

# Update on Canine and Human Rabies in a Rabies Endemic Situation in the Republic of Guinea

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## Abstract

Each year, rabies kills nearly 60,000 people worldwide. Asia and Africa are the most affected. It is a public health problem because of the number of stray dogs in these nations. In Guinea, rabies is endemic and cases are often under-reported. The objective of this study was to determine the prevalence of rabies among human and animal exposures in Guinea. This was a retrospective analytical study from 2019 to 2021 conducted in the country's human and veterinary health divisions and, primarily focused on rabies épidémiologique surveillance. The selection was based on human contact with an animal causing behavioural disorders, as well as animals put under observation following aggression on humans. The data were analysed using Epi Info version 21 software. Qualitative variables were expressed as proportions with 95% CIs, quantitative variables as mean  $\pm$  standard deviation. The chi2 test and the Fischer exact test were used to compare proportions. A total of 85 veterinary facilities were visited and 100 animals registered, of which 93% were reported cases of exposure to canine rabies. One thousand five hundred and thirty-one (1531) people exposed to rabies were recorded between 2019 and 2021. During the period, the prevalence of human rabies was 0.533% [0.042 - 0.064] at 95% CI and that of canine rabies was 0.55% [0.039 - 0.061] at 95% CI. The biting

animal was the dog in 97.2% of cases. Subjects over 45 years of age (57.7%) were the most affected. The prevalence of canine rabies was 0.5% compared with 0.533% for human rabies between 2019 and 2021. This low prevalence does not reflect the true extent of the phenomenon in Guinea, as few people consult health structures in the event of dog bites. Regular surveillance of the human and dog population is necessary for better rabies control in Guinea.

## Keywords

Seroprevalence, Canine and Human Rabies, Conakry, Guinea

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## 1. Introduction

Rabies is a viral disease of zoonotic origin accidentally transmitted to humans with an extremely high case-fatality of nearly 100% once symptoms appear [1] [2]. It kills nearly 60,000 people each year worldwide, with 99% of cases occurring in areas with poor socio-economic conditions [3]-[5]. Deaths from rabies are rarely reported and children aged 5 - 14 years are the most affected. It is the tenth leading cause of death from infections in humans [3].

Like other countries in the sub-region, rabies remains endemic in Guinea and continues to be a public health problem despite the availability of effective vaccines [6] [7]. The country has a surveillance system for canine and human rabies characterised by insufficient diagnostic resources and qualified personnel. In addition, there is an uncontrolled number of stray dogs, usually unvaccinated, that carry rabies to the human population [5]. Despite this high risk of rabies, the notification mechanism does not function properly because the disease is not a priority. Secondly, the fact that the country is predominantly Muslim and that direct contact with dogs is forbidden by customary and religious practices means that the population cares very little about dog health, not to mention the poverty situation [8]-[10].

In Guinea, the lack of reliable data on a national scale on canine and human rabies remains a concern in for the fight against this disease. In a study conducted at the level of human and veterinary health structures in Conakry on 2916 biting dogs under observation and 7994 people exposed to rabies risk, 14 dogs clinically affected by rabies were reported, *i.e.*, 0.5%, and 2634 people were put under anti-rabies prophylaxis among which 11 cases were clinically diagnosed, *i.e.*, 0.4% [11].

In recent years, a platform called “one health” associating the ministries of human health, livestock and the environment has been created to federate actions to combat zoonoses. Despite these awareness-raising efforts, we are witnessing a resurgence of cases of exposure to rabies following bites from unvaccinated stray dogs. In addition, there are shortcomings in the reference system for exposure to rabies risk. Thus, in the Guinean context, despite its socio-economic impact and its often-tragic episodes, rabies is not sufficiently studied. Appropriate treatment

is not always available in referral facilities, or if it is, it is often given late due to spatial, temporal and economic constraints. Therefore, rabies represents a challenge with major health and economic implications. This study, which aims to determine the global prevalence of rabies, is the first to be carried out on a national scale and will undoubtedly provide new information that will lead to decision-making in the context of rabies prevention and control in Guinea which involves regularly vaccinating dogs and other pets, avoiding contact with animals, vaccinating at-risk populations such as children and providing post-exposure prophylaxis (PEP) in the event of a bite.

The objective of this study is to determine the prevalence of canine and human rabies among human and animal exposures in Guinea.

## **2. Material and Methods**

### **2.1. Study Population**

This was a three-year cross-sectional study conducted on a representative sample of health facilities (human and veterinary) in Guinea. The study population consisted of all persons who consulted the facilities following exposure to rabies and animals that were registered in veterinary facilities for suspected rabies.

Suspicion of rabies in animals was defined on the basis of clinical signs (behavioural disorders, agitation and aggressiveness). We considered as a case of human rabies, any person received in the care structures, dead or not, presenting a neuropsychiatric picture, with hydrophobia, following an infecting contact (bite, scratch or lick on a mucous membrane) with an animal that has disappeared or in which the diagnosis of rabies has been confirmed. And for the case of canine rabies, any animal that was dead, missing or presented to the veterinary services with behavioural problems. The selection criteria focused on the accuracy and completeness of the data recorded at the services visited. Sampling was carried out in the eight administrative regions, which were considered strata from which eighteen prefectures were selected and distributed according to the size of the regions, and in the administrative region of Conakry, five urban communes of Conakry (**Table 1**). In these structures, we surveyed all the people involved in rabies prevention and treatment, whether they were public or private veterinary structures or the communal livestock directorates.

Data collection took place in human and veterinary health structures. All the prefectures selected for the survey were visited. At the human health level, data were collected on an individual form from consultation registers, patient files and dog bite notification registers. In veterinary services, data were collected from animal vaccination records, records or diaries of dogs admitted for aggression and annual reports from veterinary practices.

### **2.2. Ethical Aspects**

The retrospective nature of this study did not allow for the collection of consent from the participants. However, the research protocol was approved by the

Scientific Committee of the Chair of Biological and Biomedical Sciences in the Faculty of Health Sciences and Technology at the Gamal Abdel Nasser University in Conakry.

**Table 1.** Housing characteristics of respondents by administrative region.

	Housing characteristics of respondents							
	Enclosed courtyard		Detached dwelling		Detached household		Adjoining household	
	Workforce	%	Workforce	%	Workforce	%	Workforce	%
Boke	17	4.2	15	3.2	51	16.3	157	21.0
Conakry	98	24	24	5.2	5	1.6	137	18.4
Faranah	11	2.7	18	3.9	99	31.6	94	12.6
Kankan	91	22.3	32	6.9	41	13.1	127	17.0
Kindia	77	18.9	169	36.5	25	8.0	71	9.5
Labé	72	17.6	88	19.0	10	3.2	0	0.0
Mamou	30	7.4	58	12.5	40	12.8	48	6.4
N'Zérékoré	12	2.9	59	12.7	42	13.4	112	15.0

### 2.3. A Statistical Analysis of Data

The data were analysed using Epi Info version 21 software. Categorical variables were expressed as a proportion with 95% CI and quantitative variables as mean  $\pm$  standard deviation. The chi2 test and Fischer's exact test were used to compare proportions.

## 3. Resultats

### Demographic Characteristics of the Study Population

A total of 85 veterinary facilities were visited, of which 79 cases of potential exposure to canine rabies were recorded, of which 68 cases, or 86.07%, were managed according to the observation and prophylaxis protocol. Only one animal showed clinical signs of rabies at the end of the observation. The result of the follow-up of the biting animals showed that 59.2% were alive and 0.7% were dead. Furthermore, 8.9% of the biting animals were slaughtered and for 31.2% of the cases, there was no information on their fate. Of the animals that were slaughtered, 10.6% were sampled. It can be seen that almost 74% of the animals slaughtered and sampled were laboratory positive (**Figure 1**).

The study shows that the majority of biting animals were dogs (97.2%), followed by cats (2%). Of the biting animals, 60.7% were domestic non-stray animals and 38.3% were domestic stray animals. There were also at least 0.3% wild animals.

It should be remembered that 69.6% of the exposed animals were aggressive at the time of biting, while 26.8% of these animals were provoked by the bitten persons. According to the behaviour of the bitten animals, before their admission to the facility, 53.4% were aggressive or agitated, 42.9% were calm and 3.7% had

other unspecified behaviour. 84.9% of animal aggression occurred in urban areas compared to 15.1% in rural areas (**Table 2**).

A total of 1531 people at risk of rabies were selected for this study. The majority of victims were male (58.7%). Most victims lived in urban areas (71.8%), were not in school (42.2%) and were not married (60.7%). During the three years, 8 cases of human rabies were recorded, *i.e.*, 0.0533 [0.0421 - 0.0645] per 1000 persons (**Figure 2**).

We noted a progression in the recording of exposure cases over the years (**Table 3**), with rates of 4% in 2019 and 70.3% in 2021. We note that people in the over 45 and under 15 age groups were the most affected by animal bite cases, at 57.7% and 22.5% respectively (**Table 2**).

Over the three years, the Conakry region recorded the most cases of exposure to rabies, *i.e.*, nearly 29.80%, followed by Faranah 14.95%. The analysis of the results shows that the dog was the main animal involved with 95% (**Table 4**).

**Table 2.** Distribution of persons exposed to the risk of rabies according to socio-demographic characteristics and vaccination status of victims.

Socio-demographic characteristics	Workforce	Pourcentage (%)
Tranche d'age		
Under 15 years	345	22.5
15 to 35 years old	224	14.6
36 to 45 years old	78	5.1
Over 45 years old	884	57.7
Gender		
Male	898	58.7
Female	633	41.3
Place of residence		
Rural	432	28.2
Urban	1099	71.8
Marital status		
Single	930	60.7
Married	585	38.2
Divorced	1	0.1
Widowed	15	1.0
Level of study		
Not in school	646	42.2
Primary	483	31.5
Secondary	189	12.3
Higher	182	11.9
Other	31	2.0
Administrative regions		
Boké	223	15.02
Faranah	229	14.95

**Continued**

Kankan	129	8.42
Kindia	166	10.84
Labé	150	9.79
Mamou	62	4.04
N'zérékoré	115	7.51
Conakry		
By profession	556	36.31
Student/pupil	536	35.00
Farmer	6	0.39
Farmer	98	6.40
Retired	9	0.58
Veterinarian	16	1.04
Doctor	14	0.91
Hunter		
Hunter	1	0.06
Forest ranger	1	0.06
Other	294	19.20
Vaccination status of victims		
Vaccinated	1273	83.14
Not vaccinated	256	16.72

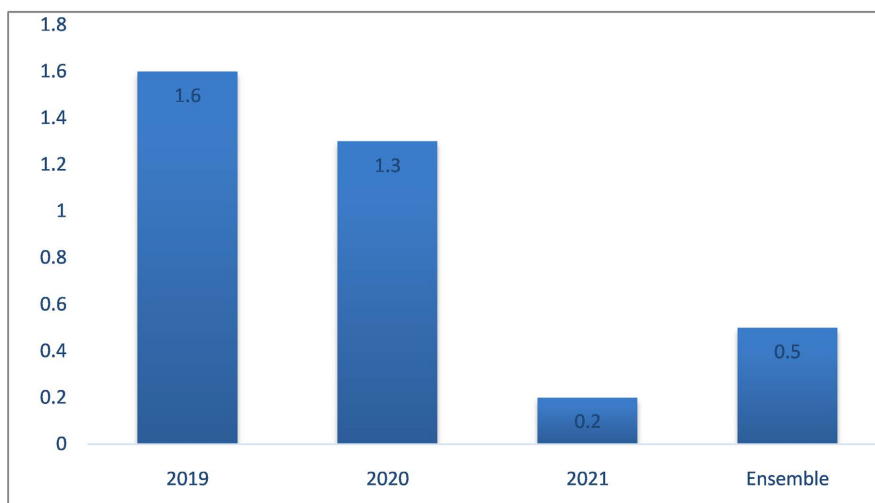
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**Table 3.** Distribution of human rabies cases in health facilities by year.

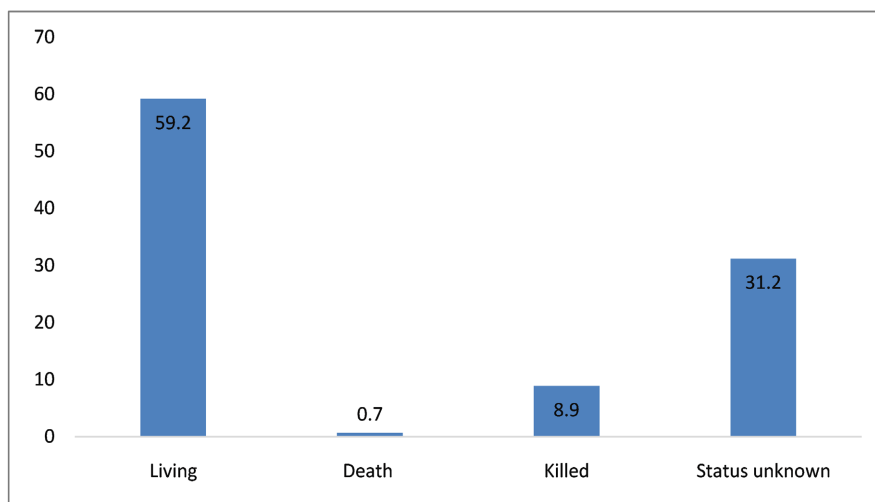
The exhibition year	Total number of cases of exposure for the year	Prevalence (%)	Occurrence of rabies			
			Yes		No	
			Workforce	Percentage (%)	Workforce	Percentage (%)
2019	62	1.6	1	1.6	61	98.4
2020	392	1.3	5	1.3	387	98.7
2021	1077	0.2	2	0.2	1075	99.8
Total	1531	0.5	8		1523	

**Table 4.** Distribution of cases of human exposure to the biting animal by year.

The type/species of the biting animal	The exhibition year			
	2019	2020	2021	Total
	Workforce	Workforce	Workforce	Workforce
Dog	60	385	1009	1454
Cat	2	7	22	31
Bat	0	0	0	0
Other	0	0	46	46
Total	62	392	1077	1531



**Figure 1.** Prevalence (%) of human rabies from 2019 to 2021. The prevalence over three years was successively 1.6 in 2019; 1.3 in 2020 and 0.2 in 2021. The overall prevalence over the three was 0.5.



**Figure 2.** Fate of the biting animal at the time of observation. Of the animals slaughtered, 10.6% were sampled for laboratory analysis and 74% were positive, *i.e.*, 0.55%.

#### 4. Discussion

From 2019 to 2021, we conducted a descriptive cross-sectional study of animal and human exposures to rabies in Guinea. The objective of this study is to determine the prevalence of canine and human rabies in Guinea.

This study may have some limitations that are described as selection bias: i) Rabies cases are reported at the level of human health facilities while biting animals are referred to veterinary services. In this case, it is difficult to link each biting animal to one or more bitten subjects. ii) Then, cases of bites from stray dogs seem to be commonly reported to health structures, whereas bites from neighbours' dogs are not or rarely reported. iii) Also, bites by animals other than dogs seem to be under-reported due to a lack of knowledge of the risk of rabies linked to these

animals and a lack of awareness. All of these situations suggest that the situation presented here may be under-reported.

Nevertheless, it appears to be the first study carried out on a representative sample of the country. In total, 1531 persons were exposed, of whom 8 cases of human rabies were reported, representing a prevalence of 0.533% [0.421 - 0.645] in Guinea. During the three years, 7 cases of death due to rabies were recorded, or 87.5%. In Senegal, authors have reported 1.5% of deaths per year in health centres and 0.2% in the CHU of FANN [12]. This low prevalence does not reflect the real extent of the phenomenon in the country, as few people consult health structures in case of animal bites are recorded. Similar proportions have been reported by some authors in Mali [13]. Males accounted for 58.7% of exposed cases. Similar results have been reported by other authors in Guinea, Mali and Senegal [11] [14] [15]. This result can be explained by the fact that they are highly mobile in search of the well-being of their families. The age of the exposed individuals ranged from less than 15 years to more than 45 years. Subjects over 45 years of age represented 57.7% of the cases in our study. Discordant results have been reported in Côte d'Ivoire [16], France [17], Bamako [14], but also in Conakry [11], where children and adolescents under 20 years of age are the most affected. The majority of victims resided in urban areas, 71.8%. These results corroborate those reported in Cote d'Ivoire [16]. Indeed, the most exposed subjects were mostly out of school (42.2%). The opposite results were reported in Côte d'Ivoire, according to which the most exposed subjects were mostly schoolchildren or pupils (49%) [16].

During the three-year study, 94.97% of bites were attributed to dogs. This frequency is close to that found in Bamako (97.1%) [13] and Abidjan (92.1%) [18]. In all studies, the dog is the most frequently involved animal because of its proximity to humans, as a pet or as a protected animal. In developed countries, canine and human rabies have almost disappeared. This disappearance in these countries is due to the vaccination of domestic dogs and the impounding of stray dogs; these measures are most often absent, making the dog the main vector of rabies in Guinea and Africa.

Of the biting animals, 60.7% were non-stray domestic animals compared to 38.3% of stray domestic animals. In Madagascar, home exposure by guard dogs accounted for 64% of all cases [19]. However, Rirabé Nodjimadji *et al.* believe that stray dogs are responsible for 80% of bite cases [12]. As for Odile Angbo-Effi *et al.*, the occurrence of exposures in homes or surroundings (52.2%), in public places (43.7%), showed that the exposure involved dogs protecting "their homes" against any "invaders", or even stray dogs who considered these public places as "their homes" that they had to defend [13].

As for the level of education, 44.8% of the exposed subjects who had never attended school and 29.3% of the primary school children were more represented in taking the rabies vaccine than the other levels. According to B. Dodet *et al.*, pre-exposure vaccination of young children is not, to date, envisaged in any country in the African region [20]. According to Savadogo M. *et al.*, children are more

exposed than adults to rabies risk because of their distracting activities. On average, it is estimated that, 30% - 50% of rabies deaths occur in children under 10 years of age [21]. According to WHO recommendations, only the full dose of curative vaccination can prevent the disease [22]. For 57.0% of respondents on rabies awareness, the source of procuring vaccines was hospital pharmacies followed by 42.8% for other sources. This can be explained by the fact that the State has put the necessary means into hospital pharmacies for the conservation and durability of vaccines in order to harmonise management and even adequate prevention. Despite this effort, 42.8% obtain vaccines from other sources.

In our study, 83.3% of people exposed to rabies had received the rabies vaccine. This result is contrary to that of Traore A K *et al.* in Mali, who showed that pre-exposure or post-exposure vaccination is not done, partly because of the lack of awareness of the risk of rabies, and partly because rabies vaccination is not financially accessible to the average citizen of Bamako [13]. Other researchers have shown that in Côte d'Ivoire, almost all the patients received rabies vaccine despite the low availability of rabies immunoglobulin [18].

A total of 79 cases of potential exposure to canine rabies were recorded, of which 86.07% were managed according to the observation and prophylaxis protocol, of which only one showed clinical signs of rabies. The result of the follow-up of biting animals showed 59.2% live animals and 0.7% dead animals. In addition, 8.9% of the biting animals were slaughtered, while in 31.2% of the cases, there was no information on the fate of the animal. In our study, only 10.6% of the slaughtered animals were sampled. It can be seen that almost 74% of the slaughtered and sampled animals tested positive in the laboratory. Comparable results have been reported by other authors [12], according to which 1.5% per year of canine rabies cases are reported.

The most common signs found in biting animals were aggressiveness (91.1%) and red eyes (29.5%). According to the literature, rabies affects the central nervous system, causing mainly neurological symptoms of encephalitis, none of which are pathognomonic of the disease in animals [21]. For Rirabé Nodjimadji *et al.*, dogs, more precisely stray dogs, being hungry and finding nothing to eat, end up attacking herds of small ruminants to devour them, hence the high number of bite cases observed in the latter [12]. In our study, 69.1% of the exposed animals were not vaccinated. Similar results were reported in Ghana, where 52.7% of biting dogs were not vaccinated [23]. Therefore, the percentage of rabies vaccination coverage found in this study is woefully inadequate to control rabies, as shown in this study [24]. For Issaka Tiembré *et al.*, in the majority of cases, the animal was not vaccinated. These high rates of unvaccinated animals could be due to the ignorance or negligence of pet owners to have them vaccinated, the high cost of the vaccine, the lack of enforcement of legislation against pet owners, and finally, the lack of public veterinary infrastructure [16]. In the study by S. Dao *et al.*, the vaccination status of bitten people and biting animals was not specified [13].

In 70% of the cases, the majority of the exposed animals were not followed up

by veterinarians. In contrast, 30% were followed up by veterinarians. This could be explained by a lack of awareness of the risk of rabies and the fact that rabies vaccination is not financially accessible to the average citizen. According to Lopes *et al.*, about 70% of the country's dog population must be vaccinated against rabies before a significant reduction in human rabies cases can be achieved [14].

## 5. Conclusions

Rabies is a major zoonosis caused by a neurotropic virus of the Lyssavirus genus. It is clinically characterised, after a long incubation period, by the development of acute encephalomyelitis with various associated nervous signs, evolving towards paralysis and death.

In some countries of the world, such as Guinea, reliable data on this disease are lacking, making it difficult to measure its real impact on human and animal health. The analysis of the information available to us led to the following results: There were 1531 people exposed during the three (3) years of the study. The prevalence of human rabies in the sample was 5.23 per thousand (8 cases for 1531 exposures). The prevalence of canine rabies was 0.7%.

The biting animal was the dog in 97.2% of cases. The age of those exposed ranged from less than 15 years to more than 45 years, with a high prevalence among those over 45 years (57.7%). Men were more exposed than women (58.7%).

More than 45% of the respondents had taken steps to slaughter their animals in the event of signs of rabies. The majority of respondents (78%) knew the signs of rabies and 73% had never been educated about rabies and its dangers. However, women were more aware of rabies than men (54%). Most (75%) were aware of vaccination as a better way to prevent rabies in humans. In 59.37%, the animals were unvaccinated.

Some risky attitudes and practices that expose people to human rabies, including the failure to seek adequate care after exposure to rabies. Therefore, proper vaccination of dogs, as well as cost reduction, public awareness and continuous training of medical and veterinary staff, will reduce the incidence of rabies. In addition, a multi-sectoral control approach, involving veterinary services with a vaccination programme for domestic animals and culling of stray animals, is required.

The public must be made aware and informed about the proper treatment of victims, which consists of administering combined rabies serum and immunoglobulin and ensuring post-exposure prophylaxis.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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