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Multisectoral One Heath Based Joint Risk Assessment of Human and Animal Rabies in Selected Districts of Sierra Leone

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Abstract

Rabies is an endemic priority zoonotic disease in Sierra Leone and scores of sporadic dog bites resulting in human fatalities have been recorded. However, risk assessments to determine likelihood of exposure and impacts on various communities has never been done. To fully understand the possible risks associated with rabies virus disease in various communities, a multisectoral transdisciplinary One Health base Joint Risk Assessment (JRA) supported by FAO, OIE and WHO was conducted. JRA was done for six districts by trained experts drawn from the ministry of health and sanitation, ministry of agriculture, ministry of environment, and universities. The underlying assumptions for the JRA was that rabies was prevalent (although no reliable epidemiological exists) and that epidemiological linkages in transmission exists between environment, animal (domesticated, unsupervised, and wild), and humans. Risk framing of the rabies hazard was based on the high incidence of exposure to sources of rabies including rabid dogs, cats, wild animals (Squirrels, and other rodents), accidental laboratory infections as a resulting of not adhering to best biosecurity practices, and improper/unhygienic handling of infected carcasses of wild animals. Following hazard and exposure characterization, a risk matrix was utilized to qualitatively determine the likelihood (negligible, low, moderate, high) of exposure and impact (negligible, minor, moderate, and severe) of the exposure on individuals and community. The JRA matrix revealed for Western Area Rural for instance, that a hunter exposed to rabies will have a high likelihood of contracting the disease, while impact is minor. Likewise, a child bitten by a rabid dog in Kenema will have a high likelihood of contracting the disease and impact will be moderate. This is consistent with the goal of the JRA and OH approach that suggest different exposure sources are associated with varying risks to humans and communities. Overall, the multi-sectoral OH JRA will inform policy makers and help formulate integrated action for detection, prevention, preparedness, and response to rabies virus disease in Sierra Leone.

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Introduction

Rabies is endemic in Sierra Leone and scores of sporadic dog bites resulting in human fatalities have been recorded (Hatch et al, 2004; Roland et al., 2022; and Gordon et al., 1933; Mbilo et al., 2021). Despite this disease being a major public health concern, the epidemiology, modes of transmission, social determinants, and impacts of rabies in Sierra Leone has not been fully elucidated (Kumoji et al., 2018; Mustapha et al, 2023; Suluku et al., 2017; Suluku et al., 2021). Given that rabies is a zoonotic pathogen, its epidemiology and control measures require close collaboration and coordination between human, animal and environmental health sectors (Acharya et al., 2020; Shafaati et al., 2023; Akinsulie et al., 2024; Tidman et al; 2022; Mshelbwala et al., 2024). To this end a multisectoral joint risk assessment (JRA) workshop was conducted with participants drawn from the ministry of health, ministry of agriculture (livestock division), and ministry of environment.

The JRA tool developed by FAO, OIE and WHO (Food and Agriculture Organization of the United Nations , World Health Organization, World Organisation for Animal Health, 2020), Joint Risk Assessment Operational Tool (JRA OT) was utilized for the multidisciplinary and multisectoral risk assessment of rabies exposure in Sierra Leone. Given that activities to identify, assess, manage and reduce risks from zoonotic diseases such as rabies benefit from coordination and collaboration between ministries and other agencies in a country that are responsible for various aspects of human health, animal health, and the environment. The JRA tool was designed to support countries in applying a consistent and harmonized approach to assessing risks posed by zoonotic disease hazards such as Rabies. The JRA for rabies was based on risk framing developed by the participants in the workshop

The aim of the JRA is to establish a status quo/situation analysis and benchmark on the prevalence of Rabies in Sierra Leone. The objectives are to, 1) conduct a JRA for rabies in Sierra Leone, and 2) provide a detailed report on the prevalence of Rabies in Selected districts in Sierra Leone that will inform policy makers and formulate an action plan for comprehensive control and prevention of Rabies in Sierra Leone.

Method or Approach for Rabies Risk Assessment

Event summary

Rabies is endemic in Sierra Leone and scores of sporadic dog bites resulting in human fatalities have been recorded. To facilitate proper response and control measures, a Joint Risk Assessment is conducted to guide the process. In this case, a Joint Risk Assessment is done by competent Risk Assessment Team in Selected Districts (Bombali, Western Area Rural, Kailahun, Moyamba, and Kenema) from 26 to 30 July 2021 commencing from 8:30am to 5:00pm daily at the Atlantic Lumley Hotel, Freetown, Sierra Leone.

Risk Framing

Hazard:

- Exposure to sources of rabies including rabid dogs, cats and wild animals (Squirrels, and other rodents)

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- Accidental laboratory infections as a resulting of not adhering to best biosecurity practices
- Improper/unhygienic handling of infected carcasses of wild animals

Scope:

The JRA is conducted in five selected district (Bombali, Western Area Rural, Kailahun, Moyamba, and Kenema) in Sierra Leone.

Key assumptions underlying JRA

The assumptions that are formulated for the different scenarios under discussion are:

1. Rabies is prevalent and endemic in the country but reliable data is difficult to access
2. There is epidemiological link between domesticated and wild and unsupervised animals

Results for Rabies JRA

The JRA for Rabies by a multisectoral team of experts was completed for selected districts and the likelihood of spillover from animals to humans and potential impacts determined for the various districts. The habits and practices of communities was used to determine exposure scenarios as well as estimates of likelihood and impacts of rabies. The likelihood of a bush meat seller in Moyamba town been exposed to rabies through handling of bush meat in the next six months was estimated to be moderate and the impact was minor (Fig 1). This assumes that the prevalence of rabies in the wild is known to be low and the epidemiological correlation between domesticated and wild animals is known to be low. Moyamba district is not a hotspot for rabies and the probability of transmission from wild animals to humans is very low. The uncertainty level associated with both the likelihood and impact estimated as a very high risk given the lack of prevalence or incidence data from the district.

The likelihood and impact of exposure of a hunter to rabies in Western Rural for the next five months is high and the impact is minor (fig 2). The rationale for the likelihood and impact estimates for rabies in Western Rural was based on the high incidence of dog bites, high interaction between wild and domestic animals, high rate of unsupervised dogs, and low vaccination rate for domestic animals. It assumes the interaction between unsupervised dogs and rabid dogs is high, there is a high prevalence of rabies among unsupervised dogs, and the probability of transmission of Rabies from wild animals to humans is low. The uncertainty level for the estimation of the likelihood and impact is high given the lack of prevalence data.

The likelihood of exposure of a child to rabies in Kenema from a dog bite for the next three months was considered high and the impact determined to be moderate (fig 3). The risk assessment results for Kenema was based o the high incidence of dog bites and incidence of laboratory confirmed cases of rabies between 2019 to 2020. As in the previous risk assessments, the uncertainty level for the estimation of the likelihood and impact is high given the lack of prevalence data.

The likelihood of exposure of a veterinarian to rabies during treatment of dogs in Kailahun in the next six months is low and the impact is negligible (Fig 4). The rationale for the likelihood and impact estimated is that national vaccination of dogs in Kailahun has been conducted since 2019 and routine vaccination of veterinary personnel against rabies is ongoing. The uncertainty level associated with the estimate of likelihood and impact is considered high due to lack of

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prevalence data. Similarly, the likelihood of exposure of a lab technician collecting and testing samples from a suspected rabid dog in Teko Lab was low and the impact found to be negligible (Fig 5). The rationale for likelihood estimate is based on the national vaccination of dogs in Bombali conducted from 2019 to 2021 and the routine vaccination of Veterinary Personnel against rabies. The uncertainty level associated with the estimate of likelihood and impact is considered high due to lack of prevalence data

Discussion

The JRA of rabies in selected district of Sierra Leone was conducted by a multisectoral and multidisciplinary team of experts. The JRA provide qualitative determination of the likelihood of exposure and impacts of exposure to rabies in the selected districts under various exposure scenarios (Figure 6 and 7). The likelihood for people handling bush meats in Moyamba is moderate and the impact is minor. However, no data is available on the transmission of the disease through handling of infected carcass. Although Rabies is known to be prevalent in Sierra Leone, incidences of outbreaks from handling bush meat is rare. The situation can be managed through sensitization of stakeholders (Bush meat hunters, traders and consumers) on the risk of handling bush meats. Moreover, hunters whose livelihoods depend on hunting wild animals can be encouraged to take pre-exposure vaccines against rabies. The general public can also be encouraged to promptly report all cases of animal bites to the nearest health facilities. These findings are consistent with previous reports on rabies exposure and transmission patterns in Sierra Leone and West Africa (Suluku, 2023; Nyandebo et al., 2022; Kumoji et al., 2018)

The likelihood of a hunter exposed to rabies in Western Area Rural is high and the impact is minor. The likelihood is high because of the high incidence of dog bites and interaction between wild and domestic animals and ad there is a high rate of unsupervised dogs in Western Area Rural. Western Area Rural is congested with unsupervised dogs that are likely to extend their fending/scavenging in nearby bushes where people are likely to hunt. There is likelihood that unsupervised dogs are likely to interface with wild animals within the same environment. Moreover, in many parts of Sierra Leone especially in rural areas, people use dogs for hunting rodents and other wild animals. These findings is consistent with reports on urban rabies in Sierra Leone (Hatch et al., 2004; Suluku et al., 2021).To effectively manage this situation, a massive vaccination campaign against rabies in cats and dogs has to be mounted. The public should be educated and sensitized on the management of dogs. Also, the public can be encouraged to promptly report all cases of animal bites to the nearest health facilities.

For Kenema District**,** **t**he likelihood of exposure to rabies is considered high and the impact is moderate due to, 1) endemicity of rabies in Kenema, 2) A clinical case fatality has been recorded in 2021, 3) three confirmed cases from 2019 to 2020, and 4) high incidence of dog bites and few confirmed cases. Kenema is a hotspot for rabies and there are ample evidence of high rates of dog bites. Although there had been a sustained program of vaccination of dogs and other canines against rabies, a huge number of dogs, especially unsupervised dogs, is yet to be accomplished. This agrees with recent findings by Mustapha et al., 2024 on prevalence of dog rabies in Kenema district.

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Effective management can be realized through the mounting of a massive vaccination campaign of dogs and cats, sensitization and education of the public about dogs and cats management and finally encouraged the prompt report of all cases of animal bites to the nearest health facilities (Suluku et al., 2021; Atuhiere et al., 2024; Suluku, 2023).

The likelihood of a vet exposed to rabies during treatment of a dog in Kailahun is low and the impact is negligible because there had been a sustained vaccination campaign of dogs and cats in Kailahun. The Laboratory Personnel are likely to have been vaccinated against rabies. Best management practices can be obtained by sustaining the vaccination of dogs and cats against rabies. Encourage lab technicians to observe best biosafety practices in dealing with suspected rabid cases. This is in agreement with the findings and recommendations of previous reports (Suluku et al., 2021; Suluku et al., 2022)

The likelihood of a Laboratory Technician to be exposed to rabies during collection and testing of samples is low and the impact is negligible because, 1) Laboratory Technicians are likely to have received a pre-exposure vaccine, 2) there had been a sustained vaccination of dogs and cats from 2019 to 2021, 3) Observation of best biosafety practices, and 4) Employment of trained and experienced laboratory Technicians. Recommended practices can be obtained through sustained vaccination of dogs and cats, proper record keeping of animal bites, treatment portfolios of patients.

Recommendations

i. Comprehensive field and laboratory data regards the prevalence of the disease, the potential threat of transmission among wild animals and unsupervised dogs, potential source of transmission through handling of infected bush meat, prevalence of the disease and means of transmission from wild rodents (squirrels) and rate of accidental transmission among laboratory staff.

ii. A comprehensive and detailed vaccination coverage of dogs against rabies. This information is needed to ascertain the scope of vaccination coverage and ascertain the risk factor associated with interacting with dogs within the same environment where both dogs and humans co-exist.

iii. Conduct a gap analysis of laboratories to ascertain the number of trained and qualifies staff and the capacity of diagnostic laboratories. This essential in the fight against this zoonotic disease that will ensure sustained interventions to control the disease

iv. Vaccination of dogs and other canine – Trained and experienced staff should be tasked with this responsibility and must be handled with the professionalism that is required

v. Sample collection and processing should also be handled by competent (trained and experienced) staff using standard operating procedures (SOP). This will not only minimize risk of accidental infection but will ensure the collection of quality samples.

vi. The public and specifically targeting hunters and processors of bush meat should be educated about the potential risks of handling infected bush meat.

vii. Risk communication is an important component in the effective control of zoonotic diseases particularly Rabies.

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In Sierra Leone where majority of the people are illiterate and not adequately informed about the associate risks of contracting zoonotic diseases, any unprofessional communication to the public may have dire consequences in managing the disease. Drawing from the experiences of the Ebola outbreak in 2014, Risk communication of zoonotic diseases must be handled by professionals in their own rights. In Sierra Leone, the One Health platform can leverage on the expertise of staff from the Ministry of Health and other identified sources.

The immediate recommended next steps for rabies action from the JRA are:

i. Conduct a comprehensive JRA for rabies including sector-specific risk assessment
ii. Conduct a comprehensive capacity gap analysis of veterinary diagnostic laboratories to ascertain the status quo and put modalities for capacity development
iii. Conduct a baseline survey on the scope of vaccination of dogs against rabies that will inform future engagements
iv. Develop a database for Rabies management that will capture rates of dog bites, human infections, case fatality, etc. this information will be pertinent for future engagements

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Figure Legends

1. **Figure 1: The likelihood and impact of a bush meat seller in Moyamba town been exposed to rabies through handling of bush meat in the next six months**

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2. **Figure 2:** The likelihood and impact of exposure of a hunter to rabies in Western Rural for the next five months
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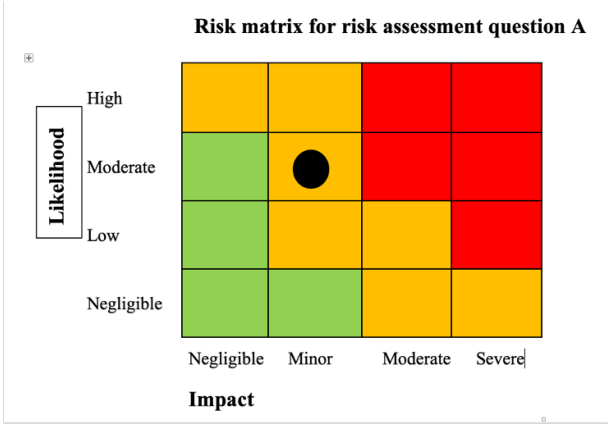

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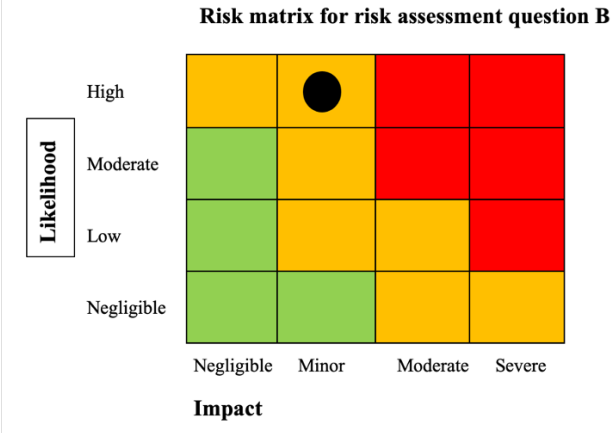

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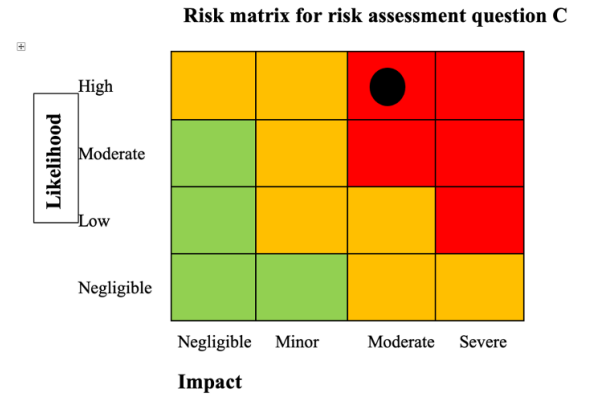

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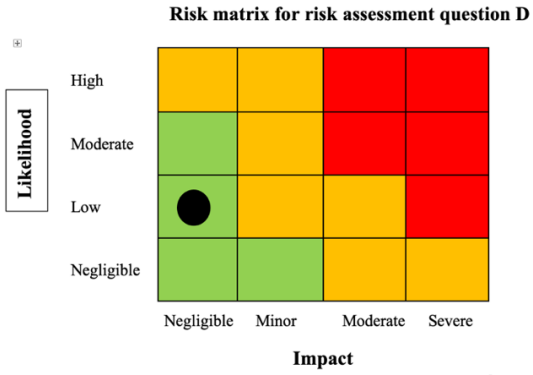

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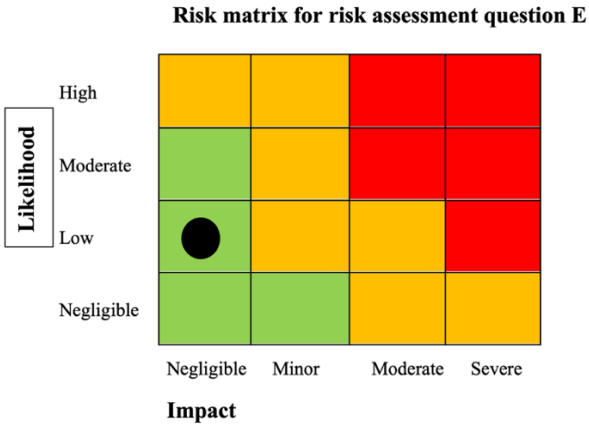

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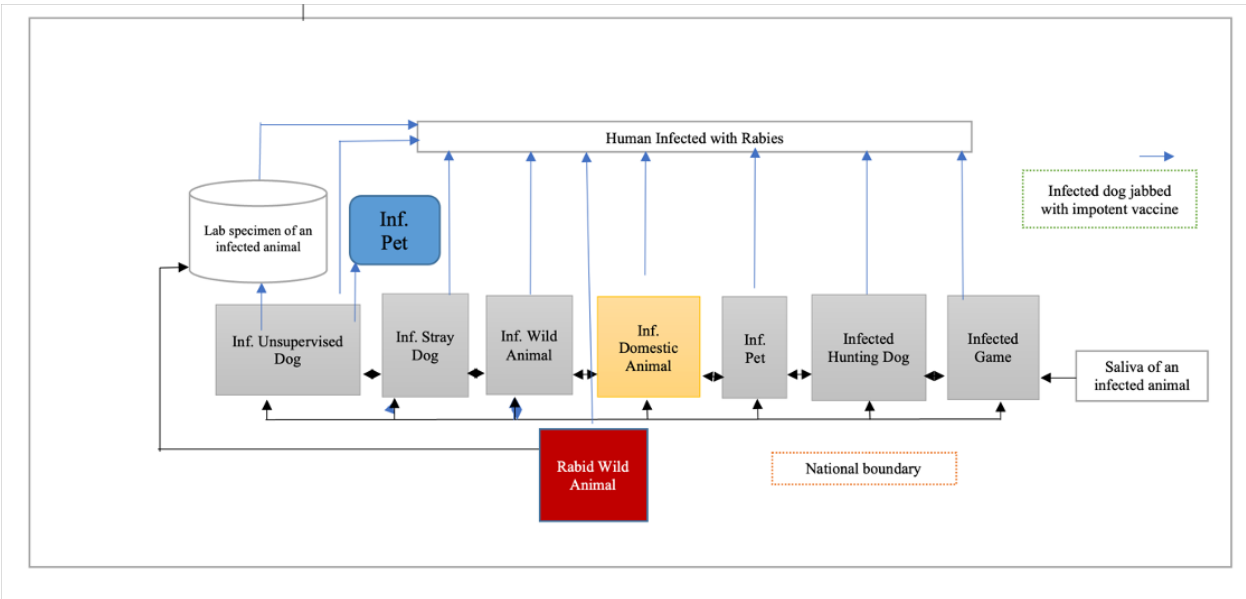

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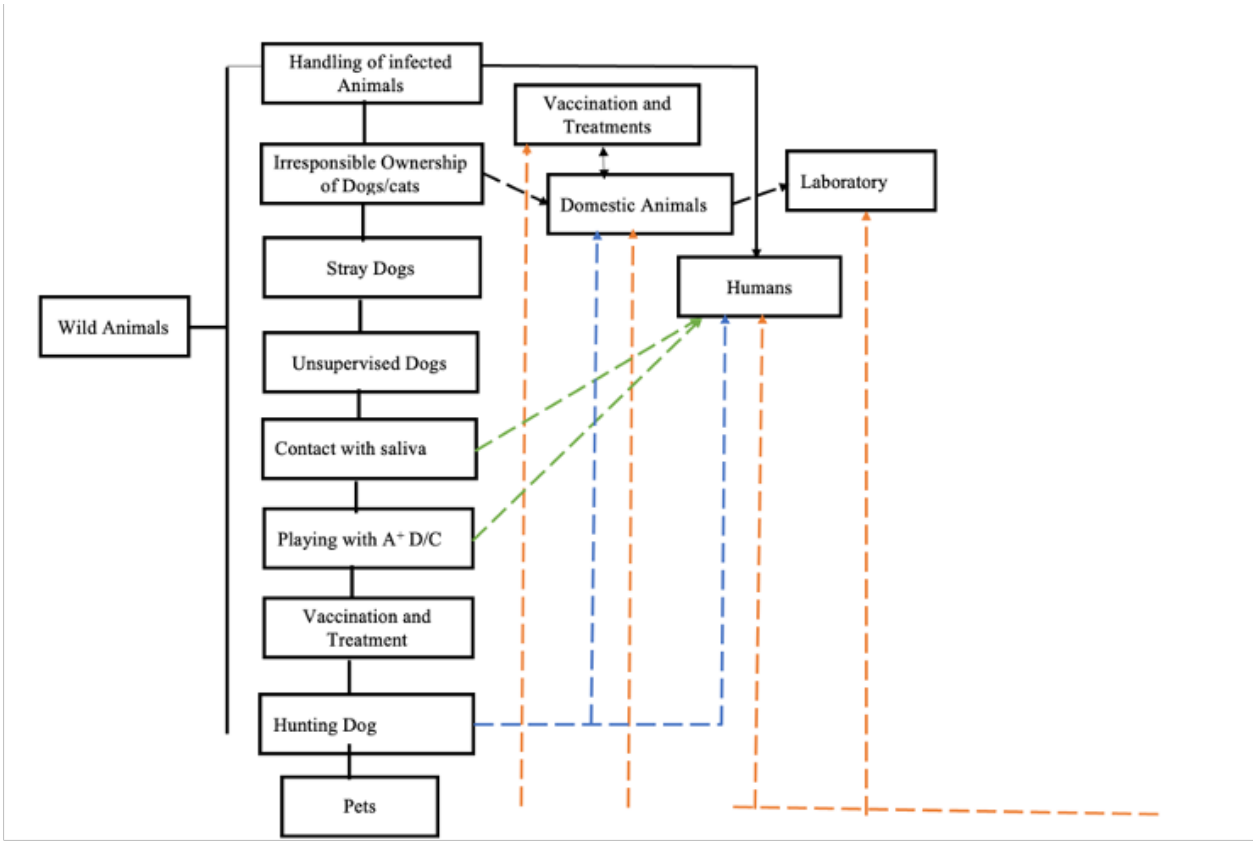

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