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Evaluation of the rabies surveillance system using the One Health approach in Mozambique, 2020-2021

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Abstract

Introduction: *since 2014, Mozambique has experienced several outbreaks of rabies, the prevention and control actions were sectoral, which represented a greater waste of resources, time and, consequently, an increase in cases of animal bites and rabies. In 2020, the national strategic plan for rabies control in Mozambique was implemented to ensure coordinated rabies prevention and control actions using the One Health approach. Due to the new guidelines on rabies surveillance, such as weekly information sharing and joint research between sectors. We evaluated the system to understand the level of involvement of the actors and the fulfilment of its objective and to propose recommendations for improvement.* ***Methods:*** *we evaluated the rabies surveillance system in Mozambique based on qualitative and qualitative attributes. Manuals, flowcharts, reports and case investigation sheets for the human and animal components of rabies were used as data sources. Means, standard deviation, rates and proportions were calculated using Microsoft Excel 2019.* ***Results:*** *evaluation of the attributes identified weaknesses related to sharing information and coordinating rabies control and prevention actions between the two sectors. In the human component, 48,606 cases of animal bites were reported nationwide. Of these, 1.2% (595/48,606) cases were investigated. We analysed 595 notification forms for the human component and were unable to locate the forms for the animal component. On average, 82.0% (SD±29.1%) of the variables on the notification form were filled in. The variables animal observation 16.0% (95/595), post-exposure prophylaxis 33.3% (198/595) and vaccination status of the offending animal 11.8% (70/595) had a lower-than-average completion rate. The average time of care was less than 48 hours (SD±3.55), and animal bite cases underwent post-exposure prophylaxis in less than 24 hours.* ***Conclusion:*** *in the human component, the system presents regular data quality, timely, with limitations in terms of acceptability and simplicity. It was not possible to evaluate the animal component. It is recommended that a multisectoral platform be created to share and visualize rabies surveillance data in Mozambique.*

Introduction

Rabies is a zoonotic viral disease caused by a lyssavirus that affects the central nervous system of mammals [1]. Human rabies is transmitted by contamination with saliva containing rabies virus through bites from carrier and/or infected animals. In the urban rabies cycle [1], carnivores (dogs) are of significant importance on the African continent [2,3]. Rabies is responsible for around 60,000 deaths worldwide every year [4]. Among zoonotic diseases, rabies is endemic and neglected in low- and middle-income countries, including Mozambique, where approximately 99% of reported cases of human rabies are due to bites by infected domestic dogs [5]. Around 40% of deaths occur in people under 15 years of age [5]. So far, rabies prevention and control programs are carried out using mass vaccination of domestic and community dogs and cats and mass awareness programs. However, the burden of rabies has not been reduced, as these approaches do not include all stakeholders (human, animal and environmental health sectors) in disease management programs.

In Mozambique, an average of 18,000 cases of animal bites and 20 suspected human deaths are reported every year [6]. The occurrence of cases of bites, mainly canine and human deaths, as well as cases of rabies in animals has been reported every year and in all provinces. In 2018, at the zoonosis prioritization workshop using the One Health approach through the Centers for Disease Control and Prevention-United States of America (CDC-USA) zoonosis prioritization tool, which encourages countries to prevent and control zoonoses through multisectoral, multidisciplinary, interdisciplinary and transdisciplinary involvement. Rabies was one of the diseases prioritized and ranked first on the list [6].

In 2019, a National Strategic Plan for Rabies Control 2020-2024 was drawn up and implemented between the Ministry of Health (MISAU) and the Ministry of Agriculture and Rural Development (MADER), to coordinate activities to combat rabies in Mozambique [7]. Although they have points of intersection, rabies surveillance in animals and humans are independent. In this context, the rabies surveillance system was evaluated to understand the involvement, coordination and communication between human and animal health, and to propose recommendations for improving the effectiveness of the system.

Methods

An evaluation of the rabies surveillance system was carried out using the One Health approach, describing the qualitative and quantitative attributes based on the guidelines of the Public Health Surveillance System Evaluation, 2001 of the United States Centers for Disease Control and Prevention. Secondary surveillance data on rabies in human and animal health were also used, consisting of notification forms for outbreaks of infection in animals, case investigations in humans and follow-ups of aggressor animals from the Ministry of Health and the Ministry of Agriculture and Rural Development from 2020 to 2021.

A documentary assessment was made of the manuals, flowcharts and annual reports drawn up by the rabies surveillance service of the Ministry of Health and the Ministry of Agriculture and Rural Development. The Microsoft Excel, Office 2019 program was used to construct tables and graphs, and the mean, standard deviation, rates and proportions were calculated for descriptive statistics. The surveillance system was evaluated according to the parameters in Table 1.

The evaluation criteria of simplicity, flexibility, acceptability and data quality were based on Mozambique's National Strategic Plan for Rabies Control. The Weekly Epidemiological Bulletin is an instrument for collecting and sharing information that is filled in by the person responsible for surveillance of the Health Unit (HU) each week in human health.

Results

Simplicity

Within the framework of the One Health approach to rabies control and prevention, the case notification flowchart for both humans and animals was analyzed, showing that there are four levels of notification Figure 1. Which allows this indicator to be classified as 0 points. There are two instruments for reporting cases in both human and animal health. The existence of two instruments gives this indicator a score of 0. Information on both the animal and human components is shared in paper format at all levels, this indicator was rated 0 points, for the simplicity attribute the system scored less than 3 points.

Flexibility

There was a need to redefine the frequency of information sharing and the coordination of rabies prevention activities between the MISAU and MADER during the period under evaluation, and the weekly frequency of information sharing was not incorporated. For the flexibility attribute, the system was classified as non-flexible.

Acceptability

With regard to the human component, 48,606 cases of animal bites were reported nationwide in the Weekly Epidemiological Bulletin. Of these, 98.8% (48011/48,606) were not investigated. Of the 595 animal bite cases investigated, 70.0% (416/595) were from Sofala Province, 12.8% (76/595 in Nampula, 9.6% (57/595) in Maputo City, and 2.7% (16/595) in Tete. During this period, 42 cases of human rabies were reported Figure 2.

In the animal component, 26 cases of rabies in animals were notified through the Monthly

Epidemiological Bulletin, 6 in Manica, 14 in Gaza, 3 in Nampula and 3 in Tete (Figure 2). It was not possible to locate the infection outbreak notification forms and the notification record of the aggressor animal received from human health, which is why the indicator "Percentage of cases investigated in the animal component" was not measured. During the study period, there was no record of information sharing in either the human or animal component, and consequently they were not measured.

Data quality

We analyzed 595 case investigation forms for the human component and were unable to locate the forms for the animal component. In general, the variables on the notification form were on average 82.0% (SD±29.1%) complete. The variables animal observation 16.0% (95/595), post-exposure prophylaxis 33.3% (198/595) and vaccination status of the offending animal 11.8% (70/595) had a lower-than-average completion rate Table 2.

Timeliness

The average time from aggression to arriving at the HU was less than 48 hours (SD±3.55) and the average time from arriving at the HU to taking post-exposure prophylaxis was less than 24 hours (SD±0.596) (Table 3). There was no evidence of quarterly/monthly sharing of human-to-animal and animal-to-human health information.

Discussion

The importance of multisectoral and interdisciplinary partnership in the elimination of rabies mediated by domestic animals is recognized [1]. The result of this evaluation of the system shows that there are still challenges in implementing the strategic plan for rabies control between human and animal health. It was not possible to demonstrate the effective exchange of information and coordination of rabies prevention activities due to the lack of records. A flexible system can accommodate and adapt changes according to new evidence [8], the result of this evaluation showed that the system was not flexible one year after the implementation of the National Strategic Plan for Rabies Control, the plan provides for weekly sharing of information between MISAU and MADER, however, information continues to be shared quarterly from human to animal health and monthly from animal to human.

Of all animal bites, 1.2% (595/48,606) of cases were investigated. The aim of the surveillance system is that "all cases of animal bites with the capacity to transmit rabies should be investigated and the offending animal followed up within 10 days of the attack" [7]. The lack of investigation into animal bites could jeopardize the achievement of the goal of zero human deaths from dog-mediated rabies by 2030, launched in 2015 [1]. This result should be interpreted with caution, because the logistics of the paper notification form going from the Health Unit to the district, from the district to the province, from the province to the ministry, and at the ministry the data is entered into a repository, may have contributed to the few records of animal bite cases investigated, considering that the notification criteria in the Weekly Epidemiological Bulletin is the same for animal bite case investigation.

Despite the few cases investigated, the surveillance system in the human component shows regular data quality and timeliness, facts that could contribute to the prevention and control of human rabies, these attributes were not evaluated in the animal component due to the lack of access to surveillance data. In terms of usefulness, the system has failed to meet one of the objectives of its creation, which is to contribute to the elimination of the urban rabies cycle by investigating all suspected cases of rabies and vaccinating all people with high-risk exposure and promoting effective collaboration between human and animal health.

Conclusion

In the human component, the system has regular data quality and is timely, with limitations in terms of acceptability and simplicity. This was not possible to assess in the animal component. Despite this limitation, the system proved useful in revealing the magnitude of the problem under surveillance, which could be used in political decision-making.

Recommendations for MADER and MISAU

We recommand to develop an intersectoral and institutional data visualization panel to better coordinate and strengthen the bite and rabies surveillance system, making decision levels more flexible/decentralized.

Competing interests

The authors declare no competing interests.

Authors' contributions

Conception and design of the study: Inácio Alfredo da Costa and Osvaldo Frederico Inlamea. Implementation of the study: Inácio Alfredo da Costa, Aline Confiance Gatambire, Almiro Rogério Tivane. Contribution of materials and tools for analysis: Inácio Alfredo da Costa, Miquelina Vaz Chicanequisso, Ilda Chilengue, Érika Rossetto. Provided critical revision of the manuscript: Cynthia Baltazar, Sadia Ali, Inocêncio Chongo, Osvaldo Frederico Inlamea. All the authors have read and agreed to the final manuscript.

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Figure 2: distribution of human and animal rabies cases by province, Mozambique, 2020-2021

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Table 1: attributes, criteria and parameters for classifying the attributes

Attribute	Evaluation criteria	Parameters	Classification
Simplicity The simplicity of a system is about its structure and operability.	Number of entities involved.	≤3 níveis = 1 >3 níveis = 0	≥ 2 = Simple < 2 = complex
	Instrument for collecting information.	1 instrumento = 1 > 1 instrumento = 0	
	Method of transmitting data and information.	Electronics = 1 On paper = 0	
Flexibility A system is flexible when it accommodates new information and operational needs with fewer additional resources while maintaining its quality.	Incorporation of weekly information sharing.	Share ≤ weekly = Yes Share > weekly = No	Yes=Flexíble No= inflexíble
Acceptability Reflects the willingness of people and organizations to participate in surveillance	Percentage of human cases investigated.	≥75% = 1 <75% = 0	≥ 3 = acceptable < 3 = No acceptable
	Percentage of animal cases investigated.	≥75% = 1 <75% = 0	
	Rate of human-to-animal health information sharing.	≥75% = 1 <75% = 0	
	Rate of animal-to-human health information sharing.	≥75% = 1 <75% = 0	
Data quality Reflects the completeness and validity of the data recorded in the public health surveillance system. Method: this attribute was assessed by measuring the completeness of the fields filled in for the variables.	**Human health** Date of aggression, Date of care, Date of vaccination, Date of notification, Address/District/Province/, Age, Sex, aggressor animal, animal's vaccination history, animal's origin; Observation of animal within 10 days of aggression.	**Completed:** 90 - 100% = 2 80% - 90% = 1 <80% = 0	≥3 = Good 2 = fair <2 = Bad
	Animal health Date of notification, date of start of follow-up, province, district of animal followed, type of animal followed, outcome, date of outcome, sample taken (if death).	**Completed:** 90 - 100% = 2 80% - 90% = 1 <80% = 0	
Timeliness. Reflects the speed between stages in a public health surveillance system.	**Timeliness of service:** The difference in days between the date of assault and the date of attendance.	**Human Health** <Two days = 1 ≥ Two days = 0	≥ 3 = oportuno < 3 = não oportuno
	Timeliness of treatment: The difference in days between the date of attendance and the date of post-exposure prophylaxis.	**Human health** <24 horas = 1; ≥ 24 horas = 0	
	Timeliness of notification: The difference in days between the date of attendance and the date of notification.	**Human health** <Two days = 1; ≥ Two days = 0	
	Frequency of database analysis and information sharing	**Human health** ≤ 1 week = 1; >1 week = 0	
		Animal Health ≤1/week = 1; >1 /week= 0	

Table 2: evaluation of the indicators of the acceptability attribute of the rabies surveillance system, Mozambique, 2020-2021		
Indicators	**Result**	**Classification**
Percentage of human cases investigated	1.2% (595/48,606)	Not evaluated
Percentage of animal cases investigated	Not evaluated	
Rate of human-to-animal health information sharing	Not evaluated	
Animal to human health information sharing rate	Not evaluated	

Table 3: completeness by variable, Mozambique, 2020-2021				
Variable	**No filling**		**Filling**	
	nº	**%**	**nº**	**%**
Notification Date	0	0,0	595	100,0
Date of Investigation	0	0,0	595	100,0
Date of Assault	24	4,0	571	96,0
Sex	3	0,5	592	99,5
Age	29	4,9	566	95,1
Address (neighborhood/village)	18	3,0	577	97,0
Service Center	73	12,3	522	87,7
District	70	11,8	525	88,2
Province	5	0,8	590	99,2
Location of injury	38	6,4	557	93,6
Lesion classification	41	6,9	554	93,1
Post-exposure prophylaxis (D0)	397	66,7	198	33,3
Aggressor animal	74	12,4	595	100,0
Origin of the offending animal	59	9,9	536	90,1
Vaccination status of the animal	525	88,2	70	11,8
Observation of the animal	500	84,0	95	16,0
Technician's signature	36	6,1	559	93,9
Mean				**82,0**
SD				**29,1**

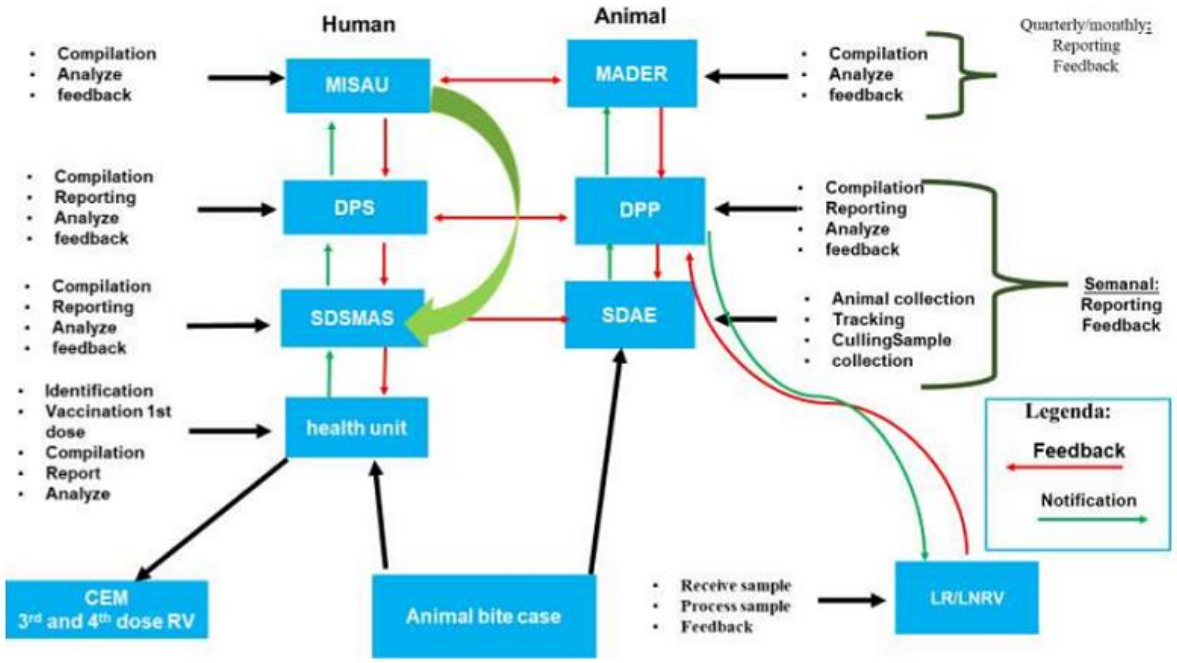

Figure 1: flowchart of the rabies surveillance system, Mozambique, 2020-2021

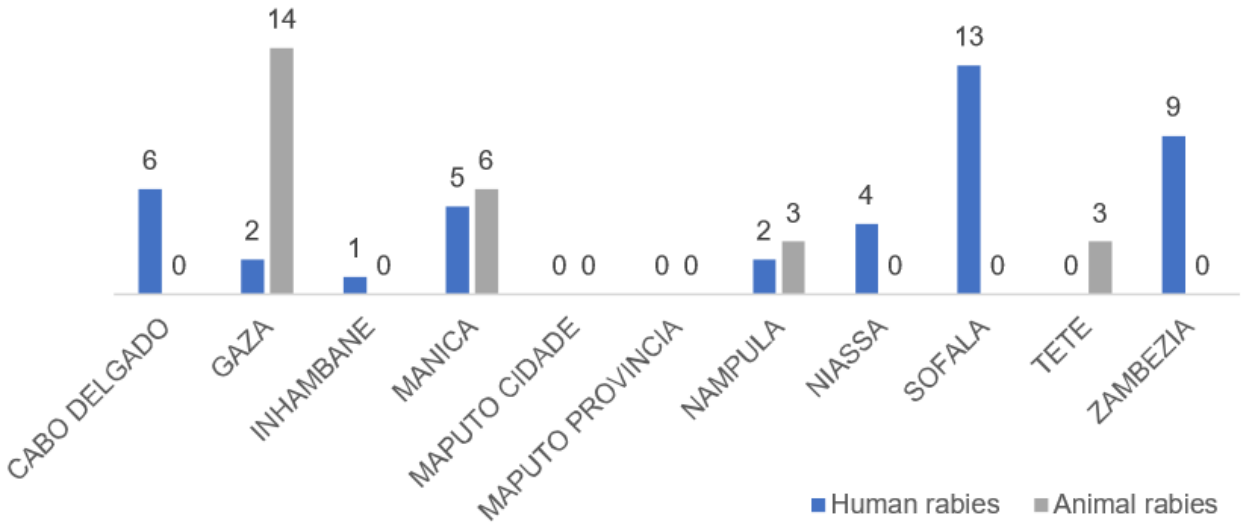

Figure 2: distribution of human and animal rabies cases by province, Mozambique, 2020-2021