Awareness of rabies control and challenges to the intersectoral management of dog bites in Western Cameroon

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Abstract

Background: Rabies is a zoonotic and a typical One Health challenge. Intersectoral surveillance is a critical component of rabies control programmes. However, the under-reporting of animal bite cases and the lack of coordination between sectors involved in the surveillance may lead to failure in the control efforts of this public health concern.

Methods: A cross-sectional study was conducted at the operational level. Two separate survey grids were used for simultaneous data collection in the study sites, including 385 dog bite victims within communities and 273 human health and animal health professionals responsible for rabies surveillance in health and veterinary facilities

Results: There was no association (OR: 0,76; CI: 0,452-1,39 and p=0.38) between data loss and professional profile of the surveillance focal points; however, there was a significant association between the under-reporting of physical aggression cases of dog bites by victims and the level of education (OR: 1.75; IC:1.02-2.99 and P=0.0413), and with individuals younger than 20 years and those over 50 years of age (OR:0.39; CI:0.16-0.96 and p=0.0415). Indeed, there was a positively and statistically significant association (OR: 3.11; CI: 1.94-5.00 and p<0.0001) between knowledge of rabies with under-reporting of dog bites by community members; while negatively associated CI: 0.52-1.82 and p=0.9226) with the level of education. Interestingly, there was no significant difference in the under-performance in case reporting whether the surveillance focal points had received prior training on rabies surveillance (OR: 1.14; CI: 0.64-2.01 and p=0.66), had knowledge of operational case definition (OR: 0.93; CI: 0.54- 1.58 and p=0.7851) or /and knew the manifestation of rabies (OR: 0.88; CI: 0.51-1.51and p=0.6408).

Conclusion: The under-reporting of rabies bites in the West region of Cameroon is as a consequence of negligence and lack of application of the one health approach on rabies surveillance by the surveillance focal points in District health sectors, leading to the no-exhaustive collection and patchy dissemination of dog bite data.

1. Introduction

Rabies is one of the oldest zoonotic infectious diseases in medical history [1, 2] caused by a virus belonging to the *Lyssavirus* genus [2]. Known as a neglected disease, rabies is transmissible to humans as well as domestic and wild animals [3]. It is usually transmitted invasively through saliva that penetrates a wound (after a bite, scratch or lick). The clinical manifestation of rabies consists of encephalitis with severe and distinct symptoms that inevitably result in death. Dogs are primarily responsible for most human rabies and account for up to 99% of human transmission in Asia and Africa [4, 5], making a major public health problem in most developing countries (with an estimated 59,000 deaths per year globally). The burden of the disease is particularly huge in the tropical and subtropical regions of Africa and Asia [1, 2] with an estimated 44% of human rabies cases occurring in Africa with 7,000 deaths yearly in the central part of the continent [6]. The World Health Organization (WHO)

estimates the number of deaths from rabies in urban areas at 2 per 100,000 and in rural areas of Africa at 3.6 per 10,000 [7].

The burden is mostly higher among rural communal areas with large stray dog populations and low dog vaccination coverage [8–11]. Poverty and poor awareness of rabies are generally associated with an increased vulnerability to the disease and are, consequently, major obstacles in prevention and control, especially in rural areas [12, 13]. A general understanding of dog behaviour, responsible pet ownership, appropriate health service-seeking behaviour following dog bites and rabies prevention are all crucial in rabies control and necessary to be addressed by awareness-raising interventions to reduce vulnerability and exposure [3].

Like in many other countries, rabies is a notifiable disease in Cameroon since 2001 [17]. As such, a reliable and sensitive epidemiological surveillance and reporting system must be in place to facilitate regular data collection and reporting of animal exposures. Such surveillance is often inadequate and official reporting of human and animal disease incidence remains unsatisfactory and incomplete. It is increasingly recognized that available data underestimate the true incidence of rabies and that, in many cases, the true quantitative burden of the disease is best represented by estimates [6].

According to the same study, the actual number of rabies cases could be 160 times higher than the number of reported cases if epidemiological surveillance had been effectively implemented. Many dog bite cases are not identified or reported; people with rabies most often die at home without being diagnosed. Cases diagnosed in hospitals are partially reported, and victims of bites do not receive appropriate PEP due to a lack of awareness among health workers, or due to the expensive costs [7, 14].

In 2018, the Tripartite and Global Alliance for Rabies Control launched the Global Strategic Plan (GSP) to end human deaths from dog-mediated rabies by 2030 [15]. However, the epidemiology of rabies from most West and Central African countries remains poorly defined, making it difficult to assess the overall rabies situation and progress towards the 2030 goal [15].

Cameroon remains endemic for rabies, where dogs are the main vectors, but there is no national rabies control action plan despite the inclusion of the One Health approach in rabies surveillance (Fig. 1) in ministerial guidelines. In 2015, a total number of 5878 dog bites cases were recorded in the country [16]. Yet, these data are still fragmentary and certainly do not reflect the reality of the burden of this disease [16]. In the absence of exhaustive epidemiological data, the health it may be difficulty for the authorities to perceive the severity of the disease's implications on public health. This might result into paying least attention to the disease and, and therefore, not allocating sufficient resources to rabies control efforts [7].

A study reported that in the West Cameroon Region, most animal exposures and human rabies cases were not reported [17]. Moreover, surveillance was mostly passive and incomplete, and no case report forms, or rabies case registers were available. Subsequently, the rabies surveillance network in the West Cameroon Region was strengthened with 337 fully documented animal exposures and 143 undefined exposures recorded in the studied Health Districts, for a total of 480 exposures [17]. Similarly, a higher

number of animal exposures were also recorded in 2015 and in the first 6 months of 2016. These data from approximately 78% of the population in the West Cameroon region, are 8–10 times higher than the 57 exposures previously reported for the whole region in 2013 [16].

A comparative review of the rabies epidemiological surveillance data found in the outpatient register and those reported in the district health Information Software 2 (DHIS2) – the main medium for notification of cases, in the West region of Cameroon from 2019 to 2021 shows a clear discrepancy in all the Health Districts of the region, between the surveillance data found in the outpatient registers and those reported in the DHIS 2. In addition, the reported data were strongly underestimated [18].

Nevertheless, since the beginning of 2017, the proportion of data reported to the surveillance system has decreased statistically compared to the previous two years. This could be related to the under-reporting of dog bite cases in the surveillance system in the districts, which indicates the lack of an effective surveillance system [16]. Hence, this research aimed at analyzing the inadequacies in the collection and dissemination of rabies surveillance data in the West Cameroon region.

2. Material and methods

2.1. Study design and area

This was a cross-sectional study, conducted from November 2021 to July 2022. The study was conducted in the West region of Cameroon. This region is one of the 10 health regions in Cameroon. Demographically, it covers an area of 13,892 km2 for a total population of 2,356,728 inhabitants. In terms of health, this part of the country, administered by a Regional Public Health Delegate, has a total of 20 Health Districts, 235 health areas and 886 health facilities [19].

The choice of the West region as the study site is justified by the fact that this region had the lowest performance (72%) relative to surveillance of human rabies between January 2019 and December 2021 as compared to the 05 regions bordering the Western region of Cameroon (North-West: 78%; South-West 80%; Littoral: 83%; Centre: 82%; Adamaoua: 82%) [20].

Accordingly, all the Health Districts of the region were studied (Fig. 1).

2.2. Sampling strategy

On one hand, a census of all animal health and human health professionals involved in rabies surveillance at the operational level in the study area was conducted. Access to health professionals was facilitated by their respective Regional Delegations (human and animal health). These delegations provided us with contacts of rabies surveillance focal points, and informed their various fellows of the operational level about the research via their professional forums. Concerning victims of dog bites in communities, access was facilitated by the Community Health Workers of the different health areas

visited. These latter, mastered their communities in general and victims of dog bites in particular. On the other, victims of dog bites in communities were accessed via a cluster sampling at many degrees. Thus, data have been collected from surveillance focal points, heads of health sectors and heads of zoo-technical centers. Regarding the sampling in the community members, the minimum sample size was calculated using the Lorentz formula. The prevalence used was 3.6% [21].

$$n = \frac{(z)x2p(1-p)}{d2} = 0.036\,\frac{(1-0.036)1{,}96^2}{0{,}05^2} = 53$$

Where,

n = minimal sample size

z = 1.96 (value of standard normal distribution for a 95% confidence level) p = prevalence

d = error.

2.2. Data collection

On one hand, data were collected via quantitative questionnaires addressed to health (human and animal) professionals and victims of dog bites in communities. On the other, documentary review through consultation of external register, notifying forms, and dog bites cases investigating forms of human health services (health facilities & Districts) and Zootechnical posts. Historical data of notified rabies cases were exploited through DHIS2.

2.3. Statistical analysis

The main variables studied were age, sex, level of education, respondents' knowledge of rabies and its vector, post-exposure practices to dog bites, the exhaustiveness of the declaration of cases of dog bite dog and multi-sectoral collaboration according to the One Health approach. The data obtained were entered into an Excel 2019 spreadsheet and analyzed using the EPI INFO 7.2 software. The search for potential associations was performed by logistic regression. Significance was considered for P-values less than or equal to 0.05 and 95% was used as confidence level.

3. Results

3.1. Socio-demographics of victims of dog bites

Most of the victims of dog bites were between 20 and 50 years old (70.91%). The female gender was the most represented with 55.59% given a male-female ratio of 1.25. Most respondents (76.36%) had attended school but none of them acceded to tertiary education (Table I).

Table I. Socio-demographic characteristics of the victims of dog-bites

Variables	Number	Frequency (%)
Age group		
< 20 years	55	14.29
[20-50 years]	273	**70.91**
> 50 years	57	14.80
Sex		
Female	214	**55,59**
Male	171	**44.41**
Level of education		
Null	91	23.64
Primary	130	33.76
Secondary	164	**42.60**

3.2. Knowledge and practices of respondents relative to rabies surveillance

Table II shows that the majority (60.52%) of community members had knowledge about rabies. Nevertheless, 66.49 of them had no surveillance-related practices. However, the level of knowledge of the rabies surveillance focal points on the operational definition of cases of this disease was 61.9% and 35.9% on the manifestations of the disease. On the other hand, all of the surveillance focal points knew the mode of control of rabies transmission and 56.41% of them were familiar with the tools for collecting and notifying cases. Only 46.15% knew and respected the deadlines for recording cases of dog bites in the various media. But, notifying cases and respecting the process were adhered to by 54.58% of surveillance focal points managers. The overall rate of planning and implementation of awareness-raising activities on rabies and its surveillance was 63.37%. The sadly neglected aspect was the collaboration between the Cameroun Ministry of Health (MINSANTE) and the Ministry of Livestock, Fisheries and Animal Industries (MINEPIA) which was low at 33.33% in the western region.

Table II. Distribution of knowledge and practices of respondents relative to rabies surveillance

Respondent	Variable	Categories	Number	Frequency (%)
Victims of dog-bites	Knowledge of rabies	No	152	39.48
		Yes	233	60.52
	Notification of dog-bites	No	256	66.49
		Yes	129	33.51
Focal points	Knowledge of operational case definition	No	104	38.10
		Yes	169	61.90
	Knowledge of the manifestation of rabies	No	175	64.1
		Yes	98	35.90
	Knowledge of the modes of transmission	No	0	0.00
		Yes	273	100.00
	Mastery and adequate use of collection and notification media	No	119	43.59
		Yes	154	56.41
	Compliance with deadlines for recording bite cases	No	147	53.85
		Yes	126	46.15
	Compliance with deadlines for notifying bite cases	No	124	45.42
		Yes	149	54.58
	Implementation of rabies surveillance planning and awareness tools	No	100	36.63
		Yes	173	63.37

CI. Confidence Interval

3.3. Factors associated with under-reporting of rabies surveillance data at the operational level

The results showed that there was a significant association between the under-reporting of dog bites by victims and the level of education, the victim's age, and knowledge related to rabies (Table III).

After adjustment of these preceding factors, it has been revealed that there was a statistically significant association (OR: 3.11; CI: 1.94-5.00 and $p < 0.0001$) between under-reporting of dog bites by victims and their knowledge related to rabies (Table IV). The odds that a victim dog bite who notifies the surveillance systems is knowledgeable on rabies is 3.11 folds higher as compared to that of being non-knowledgeable on rabies.

Table III. Univariate analysis of factors associated with under-reporting of dog bite cases by victims

Variables		Notification of cases n(%)	Odds ratio	Odds ratio-95% CI	P-value
Education level	None	54 (59.34)	1	0.74–2.25	Ref
	Primary	85 (65.38)	1.29		0.3604
	Secondary	**120 (71.86)**	**1.75**	**1.02–2.99**	**0.0413**
Knowledge of rabies	No	80 (51.61)	1		Ref
	Yes	**179 (76.82)**	**3.11**	**2.01–4.82**	**< 0.0001**
Age group	< 20]	46 (83.64)	1		Ref
	[20–50]	175 (63.41)	0.34	0.16–0.72	0.50
	[50 >	**38 (66.67)**	**0.39**	**0.16–0.96**	**0.0415**

CI. Confidence interval

Table IV. Multivariate analysis of factors associated with under-reporting by the community

Variable		Adjusted Odds ratio	Adjusted Odds ratio-95% CI	P-value
Education level	None	1	0.47–1.57	Ref
	Primary	0.86		0.6155
	Secondary	0.97	0.52–1.82	0.9226
Knowledge of rabies	No	1		Ref
	Yes	**3.11**	**1.94-5.00**	**< 0.0001**
Age range	< 20]	1		Ref
	[20–50]	0.38	0.17–0.85	0.0183
	[50 >	0.54	0.20–1.46	0.2252

CI. Confidence interval

Further analysis of factors associated with the under-performance of health districts has been performed(table V).

Table V. Analysis of factors associated with under-performance of health districts relative to rabies surveillance.

Variable		Under-performance (%)	Odds ratio	Odds ratio-95% CI	P-value
Trained in rabies surveillance	No	133 (70.37)	1		Ref
	Yes	62 (72.94)	1.14	0.64–2.01	0.664
Knowledge of operational case definition	No	80 (72.07)	1		Ref
	Yes	115 (70.55)	0.93	0.54–1.58	0.7851
Knowledge of the manifestation of rabies	No	80 (72.73)	1		Ref
	Yes	115 (70.12)	0.88	0.51–1.51	0.6408
Mastery and adequate use of collection and notification media	No	103 (69.59)	1		Ref
	Yes	92 (73.02)	1.18	0.70-2.00	0.5334
Compliance with deadlines for recording bite cases	No	88 (73.33)	1		Ref
	Yes	107 (69.48)	0.83	0.49–1.41	0.4851
Compliance with deadlines for notifying bite cases	No	90 (72.00)	1		Ref
	Yes	105 (70.47)	0.93	0.55–1.57	0.7806
Implementation of rabies surveillance planning and awareness	No	141 (73.44)	1		Ref
	Yes	54 (65.85)	0.70	0.40–1.22	0.2055

CI. Confidence interval

4. Discussion

Several studies [23–25] have explored rabies surveillance in the western region of Cameroon, in line with WHO recommendations highlighting the importance of involving communities and health facilities at all levels of the health system [26]. To this end, the 658 participants involved in this study included 273 health professionals of which 235 were rabies surveillance focal points and 38 were zoo technical station managers, while 385 respondents were community members and victims of dog bites. This study showed a positive association between the level of education and rabies surveillance. This is corroborated by previous studies that found that education would improve knowledge and consequently strengthen rabies surveillance by improving the reporting of community bites to health facilities [7, 14]. Everyone studied in the community in this study had already been bitten by a dog, but their post-biting practices varied. This result is consistent with the work by Yurachai *et al* (2015), where 33.24% of dog bite victims sought medical attention for their injuries; while 43.56% had resorted to traditional healers, and 23.20% had self-medication [9]. These varieties of practices may be attributed to either mystical beliefs, lack of knowledge or lack of financial means as supported by, a study in Ethiopia [27] that indicated that only 7% of dog bites victims had performed the correct emergency procedures while 75% were confident that traditional healers effectively treat rabies.

Furthermore, the lack of performance was also found as one of the main challenges in rabies surveillance in the study area. This could be explained by the lack of training of the implementing actors at the operational level on the one hand, but also probably by the rarity of suspected rabies cases reported by the latter that prefer to focus on the identification and reporting of dog bite cases only [17]. Although there was no statistically significant association between this low level of knowledge and the under-reporting of rabies surveillance data, it remains crucial to raise knowledge about rabies and its manifestations for more sensitive surveillance of the disease. This is in line with the WHO advocacy which states that to implement community-based surveillance effectively, it is essential that health professionals are familiar with the key terms used in the MRIS strategy such as the operational definition of the disease, its mode of transmission as well as its clinical manifestations and surveillance processes [22]. Although rabies is a notifiable disease, in the majority of the studied countries, national surveillance systems do not adequately capture the disease [15]. The implementation of rabies surveillance activities as recommended requires not only a perfect mastery of the different data collection and reporting tools required but also scrupulous respect for the deadlines for reporting cases [4]. However, the overall rate of mastery of data collection and reporting tools for rabies surveillance by the surveillance focal points was 56.41% in the region of this study. It was observed that 100% of the health personnel have a perfect command of the outpatient register and the DHIS 2 as a means of recording cases/collecting epidemiological surveillance data and as a tool for reporting cases (dog bites and suspected rabies cases) [28]. Conversely, 43.59% of them were completely unaware of the existence and use of the case notification forms (dog bite and suspected rabies) recommended for all new notifications. This is a result of frank negligence due to the fact that the weekly surveillance data would be collected in the consultation registers and entered directly into the DHIS 2 without being consolidated on a physical notification form and archived in the health facility. This result is similar to that of Ly et al, who also noted the non-existence of notification forms for dog bites in all the Health Districts targeted by their survey [29]. Also, a study conducted in Cameroon in 2022 showed that 24% of the surveillance focal points were briefed on the use of the DHIS 2 [30] – a software tool to facilitate the collection of individual or primary data; the aggregation, storage, sharing and analysis of data [31], that can be consulted by all health workers to facilitate decision-making in the event of epidemics and can allow collections of all data needed to improve epidemiological surveillance [19]. But, the fragmentation of the National Health Information System (NHIS) in Cameroon impacts negatively the coordination and management of health information, resulting in the absence of norms and standards for the use of health information [20]. With regard to the timeliness of notification of the disease, WHO recommends immediate notification (without delay) of every immediately notifiable disease or health event, with a weekly notification [26]. However, the results of our survey show a 54.58% overall rate of reporting timeliness in the West Region. Although no statistical link was found between the level of control of the different media, the notification delays and the underperformance in terms of the completeness of the epidemiological surveillance data, it would be obvious to admit the influence of this under-performance on the completeness of the rabies surveillance data. Public awareness of dog bite prevention and prompt reporting of dog bite cases remains essential for improving rabies surveillance and control measures [6]. In the western region, the rate of implementation of awareness sessions for the population in support of rabies prevention and

surveillance by the surveillance focal points is evaluated at only 63.37%. While 44.5% of surveillance focal points implement it monthly, 50.86% quarterly and 4.62% semi-annually. Although there is no recommended communication schedule in support of rabies surveillance, it is important to take advantage of opportunities to disseminate the rabies awareness message to everyone in their area of practice [6].

The West region of Cameroon has accumulated a performance in terms of the completeness of rabies epidemiological surveillance data evaluated at 74%. Overall, this performance is well below the national completion objective set by the program at 90% [22]. Furthermore, the rate of loss of rabies surveillance data between the consultation registers (data recording media) and the DHIS 2 is estimated at 29% at the regional level [26]. A similar study [7] estimates the number of deaths from rabies in Africa at 3.6 per 10,000, which it says could be 160 times higher than the number of reported cases if epidemiological surveillance had been effectively implemented. After the strengthening of disease surveillance in Cote d'Ivoire the number of cases detected increased considerably [23]. This dual situation is associated with the inadequacies noted in the control of notification deadlines and/or the negligence of the latter in implementing this activity as recommended. It should also be noted that the carelessness of the majority of the surveillance focal points in respecting the promptness of notification will drive the strong discrepancy recorded between the surveillance data collected in the data carriers and the DHIS 2 tool, where the filling in of data does not conform to the collection sources.

As per the multisectoral collaboration in surveillance sensitivity, the results of our study show a low collaboration rate (27%) between MINSANTE and MINEPIA actors at the regional level. This result is far below the 100% collaboration rate desired by the One Health concept in the context of rabies surveillance [4]. The inexistence of a real interface between the two sectors of activity on one hand, and on the other hand, the failure to take into account the complementarity of the activities of these two sectors, would be at the origin of this low rate of collaboration in the West region.

The sub-region of Central Africa seems to have accepted the challenge to eliminate rabies with governments committed to pushing forward rabies elimination like their counterpart in the West African sub-region; while progress is observed elsewhere, elimination efforts remain trapped due to the lack of commitment and financial constraints by governments. The hope to meet the 2030 goal is very low without international solidarity to assist more than two-thirds of the low-ranked human development group of countries with HDI $\leq$ 152. Experience sharing by leading countries and capacity building in the needy countries will help to reinforce the surveillance program in Africa, thereby paving the way for the common goal of zero human rabies deaths by 2030 [15].

5. Conclusion

This study aimed at analyzing the inadequacies in the collection and dissemination of rabies surveillance data in the West Cameroon region. Although rabies is known as a very old disease, the level of knowledge about its severity and the need for effective surveillance remains quite low among the populations of the

region. This seems to be influenced by the low literacy rate in some health districts, impacting the reporting of dog bite cases. The low rate of collaboration between MINSANTE and MINEPIA could be attributed to negligence, resulting in the epidemiological surveillance data not complying with the data collection sources. Nevertheless, the quality and availability of the data collection media for rabies surveillance in the health facilities are good, as well as the mastery of the use of the DHIS 2 by all the surveillance focal points surveyed in the West region. Overall, the under-reporting of rabies bites in the West region of Cameroon is a consequence of negligence and lack of application of the One Health approach on rabies surveillance by the surveillance focal points in district health sectors, leading to the no-exhaustive collection and patchy dissemination of dog bite data.

Declarations

Ethics approval statement

This research proposal was approved by the Ethics Committee of the University of Douala, which therefore issued us an ethical authorization (N°3087CEI- UDo/05/2022/M). In addition, two authorizations were given respectively by the Regional Delegate for Public Health (N°658/L/MINSANTE/SG/DRSPO/CB/CA), and the Delegate for Livestock, Fisheries and Animal Industries (N°025/22/AS/MINEPIA/SG/DREPIA-O/SRAG) of the Western Region of Cameroon. Informed consent were obtained from each participant..

Consent for publication

Not applicable

Availability of data and material

The original data generated by this study is available on reasonable request addressed to the corresponding author.

Declaration of Competing Interest

The authors declare that there is no conflict of interest in this work.

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Authors' contributions

CID, MS and NAM conceptualized the work. CNT, CSN, MND, JMF, MNN and ANN collected the data; AK, CNT, VTN and CID gathered the literature; CSN, OKK, and CID analyzed the data. CNT, ANN, CID and CSN

drafted the original manuscript; CID, OKK and NAM substantially revised the manuscript, and all authors read and approved the manuscript.

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Figures

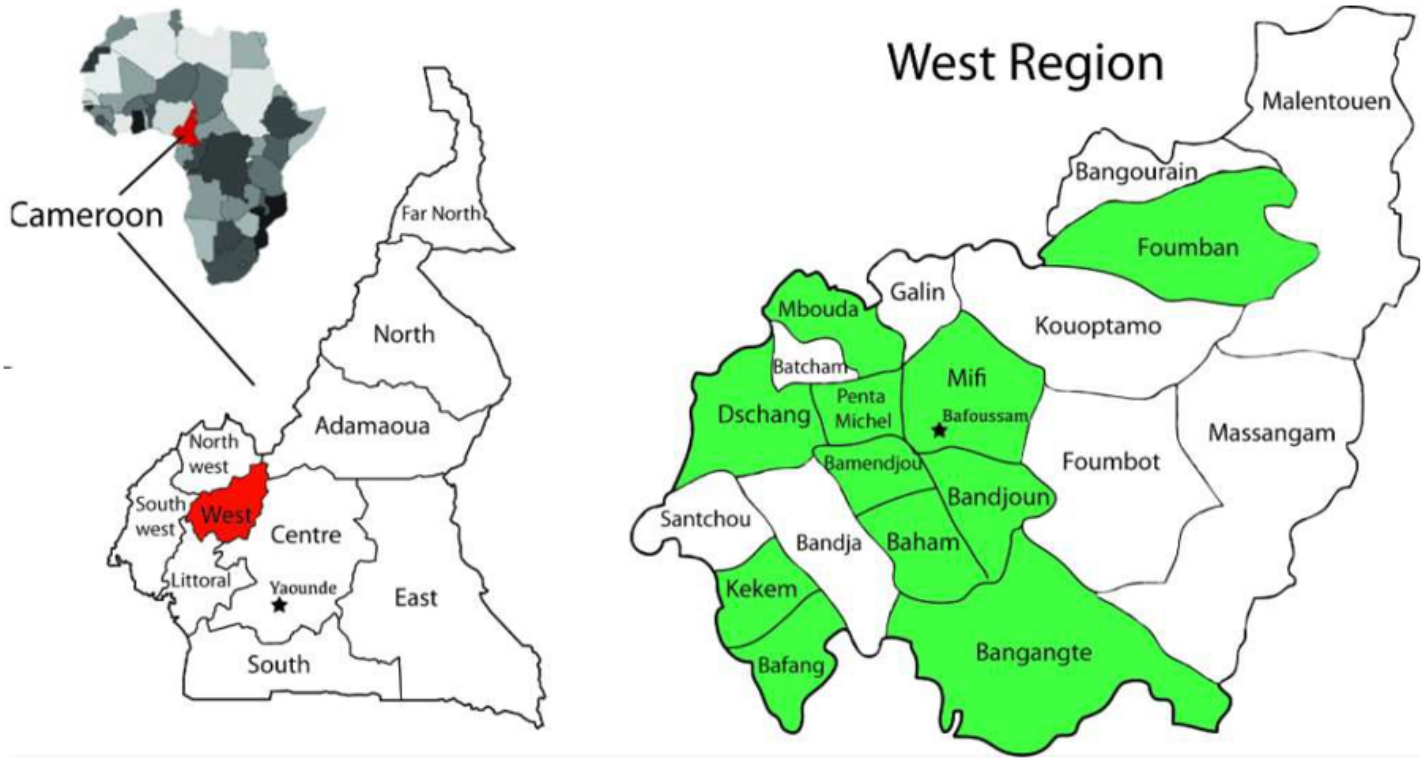

Figure 1

Map of the West region of Cameroon divided in health districts.