectious diseases are zoonotic in origin the world over especially in non-human primates arising from bush meat (Taylor *et. al.*, 2001; Karesh and Noble 2009; Leroy *et. al.*, 2004; Weiss and McMichael 2004; Wolfe *et. al.*, 2005b; Zheng *et. al.*, 2010).Individuals that are directly involved in the preparation and trading of bushmeat are likely to be prone to accidental cuts that predisposes them to zoonoses (Subramanian. M, 2012; Wolfe *et. al.*, 2005a; Wolfe *et. al.*, (2004a, b)).Another concern is the effect of hunting on the population dynamics of the harvested species within the country for which there is paucity of information.

There areseveral huntingpractices (trapping, single/two man hunting party with/without dogs, gang/communal hunting with dogs and nets, burrow tunnel hunting, poison baits, intentional fire setting, hunting with short guns etc.) used by rural resource poor communities to catch wild animals to augment household animal protein needs and for sale. Dogs are very essential and widely used in gang/communal hunting to locate prey, chase animals into trapping net positions or even catch animals. With no state law prohibiting or defining subsistence hunting in Sierra Leone, hunting in most resource poor rural settings, is a major source of livelihood and income especially for rural resource poor agricultural farming families. This however exposed to wildlife habitats and increased exposure risk during preparation and processing of hunt harvest (fur, blood and other body fluids) with high probability of diseases transmission from the wild (Weiss and McMichael, 2004;Naughton-Treves *et. al.*,1998). Risk is very high especially among women involved in trade and butchering (Subramanian. M, 2012; Wolfe *et. al.*, 2005a; Wolfe *et. al.*, (2004a, b)

Notable viral transmission of super pathogens between humans and non-human primates (HIV: 1&2 believed to evolved from strains of Simian Immunodeficiency Virus(SIV) (Hahn *et. al.*, 2000; Lemey *et. al.*, 2003; Daszak *et. al.*, 2007), through blood and other body fluids (Hahn *et. al.*, 2000; Wolfe *et. al.*, 2004a, b; Karesh and Noble 2009).

As widely evidenced and reported by many scholars, short guns,nylons and wires/cable snares are now predominantly use and have replaced traditional hunting practices (e.g., nets, bow and arrow, and machete), enhancing hunters to catch a large volume of meat per hunt (Bowen-Jones and Pendry 1999; Bowen-Jones *et. al.*, 2003; Nasi *et. al.*, 2008;Fa *et. al.*, 2006)

This paper examines traditional knowledge, attitudes and hunting practices carried out by rural hunters and their implications for public health in Sierra Leone.

Materials and methods

Study area

Moyamba district, the study area encompasses a total land area of 6,902km^2 (2,665sq miles), in the south-western part of Sierra Leone with a population size of 318,064 (Statistics Sierra Leone,2015). It is bordered by the Atlantic Ocean in the west; Port Loko and Tonkolili Districts in the North; Bo and Bothe Districts in the east and south respectively.The district lies within latitude 8° 00' 00"N and longitude 12° 30' 00" W (National Geospatial-Intelligence Agency, 1993).

Moyamba district comprises of fourteen chiefdoms namely Lower Banta, Upper Banta, Timdale, Bagruwa, Kagboro, Dasse, Kowa, Kaiyamba, Kongbora, Kori, Kamajei, Fakunya, Ribbi and Bumpe. The district is composed of a heterogeneous ethnic population comprising of the Mende (60%)and other ethnic groups (Sherbro, Temne and Loko) making up the remaining 40%.

Moyamba District, like other areas of Sierra Leone, experiences a wet semi-equatorial climate with two seasons. The rainy season begins in May and ends in October with the heaviest rains in July and August. The dry season on the other hand begins in November and ends in April. Mean annual rainfall figures range from around 125mm to slightly over 250mm. The relative humidity is 72% in the rainy season and 80% during the dry season. The average annual temperature is about 28°C with the main vegetation types being secondary farm bush, grassland, mangrove and inland valley swamps. The activities of the people are predominantly farming (over 90% of its inhabitants) with farming methods involving indiscriminate felling of trees, continuous cultivation and the creation of new settlements which have severely affected the vegetation of the district even dough they remain cultivable.

Apart from its potential for agriculture, the district is also endowed with a lot of natural resources most of which are minerals chief amongst them being Bauxite and Rutile deposits. Others include Zircon deposit, salt deposits and fishing communities along its coastal areas, arable agricultural lands and fertile inland valley swamps and water falls.

Study population and design

The study population comprise of active healthy men population (adults, youths and adolescence) in eight selected chiefdoms (Kori, Kamajeh, Kowa, Dasse, Upper Banta, Timidae, Kargboro and Ribbi). A total of 400 men, 50 from each of the 8 selected Chiefdoms from different sections and villages were purposively and randomlyselected and interviewed between the months of January to December 2017. Selection of the chiefdoms wasbased on fair representation of the ethnic settlements and heterogeneous ethnic population within the study area.

Data collection methods

Various data collection methodswhich includequestionnaires, key informant interviews and direct participation in hunting drive and trap inspections were used in a bid to gather more information on the hunting practices.

Purposeful questionnaires both open and closed targeting male population were designed to get information on personal demographic data of respondentsand drivers/socio-economic factors influencing hunting behaviors, hunting practices/type adopted, vulnerable animal species extracted (this

was done using published diagrams to identify wildlife species) and contact frequency of the different hunting practices.

Key informant interviews with identified renowned hunters in each area were also carried out to get an in-depth overview on different hunting practices adopted by communities for the different vegetation types. Interviews were done inMende in the different communities that is widely heterogeneous. Visit to each community first targeted community leaders and elders, andinvolved briefing them on the purpose of the visit. Hunters were then identified during the meeting and their consent requested with regards their voluntary participation in sharing their experience and skills. Participatory approach in direct communal/gang hunting drive and trap inspections were also done in order to have a primary insight and experience in these activities.

Data analysis

Data were entered, stored and analyzed using Microsoft Excel sheet 2010. The excel work sheet data was entered in statistical package for social scientists (SPSS) version 20. Descriptive statistics (frequencies and percentages) was used for easy presentation and comprehension.

Results and Discussion

In this study, purposeful questionnaires that targeted the male population spanning different age groups in the study area were assessed in order to ascertain the key drivers and/socio-economic factors that influence hunting behaviors, practices/type adopted, vulnerable animal species extracted and contact frequency of the different hunting practices.

Table 1 below represents the marital status of respondents that participated in the study. Out of the 400 participants, 91.25% were married while those in the divorce category had the lowest (0.25%) participants.

Table 1: Marital status of respondents

Marital status	Frequency	Percentages (%)
Single	15	3.75
Married	365	91.25
Divorce	1	0.25
Widower	19	4.75
Total	400	100

Table 2 represents the religious belief of the various participants in the study. The highest number of respondents (52.5%) in the study were Muslims while Christians ranked in second place. Respondents with traditional religious beliefs had the least number of participants (2.5%).

Table 2: Religious beliefs of respondents

Denomination	Frequency	Percentage (%)
Christian	180	45
Muslims	210	52.5
Traditional	10	2.5
Total	400	100

In relation to ethnic group of respondents that participated in the study, the Mende ethnic group comprised of 66%, followed by the Sherbro (Table 3).

Table 3: Percentage number of respondents per ethnic group

Ethnicity	Frequency	Percentages (%)
Mende	264	66
Temne	38	9.5
Sherbro	80	20
Others	18	4.5
Total	400	100

In terms of the educational background of the respondents (Table 4), a majority (64%) were illiterate. Those with primary education ranked highest in number (27%), secondary education (7%) and tertiary (2%).

Table 4: Educational background of respondents

Level	Frequency	Percentages (%)
Illiterate	256	64
Primary education	108	27
Secondary	28	7
Tertiary	8	2
Total	400	100

Table 5 represents the occupational activities of respondents in the study, and shows those in the farming category to make up the highest number (66.5%) of respondents, followed by fishing (17.75%) and Teachers the least (1.5%).

Table 5: Type of occupational activities respondents are involved in

Type	Frequency	Percentage (%)
Farming	266	66.5
Fishing	71	17.75
Traders	22	5.5
Bike riders	16	4
Teachers	6	1.5
Others	19	4.75
Total	400	100

Hunting practices/type adopted

1. **Trapping**

Trapping was found to be the most predominant hunting method in the study communities usingvarious trap types aimed at restraining and/or strangulation until death or capture. The different traps are all snares with principally twisted wires/nylon which makes up the component and targets the neck or limbsof the prey.As widely evidenced and reported by many scholars, nylons and wires/cable snares used in trapping are now predominantly use and have replaced traditional hunting practices (e.g., nets, bow and arrow, and machete), thus, enhancing hunters to catch a large volume of meat per hunt in line with similar documentations (Bowen-Jones and Pendry 1999; Bowen-Jones *et. al.*, 2003; Fa *et. al.*, 2006; Nasi *et. al.*, 2008). Adult men, the abled aged, youths and teenagers all set up one or more trap type in deep forest (mainly for meat) and, in and around cultivated crop fields or farm lands (crop protection and meat). It was noted that the inspection frequency of these traps was highly dependent on the time at which it was builtas most animals,were said to avoid areas where there have been recent human activities.Inspection frequency was commonly based on the catch and how encouraging it becomes.In general, it was found to bea common practice for the hunter or farmerto inspect the traps as a first priority in the morning before any other chaos especially those around cultivated crop fields, or late evenings before dusk, to prevent if any, the decomposition of the catch or theft. Table 6a representsPercentage of sample population involved in various hunting practice andtable 6b, the most vulnerable animal species harvested from the various trap types in vernacular (Mende) and English.

Table 6a: Percentage of sample population involved in various hunting practice (s)

Hunting types/practice	**Percentage in relation to reference sample population in % (n=400)**
Trapping practiced (multiple)	95
Gang/communal hunting with dogs and nets	59
Single- or two-man hunting party with dogs	10
Burrow tunnel hunting with or without dogs	12
Poison baits	5
Intentional fire	7
Hunting with short guns	14

Table 6 b:Vernacular names of trap types and vulnerable species harvested

Trap types in Vernacular										
Mende	**Mende**	**English**	**Ruminants**	**Ungulates**	**Rodents**	**Canis**	**Primates**	**Birds**	**Reptiles**	**Porcine**
Dangeae	Mpaequei Nkiwie Sewei Seegee Kalie	Mongoose Giant rat Grass cutter Porcupine Snake			Yes Yes Yes	Yes			Yes	
Bambiee	Twawei Hagbeluei Ngieque Mpewee Doepae Ndogboe besie Tawei	Duiker Duiker Deer Warthog Buffalo	Yes Yes Yes		 Yes	 Yes Yes				Yes
Feagae	Ssewei Kaikue Nkiwie Mpaequei	Grass cutter squirrel Giant rat Mongoose			Yes Yes Yes	Yes				
Towaea	Nignee	Rat			Yes					
Kongomie	Nkiwie Bovie Mpaequei Ngahein	Giant rat Tree squirrel Mongoose			Yes Yes	Yes				
Foukouei	Nignee Kaikue Nkiwie Kokowe Paquee Bovie Ngauhein	Rat Squirrel Giant rat Bush fowl Pangolin Tree squirrel			Yes Yes Yes Yes	Yes		Yes		
Kpawah mbuwei	Twawei Hagbeluei Ngieque Mpewee	Buffalo Duiker	Yes Yes			Yes Yes				
kpewie	Ngieque Kwaa Kondae Mpewie Bovie Nguaahei	Monkey Tree squirrel					Yes			
Fogbea	Ngonie Kaikwe Ngieque Kwaa	Guinea fowl Squirrel Monkey								
Mkpuwei	Taewei	Buffalo								

2. Gang/communal hunting with dogs and nets

Gang/communal hunting with dogs and nets is practiced once a while mostly after they are done with their daily routine engagements, approach to a festive season, burial ceremonies, charity engagements, and reported disturbances and destruction of cultivated crops etc.Communal hunting practice is purposely done around cultivated farm lands, fallow lands and grasslandsaimed at targetingspecies such as grass cutters, porcupines, duikers and other species in forests. The hunting groupsare mostly composed of males above ten years of age. The intended hunting site is fenced off with hunting nets

sets around the perimeter of the intended area, and guarded from the outside, by each owner of the nets being used. Trained hunting dogs are then introduced into the field together with teaser boys to sniff, locate and drive their prey to the nets. Any prey entering the net is struck by the net owner guarding his net. Dogs also often catch their prey before they reach the net. The catch is shared thus: the dorsum running from the thoracic region to the sacrum "portion given to dog owners within the hunting party"; the entire belly, head and entrails to owners of nets use in the hunting; and the appendages "fore and hind limbs" to be shared among the entire hunting party irrespective as to whether you are dog or net owner. Portion for the dog owners is equally shared among all the dog owners and the same implies for the net owners irrespective as to whether it is catch by a particular dog or net.

3. Single/two man hunting party with dogs

The single/two man hunting party with dogs entails a single individual and his dogs or with two individuals at times. In this method, the dogs are the main hunting drive involved in all the operations which involves sniffing, locating, chasing and capturing of the prey. The harvest is shared thus:a portion for the dog that catches the prey (given to its owner)before a general equal share of the remaining meat among the hunting party.

4. Burrow tunnel hunting

In burrow tunnel hunting, a possible prey burrow is identified with/without dogs. This burrow is then dug open using cutlass and hoe until the prey is captured. Alternatively, fire is set in all the possible openings and the prey is suffocated with smoked till it is forced out of the burrow.

5. Poison baits

Poison baits is usually used in areas evidenced by frequent feeding activity mostly open grassland and fallow lands; or in areas where there is report of mass destruction of crop. An attractant in the form of harvested stale urine is mostly used. This is mixed with the mud from previous feeding site of the target animal. Most species are vulnerable with grass cutters been the most vulnerable. Similarly, poison bait is used to poison duikers, water bucks etc. The poison is applied on bread loaf or banana and placed on an elevated platform. Poison baits are characterized by indiscriminate massive death of all age groups of the prey and may also result in contamination of the carcass which can pose serious threat to public health.

6. Intentional fire setting

Intentional fires are consciously set on overgrown grassland and other fallow lands with various objectives among which are: elimination of trash and promotion of regrowth (nomadic herders), land clearing (farming), tracking and shooting of prey around swampy areas and other water courses (hunters), and circular fires to trap preys. Almost all species are susceptible and the harvest is collected when the fire die out.

7. Hunting with short guns

This is done in most areas even though guns are prohibited by law. They are manufactured locally by blacksmiths in some communities or smuggledinto the country. Short gun hunting is mostly done at night especially when the moon is dark in dense forests, harvested farmstead, areas of young sprouting grasses after bush fire and along temporary water ways. All species are prone but the hunters mainly prefer big catch like water buck, bush bucks and duikers. In some areas, monkeys are targeted in the late evenings and early in the morning in their roosting areas.Informal discussions with over 90% of the sample population implicated the use of short gun to be the most destructive in terms of harvest rate in line with documentations (Bowen-Jones and Pendry 1999; Bowen-Jones *et. al.*, 2003; Fa *et. al.*, 2006; Nasi *et. al.*, 2008)and as a contributor to the extinction of threatened and endangered species.

Conclusions

The finding concludes that hunting is a traditional practice is common among resource-poor rural male folks in rural communities and serves as a major source of livelihood for many farm families. Trained traditional hunters pass this culture from one generation to another and provide a formidable source of inter-communal engagement that fosters peace and unity especially in close proximity communities that are periodically engaged in gang/communal hunting.

In an area where rabis is endemic, hunting can serve as a source of disease transmission among wildlife and domestic canine. During man-dog hunting method, dogs are predisposed to rabid wild animals which may inflict bites on them or be bitten by rabid dogs. Infected carcasses may also serve as a source of infection among people; and entrails mostly fed to hunting dogs as a reward, may equally be a source of infection to domestic dogs. The preparation of hunt harvest for food (unprotected hands in direct contact with blood and other body fluids), also presents another avenue for zoonotic transmission especially for Canis and rodents species harvested as was emphasized (Subramanian. M, 2012).

Other hunting techniques such as poison baits and intentional fire setting have serious public health and environmental implications. Animals hunted using poison baits are likely to carry poisonous residues in the carcass which when consumed untreated may have dire consequences on public health. Moreover, the use of wild fire will likely distort the ecosystem and biodiversity. This loss of valuable biodiversity may result in environmental disasters such as erosion, floods and erratic rainfalls.

Notwithstanding, hunting as a traditional rural practice will continue but remain challenged by climate change that catalyze the emergence of zoonoses. The close interaction between man and wildlife is an inevitable channel for the spread of zoonoses including rabies.

Recommendation

1. Personal protection for people that are directly involved in processing and sharing of hunt harvest from direct contact with blood and other body fluids.
2. Vaccination of dogs use for hunting as they usually encountered stiff resistance from prey.

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