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Factors contributing to the vulnerability of healthcare providers in the Bandundu Health Zone and their impact on the ineffectiveness of epidemiological surveillance within the One Health approach

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ABSTRACT

Introduction
The One Health approach highlights the interconnectedness of human, animal, plant, and ecosystem health. Approximately two-thirds of human infectious diseases are zoonotic, with many emerging diseases linked to wildlife. Effective surveillance under the One Health approach is critical for preventing and managing these diseases.

Purpose
This study aimed to assess the factors influencing non-compliance with surveillance standards under the One Health approach in the Bandundu Health Zone, focusing on healthcare providers' knowledge, training, and stakeholder involvement.

Methodology
A cross-sectional analytical study was conducted through field surveys with 200 healthcare providers using a structured questionnaire. Systematic probability sampling was applied to ensure representativeness.

Results
Among the 200 respondents, 62.5% were women, 56.5% were aged 26–33 years, and 70% were nurses with 6 to 10 years of experience. The key findings of the study showed that 80% lacked adequate knowledge of the One Health approach, and 63% were unaware of zoonotic diseases. Education level was found to significantly influence non-compliance with surveillance standards ($\chi^2 = 32.2$, dof = 1, $p = 0.00$). Additionally, there were significant gaps in training on the One Health approach ($\chi^2 = 37.1$, dof = 1, $p = 0.00$), with 94% of respondents reporting insufficient stakeholder involvement and 78% failing to comply with surveillance standards. Statistically significant associations were observed between knowledge of surveillance functions ($\chi^2 = 12.8$, dof = 1, $p = 0.00$) and the failure to involve veterinarians and agronomists in the process ($\chi^2 = 17.9$, dof = 1, $p = 0.00$).

Conclusion
This study identified critical barriers to effective epidemiological surveillance under the One Health approach, including insufficient knowledge, inadequate training, and limited stakeholder engagement. To address these challenges, capacity-building and targeted training programs are essential for improving surveillance practices. Cross-disciplinary collaboration, particularly the inclusion of veterinary and agronomic expertise, is vital for enhancing compliance with One Health standards. Public health policies should prioritize these interventions to strengthen surveillance systems, improve zoonotic disease monitoring, and ultimately safeguard public health.

INTRODUCTION

The "One Health" approach emphasizes the interconnectedness of human, animal, and plant health with ecosystems in shared environments. It promotes multisectoral collaboration for integrated management of public health challenges (World Health Organization [WHO], 2024). Approximately 60% of known emerging infectious diseases are of animal origin, underscoring the need for a unified framework for their prevention and control (Riley et al., 2023). Recent epidemics, such as COVID-19 and the Ebola virus, highlight the importance of integrated strategies, particularly in regions like the Democratic Republic of Congo (DRC), where zoonoses are recurrent. Over the past decades, several emerging diseases have shaped global epidemiological dynamics: HIV in the 1980s, Creutzfeldt-Jakob disease in 1996, avian influenza AH5N1 in 1997, SARS in 2003, and the A(H1N1) influenza pandemic in 2009 (Skowrom et al., 2023). In West Africa, the 2013–2015 Ebola outbreak caused significant health and socioeconomic impacts (WHO, 2022). In the DRC, Ebola outbreaks have been reported since 1976, with high fatality rates (up to 90%), notably affecting healthcare professionals (WHO Regional Office for Africa [OMS AFRO], 2023). To date, the thirteen recorded outbreaks in the country have resulted in 4,722 cases and 3,193 deaths, with an overall fatality rate of 67.6% (Ministry of Health and Development, 2022). The Kwilu province, particularly the Bandundu Health Zone, is especially vulnerable due to the resurgence of epidemics such as measles, Mpox, rabies, typhoid fever, and polio, as well as natural disasters and environmental issues (DPS Kwilu, 2024). However, gaps in epidemiological surveillance, exacerbated by insufficient multisectoral collaboration and lack of training, undermine prevention and control efforts. This study aims to analyze the vulnerability factors among healthcare providers contributing to the inefficiency of epidemiological surveillance within the "One Health" framework in the Bandundu Health Zone. By shedding light on these vulnerabilities, it seeks to propose targeted interventions to strengthen the region's health resilience.

METHODS

The study was conducted in the Bandundu Health Zone, specifically within healthcare facilities, as this zone is known for a high prevalence of various illnesses and unusual events.

Type of Study

A quantitative cross-sectional study was designed to analyze healthcare providers in the Bandundu Health Zone.

Study Period

The study covered the period from September 2023 to September 2024.

Study Population and Sampling

The statistical unit comprised 200 healthcare providers from 13 Health Centres, the Hôpital Général de Référence (HGR), and the Bureau Central de Zone (BCZ). Systematic probability sampling was employed based on a declarative list. A total of 12 providers were selected from each Health Centre and the BCZ, while 32 were selected from the HGR Bandundu.

Method, Techniques, and Data Collection Tools

The study utilized the field survey method, supplemented by interviews and document reviews. A structured questionnaire with closed-ended questions was employed as the primary data collection tool. To ensure reliability and validity, the questionnaire was pre-tested on a small sample of respondents representative of the study population but not included in the final sample. Feedback from the pre-test was used to refine question wording, structure, and clarity. The pre-test also helped assess the consistency of responses and the ability of the questions to capture the intended information accurately, thereby enhancing the tool's overall reliability and validity.

Analysis Plan

Data were analyzed using SPSS version 20. Two main analyses were performed: descriptive and bivariate, with Pearson's chi-square test applied to determine statistical significance.

Ethical Considerations

Ethical principles were strictly adhered to throughout the study. The research protocol was reviewed and approved by the Ethics Committee of the Higher Institute of Medical Techniques (ISTM) of Kinshasa, under reference code no 0027/CBE/ISTM/KIN/RDC/PMBBL/2024. Respondents' anonymity was maintained by not collecting their names,

and the confidentiality of the information provided was ensured. Participants were informed that their participation was entirely voluntary and that they could withdraw at any time without facing any negative consequences or sanctions.

RESULTS

Table 1 presents the demographic characteristics of the respondents, including gender, age group, professional category, and seniority. These factors provide a foundational understanding of the diversity within the study population and are essential for analyzing the results in relation to adherence to surveillance norms within the framework of the One Health approach.

Table 1:
Demographic and Distribution of Healthcare Professionals' Knowledge and Experience on Zoonotic Diseases, Notifiable Diseases, and Environmental Events

Factor	Frequency	%
Gender:		
Male	75	37.50
Female	125	62.50
Total	200	100
Age range:		
18-25 years	10	5
26-33 years	113	56.50
41-48 years	41	20.50
Older than 48 years	36	18
Total	200	100
Seniority:		
1-5 years	30	15
6-10 years	150	75
More than 10 years	20	10
Total	200	100
Level of education:		
A2	25	12.50
A0/L2	185	87.50
Total	200	100
Professional category:		
Nurse	140	70
Doctor	20	10
Laboratory technician	40	20
Total	200	100
Having knowledge of the One Health approach:		
No	160	80
Yes	40	20
Total	200	100
Having knowledge of the ministries involved in the One Health approach:		
No	2	1
Yes	198	99
Total	200	100
If yes, which ones:		
Health	23	11.60
Health and environment	151	76.30
Health, environment, and agriculture	24	12.10
Total	198	100
Having knowledge of all notifiable diseases:		
No	155	77.50
Yes	45	22.50
Total	200	100
Having knowledge of all notifiable zoonotic diseases:		
No	126	63
Yes	74	37
Total	200	100
If yes, which ones:		
Rabies	24	32.40
Salmonellosis	10	13.50
Toxoplasmosis	5	6.80
Monkeypox	10	13.50
All the diseases mentioned above	25	33.80
Total	74	100
Having knowledge about diseases or environmental events:		
No	144	72
Yes	56	28
Total	200	100
If yes, which ones:		
Malaria	11	19.60
Respiratory disease (bronchitis)	5	8.90
Chemical poisoning	2	3.60
Flooding	21	37.50
Violent wind	8	14.30
Others	6	10.70
All the diseases and events mentioned above	3	5.40
Total	56	100

Legend: *A2 (High School Diploma), A0/L2 (Bachelor's Degree)*

Among the 200 respondents, 62.5% were female, and 37.5% were male. The majority (56.5%) were aged between 26 and 33 years, followed by 20.5% in the 41-48 years range, 18% older than 48 years, and 5% in the 18-25 years range. In terms of seniority, 75% had 6-10 years of experience, 15% had 1-5 years, and 10% had more than 10 years. Regarding education, 87.5% had an A0/L2 level, and 12.5% had an A2 level. Professionally, 70% were nurses, 20% were laboratory technicians, and 10% were doctors. When asked about the One Health approach, 80% had no knowledge of it, while 20% were aware. A vast majority (99%) knew the ministries involved in the One Health approach, with 76.3% citing Health and Environment, 12.1% mentioning Health, Environment, and Agriculture, and 11.6% stating Health only. Concerning notifiable diseases, 77.5% were unaware

of all, while 22.5% were knowledgeable. Similarly, 63% did not know all notifiable zoonotic diseases, with 37% possessing such knowledge. Among those knowledgeable, the most common zoonotic diseases mentioned were rabies (32.4%), salmonellosis (13.5%), monkeypox (13.5%), toxoplasmosis (6.8%), and a combination of all diseases (33.8%). Regarding environmental diseases or events, 72% were unaware, and 28% were familiar, with flooding being the most frequently mentioned event (37.5%), followed by malaria (19.6%), violent wind (14.3%), and bronchitis (8.9%).

Table 2 presents the organizational and policy factors that influence the respondents' adherence to surveillance norms within the context of the One Health approach.

Table 2:
Organizational and Policy Factors

N°	Factors	Frequency	%
1	Knowledge of surveillance legislation		
• No	160	80	
• Yes	40	20	
Total	**200**	**100**	
2	Have been trained in epidemiological surveillance as part of a healthcare programme		
• No	128	72	
• Yes	72	36	
Total	**200**	**100**	
3	If yes, for how long		
• Less than 5 years	22	30.6	
• 5 years or more	50	69.4	
Total	72	100	
4	Knowledge of the functions of monitoring in accordance with SIMR3		
• No	111	55.5	
• Yes	89	44.5	
Total	200	100	
5	Have been trained in the One Health approach		
• No	142	71	
• Yes	58	29	
Total	**200**	**100**	
6	Involve veterinarians and agronomists in your activities		
• No	188	94	
• Yes	12	6	
Total	**200**	**100**	
7	Otherwise, why would		
• They are not invited	96	51.1	
• They ask for motivation	34	18.1	
• Neglect	25	13.3	
• Lack of interest	20	10.6	
• Ignorance	13	6.9	
Total	**188**	**100**	
8	Have declared all unexpected and unusual illnesses and events		
• No	177	88.5	
• Yes	23	11.5	
Total	**200**	**100**	
9	Have declared all unexpected and unusual illnesses and events		
• Nothing	134	67	
• Report and investigate	66	33	
Total	**200**	**100**	
10	What to do if an epidemic disease or an unusual or unexpected event is confirmed in your region		
• Nothing at all	104	52	
• Retaliate	32	16	
• Waiting for the hierarchy	64	32	
Total	**200**	**100**	
11	If nothing, why?		
• Lack of equipment	55	52.9	
• Lack of financial resources	32	30.8	
• Neglect	17	16.3	
Total	**104**	**100**	
12	Compliance with surveillance standards as part of the One Health approach		
• No	156	78	
• Yes	44	22	
Total	**200**	**100**	
13	If not, why not?		
• Lack of knowledge	99	63.5	
• Lack of materials	11	7.1	
• Lack of involvement of agents from other ministries	46	29.5	
Total	**156**	**100**	
14	The real consequences on the ground of not implementing this strategy in your organisation		
• Non-reporting of certain illnesses in the community and unusual or unexpected events	112	56	
• Risk of development of epidemics	40	20	
• Under-reporting	48	24	
Total	**200**	**100**	
15	What can be done urgently to implement this strategy?		
• Training ministry staff in the One Health approach	148	74	
• Make resources available	22	11	
• Hold regular meetings with stakeholders from other sectors	30	15	
Total	**200**	**100**	

Legend: *SIMR3, or Integrated Disease Surveillance and Response, third edition, is an approach implemented to strengthen disease surveillance within a health system.*

The findings reveal significant gaps in organizational and policy factors related to surveillance and the implementation of the One Health approach among healthcare providers. Only 20% of respondents were aware of surveillance legislation, and 36% had received training in epidemiological surveillance, with 69.4% of these trained for five years or more. Knowledge of surveillance functions in line with SIMR3 was limited to 44.5%, while only 29% had training in the One Health approach, and a mere 6% reported collaborating with veterinarians and agronomists. Barriers to collaboration included lack of invitations (51.1%), the need for motivation (18.1%), neglect (13.3%), and ignorance (6.9%). Alarmingly, 88.5% of respondents had not declared unexpected illnesses or events, with 67% of these taking no action due to lack of equipment (52.9%) and financial resources (30.8%). Furthermore, 78% did not comply with surveillance standards under the One Health framework, primarily due to lack of knowledge (63.5%) and involvement of agents from other ministries (29.5%). The consequences of these deficiencies included non-reporting of illnesses (56%) and epidemic risks (20%). Urgent measures suggested include training ministry staff in the One Health approach (74%), resource allocation (11%), and fostering intersectoral collaboration through regular meetings (15%). These findings underscore the critical need for capacity building, resource mobilization, and intersectoral integration to strengthen surveillance systems and mitigate public health risks.

Table 3 illustrates the relationship between the sociodemographic factors of respondents and their non-compliance with surveillance standards within the framework of the "One Health" approach. The table presents the chi-square (χ^2) values, degrees of freedom (DoF), p-values, and significance levels (with a p-value < 0.05 indicating statistical significance).

Table 3:
Relationship between the sociodemographic factors of respondents and non-compliance with surveillance standards within the "One Health" approach

Variables	Compliance with surveillance standards within the "One Health" approach						χ^2	DoF	P-value	Sign.
	No		Yes		Total					
Sex of respondents	**n**	**%**	**n**	**%**	**n**	**%**	7,9	1	0,07	NS
• Male	60	80	15	20	75	37,5				
• Female	96	76,9	29	23,2	125	62,5				
Total	**156**	**100**	**44**	**100**	**200**	**100**				
Age group							16,9	3	0,00	S
• 18-25 years	6	3,8	4	9,1	10	5				
• 26-33 years	94	60,3	19	43,2	113	56,5				
• 41-48 years	23	14,7	18	40,9	41	20,5				
• Over 48 years old	33	21,2	3	6,8	36	18				
Total	**156**	**100**	**44**	**100**	**200**	**100**				
Professional category							17,9	2	0,00	S
• Nurse	108	69,2	32	72,7	140	70				
• Doctor	14	9	7	13,6	20	10				
• Laboratory technician	34	21,8	6	13,6	40	20				
Total	**156**	**100**	**44**	**100**	**200**	**100**				
Seniority							14,5	2	0,00	S
• 1-5 years	19	12,2	11	25	30	15				
• 6-10 years	127	81,4	23	52,3	150	75				
• Over 10 years	10	6,4	10	22,7	20	10				
Total	**156**	**100**	**44**	**100**	**200**	**100**				

The analysis of variables related to compliance with surveillance standards within the "One Health" approach reveals statistically significant differences across several factors. Regarding sex, the proportion of compliance is slightly higher among females (23.2%) than males (20%), but this difference is not significant ($\chi^2 = 7.9$; $p = 0.07$; N.S.). Conversely, for age groups, the variations are significant ($\chi^2 = 16.9$; $p = 0.00$; S): younger individuals (18-25 years) and older individuals (>48 years) show lower compliance (9.1% and 6.8%, respectively), while the 41-48 age group demonstrates higher compliance (40.9%). Professional category also significantly influences compliance ($\chi^2 = 17.9$; $p = 0.00$; S), with nurses showing the highest compliance rate (72.7%), followed by doctors (13.6%) and laboratory technicians (13.6%). Finally, years of experience are significant as well ($\chi^2 = 14.5$; $p = 0.00$; S), with professionals having more than 10 years of experience showing better compliance (22.7%) compared to those with 6-10 years (52.3%) and 1-5 years (25%). These results highlight that age, profession, and experience strongly influence adherence to standards, while sex appears to play a less determining role.

Table 4 presents the relationship between socio-cultural factors and non-compliance with surveillance standards in the context of the One Health approach. This table includes the chi-square (χ^2) values, degrees of freedom (DoF), p-values, and significance levels (with p-values < 0.05 indicating statistical significance).

Table 4 illustrates the relationship between socio-cultural factors and non-compliance with surveillance standards

within the One Health approach. The table presents the chi-square (χ^2) values, degrees of freedom (DoF), p-values, and significance levels (with p-values < 0.05 indicating statistical significance).

Table 4:
Relationship between Socio-Cultural Factors and Non-Compliance with Surveillance Standards in the One Health Approach

Variables	Respects de normes de la surveillance dans le cadre de l'approche une santé	χ^2	DoF	P-value	Sign.
Study level	No	Yes	Total		
A2 (High School Diploma)	23 (14.7%)	2 (4.5%)	25 (12.5%)	32.2	1
A0/L2 (Bachelor's Degree)	133 (85.3%)	42 (95.5%)	175 (87.5%)		
Total	156 (100%)	44 (100%)	200 (100%)		
Professional category	No	Yes	Total		
Nurse	108 (69.2%)	32 (72.7%)	140 (70%)	17.9	2
Doctor	14 (9%)	7 (13.6%)	20 (10%)		
Laboratory technician	34 (21.8%)	6 (13.6%)	40 (20%)		
Total	156 (100%)	44 (100%)	200 (100%)		
Having Knowledge of the One Health Approach	No	Yes	Total		
No	123 (78.8%)	37 (84.1%)	160 (80%)	31.7	1
Yes	33 (21.2%)	7 (15.9%)	40 (20%)		
Total	156 (100%)	44 (100%)	200 (100%)		
Having Knowledge of the Ministries Involved in the One Health Approach	No	Yes	Total		
No	1 (0.6%)	1 (2.3%)	2 (1%)	4.9	1
Yes	155 (99.4%)	43 (97.7%)	198 (99%)		
Total	156 (100%)	44 (100%)	200 (100%)		
Having Knowledge of All Notifiable Diseases	No	Yes	Total		
No	121 (77.6%)	34 (77.3%)	155 (77.5%)	24.9	1
Yes	35 (22.4%)	10 (22.7%)	45 (22.5%)		
Total	156 (100%)	44 (100%)	200 (100%)		
Having Knowledge of All Notifiable Zoonotic Diseases	No	Yes	Total		
No	99 (63.5%)	27 (61.4%)	126 (63%)	17.3	1
Yes	57 (36.5%)	17 (38.6%)	74 (37%)		
Total	156 (100%)	44 (100%)	200 (100%)		
Having Knowledge of Diseases or Environmental Events	No	Yes	Total		
No	115 (73.7%)	29 (65.9%)	144 (72%)	17.9	1
Yes	41 (26.3%)	15 (34.1%)	56 (28%)		
Total	156 (100%)	44 (100%)	200 (100%)		

Note: A2 = High School Diploma; A0/L2 = Bachelor's Degree

The analysis of variables related to compliance with surveillance standards within the One Health approach reveals significant differences for several factors. Regarding educational level, individuals with an A0/L2 level show a higher compliance rate (95.5%) compared to those with an A2 level (4.5%), with a significant difference ($\chi^2 = 32.2$; p = 0.00; S). For the professional category, nurses have the highest compliance rate (72.7%) compared to doctors (13.6%) and laboratory technicians (13.6%), with this difference also being significant ($\chi^2 = 17.9$; p = 0.00; S). Knowledge of the One Health approach is associated with higher compliance, with 84.1% of those who have knowledge adhering to standards, compared to 78.8% of those who do not ($\chi^2 = 31.7$; p = 0.00; S). Regarding knowledge of the ministries involved in the One Health approach, the difference is not significant ($\chi^2 = 4.9$; p = 0.3; N.S.), as almost all respondents reported knowing the relevant ministries. For knowledge of reportable diseases, the difference is significant ($\chi^2 = 24.9$; p = 0.00; S), although compliance rates are similar between those who know these diseases (22.5%) and those who do not (77.5%). Knowledge of reportable zoonotic diseases and environmental diseases or events shows significant differences ($\chi^2 = 17.3$; p = 0.00; T.S., and $\chi^2 = 17.9$; p = 0.00; T.S.), with individuals having knowledge in these areas adhering more to surveillance standards, although the differences are not as pronounced as in other variables. These results highlight the importance of education, professional knowledge, and specific expertise in improving compliance with standards within the One Health approach.

Table 5 presents the relationship between organizational factors and non-compliance with surveillance standards within the One Health approach. This table includes chi-square (χ^2) values, degrees of freedom (DoF), p-values, and significance levels (with p-values less than 0.05 indicating statistical significance).

Table 5:
Relationship between Organizational Factors and Non-Compliance with Surveillance Standards in the One Health Approach

Variables	Compliance with Surveillance Standards in the One Health Approach						X^2	ddl	P	D.S
	No		Yes		Total					
	n	%	n	%	n	%				
Having Knowledge of Surveillance Legislation										
No	126	80,8	34	77,3	160	80	4,8		0,1	P. S
Yes	30	19,2	10	22,7	40	20				
Total	**156**	**100**	**44**	**100**	**200**	**100**				
Having Been Trained in Epidemiological Surveillance within the One Health Framework										
No	98	62,8	30	68,2	128	64	37,8	1	0,0	T. S

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Yes	58	37,2	14	31,8	72	36				
Total	**156**	**100**	**44**	**100**	**200**	**100**				
Having Knowledge of the Functions of Surveillance According to SIMR3							12,8	1	0,0	T. S
No	97	62,2	14	31,8	111	55,5				
Yes	59	37,8	30	68,2	89	44,5				
Total	**156**	**100**	**44**	**100**	**200**	**100**				
Having Been Trained in the One Health Approach							24,5	1	0,0	T. S
No	113	72,4	29	65,9	142	71				
Yes	43	27,6	15	34,1	58	29				
Total	**156**	**100**	**44**	**100**	**200**	**100**				
Having Involved Veterinarians and Agronomists in Your Activities							**17,9**	**1**	**0,0**	**T. S**
No	148	94,9	40	90,9	188	94				
Yes	8	5,1	4	9,1	12	6				
Total	**156**	**100**	**44**	**100**	**200**	**100**				
Having Reported All Diseases and Unusual or Unexpected Events							10,1	1	0,0	T. S
No	145	92,9	32	72,7	177	88,5				
Yes	11	7,1	12	27,3	23	11,5				
Total	**156**	**100**	**44**	**100**	**200**	**100**				
What to Do if an Epidemic Disease or an Unusual or Unexpected Event is Suspected in Your Area							17,5	1	0,0	T. S
Do Nothing	112	71,8	22	50	134	67				
Report and Investigate	44	28,2	22	50	66	33				
Total	**156**	**100**	**44**	**100**	**200**	**100**				
What to Do if an Epidemic Disease or an Unusual or Unexpected Event is Confirmed in Your Area							4,3	2	0,3	P. S
Do Nothing at All	82	52,6	22	50	104	52				
Respond	20	12,8	12	27,3	32	16				
Wait for the Hierarchy	54	34,6	10	22,7	64	32				
Total	**156**	**100**	**44**	**100**	**200**	**100**				
The Real Consequences on the Ground of Not Implementing This Strategy in Your Organization							25,6	2	0,0	T. S
Non-reporting of certain diseases in the community and unusual or unexpected events	83	53,2	29	65,9	112	56				
Risk of epidemic development	38	24,4	2	4,5	40	20				
Underreporting	35	22,4	13	29,5	48	24				
Total	**156**	**100**	**44**	**100**	**200**	**100**				
What to do urgently to implement this strategy							15,8	2	0,0	T.S
Train the actors from the relevant ministries on the One Health approach	120	76,9	28	63,6	148	74				
Make resources available	18	11,5	4	9,1	22	22				
Hold regular meetings with stakeholders from other sectors	18	11,5	12	27,3	30	15				
Total	**156**	**100**	**44**	**100**	**200**	**100**				

***Legend**: SIMR3 (Integrated Disease Surveillance and Response, third edition)*

The data analysis of factors influencing compliance with surveillance standards under the "One Health" approach reveals both significant and non-significant trends across various variables. Knowledge of surveillance legislation shows a higher compliance rate among those informed (22.7%) compared to those uninformed (19.2%), but this difference is not statistically significant ($\chi^2 = 4.8$, $p = 0.1$). Conversely, training in epidemiological surveillance significantly impacts compliance, with 37.2% of trained respondents adhering compared to 62.8% of untrained respondents ($\chi^2 = 37.8$, $p = 0.00$). Knowledge of surveillance functions as per SIMR3 also strongly influences compliance (68.2% vs. 31.8%, $\chi^2 = 12.8$, $p = 0.00$). Similarly, training in the "One Health" approach leads to higher compliance (34.1% vs. 27.6%, $\chi^2 = 24.5$, $p = 0.00$, T.S). However, the involvement of veterinarians and agronomists in activities is limited, with only 6% of respondents reporting such involvement ($\chi^2 = 17.9$, $p = 0.00$).

Significant compliance is observed in the declaration of unexpected diseases or events, with 27.3% of respondents reporting all incidents compared to 7.1% who did not ($\chi^2 = 10.1$, $p = 0.00$). Regarding actions taken during an outbreak suspicion, 50% of respondents reported investigating and notifying authorities, compared to 28.2% who did nothing ($\chi^2 = 17.5$, $p = 0.00$). Although responses to confirmed outbreaks show some differences (e.g., 27.3% opted to respond, while 52.6% did nothing), this was not statistically significant ($\chi^2 = 4.3$, $p = 0.3$). The real consequences of non-implementation were significant ($\chi^2 = 25.6$, $p = 0.00$), with underreporting (24%) and the risk of epidemics (20%) being common concerns. Finally, urgent measures to enhance implementation of this strategy include training stakeholders (74%), ensuring resource availability (11.5%), and holding regular meetings with sector actors (15%), showing significant variations ($\chi^2 = 15.8$, $p = 0.00$). These results highlight the need for targeted training, intersectoral collaboration, and structured reporting mechanisms to improve compliance with the "One Health" approach.

It should be noted, however, that the results of the logistic regression show that certain variables have a significant impact on the effectiveness of epidemiological surveillance within the One Health framework. The seniority of health professionals has an unstandardized coefficient of -0.108 ($p = 0.002$), indicating that greater seniority is associated with reduced effectiveness in epidemiological surveillance. Additionally, the knowledge of surveillance functions according to SIMR3 (Integrated Disease Surveillance and Response, third edition) presents a coefficient of 0.207 (p =

0.001), suggesting that a better understanding of these functions enhances surveillance effectiveness. These two variables are therefore key factors to consider when strengthening epidemiological surveillance in this region. Other variables, such as sex, age group, professional category, training on the One Health approach, and other factors related to legislation and zoonotic diseases, did not show significant effects on the effectiveness of epidemiological surveillance.

DISCUSSION

The results of this study highlight the crucial importance of the One Health approach in improving epidemiological surveillance, while also emphasizing persistent gaps in training and knowledge among key actors. The distribution of participants by gender, age group, professional category, and seniority reflects trends observed in other research. For example, Priotto et al. (2014) found that young professionals, although engaged in healthcare services, often lack practical experience, which can limit their effectiveness. Similarly, Zhao et al. (2022) demonstrated that certain professions, such as farmers and housewives, are particularly vulnerable to zoonotic diseases, thus requiring greater integration of these groups into prevention strategies. The low awareness of mandatory and zoonotic diseases identified in this study also aligns with findings by Steele et al. (2021) regarding the challenges faced by healthcare professionals and veterinarians in managing these diseases. Furthermore, the lack of training in epidemiological surveillance and the One Health approach was statistically associated with low compliance with surveillance standards, which corroborates the observations of Fasina et al. (2021) on the importance of training and intersectoral collaboration for successful implementation.

However, this study has some limitations, such as the sample size and the restricted geographical scope, which may affect the generalizability of the results and call for larger, multi-site research. Finally, the results emphasize the urgency of strengthening the capacities of key actors and developing integrated and sustainable policies to prevent epidemics at the human, animal, and environmental health interface (Fasina et al., 2021; Steele et al., 2021; Zhao et al., 2022). According to Fasina et al. (2021), to ensure a sustainable future for the One Health approach, monitoring and evaluation tools must be included in policies, shifting from an activity-based approach to an outcome-driven approach. Bongutu et al. (2024) also identified limiting factors for implementing this approach in the DRC, including the lack of government financial support and poor coordination of funds. Finally, Yopa et al. (2023) noted that barriers to implementing One Health strategies in developing countries include weak governance, lack of human and financial resources, but that the availability of reference documents and good multisectoral coordination can facilitate its adoption.

CONCLUSION

This study has highlighted key vulnerability factors among healthcare providers that contribute to the ineffectiveness of epidemiological surveillance within the One Health framework in the Bandundu Health Zone. The deliberate selection of this region was based on a review of provincial surveillance documents, which revealed significant gaps in the integration of health components and the neglect of environmental factors—both critical to addressing emerging and recurrent diseases. The results of the logistic regression show that certain variables significantly impact the effectiveness of epidemiological surveillance. Specifically, the seniority of health professionals suggests that greater seniority is associated with reduced surveillance effectiveness. On the other hand, knowledge of surveillance functions according to SIMR3 indicates that a better understanding of these functions improves surveillance effectiveness. These two factors are crucial to consider when strengthening surveillance in the region. However, other variables such as sex, age group, professional category, training on the One Health approach, and factors related to legislation and zoonotic diseases did not demonstrate significant effects on surveillance effectiveness.

In light of these findings, this study offers valuable insights into the structural challenges within the local healthcare system, specifically identifying the need for targeted interventions. Policymakers should prioritize the implementation of comprehensive One Health policies, promoting the integration of human, animal, and environmental health into surveillance efforts. This includes investing in interdisciplinary training programs, establishing formal coordination frameworks, and ensuring adequate funding for surveillance activities.

Addressing barriers such as limited knowledge, lack of formal governance, and weak political will should be a focus for future health policy. For health practitioners, continuous professional development is crucial, as is adopting a holistic approach that recognizes the interconnectedness of human, animal, and environmental health. Ultimately, this study contributes to strengthening One Health strategies by providing actionable recommendations to improve the effectiveness of epidemiological surveillance in the region.

Ethical Approval: The research protocol was reviewed and approved by the Ethics Committee of the Higher Institute of Medical Techniques (ISTM) of Kinshasa, under reference code no 0027/CBE/ISTM/KIN/RDC/PMBBL/2024.

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