From theory to practice: Analyzing factors that foster the successful implementation of the one health approach for enhancing health security in Cameroon

Viviane Ndoungue Fossouo [a,*], Mohamed Moctar Mouiche Mouliom [b]

[a] National Public Health Observatory, Ministry of Health, Yaounde, Cameroon
[b] Infectious Disease Detection and Surveillance Project, ICF, Yaounde, Cameroon

ARTICLE INFO

ABSTRACT

Background: Multisectoral collaboration is crucial in effectively managing public health emergencies. The One Health approach, which emphasizes the interconnectedness of human, animal, and environmental health, has gained recognition as an effective strategy. This study analysis the factors influencing the implementation of the One Health approach in Cameroon and examines its effects on public health emergency management.

Method: A survey was conducted among 44 stakeholders from key sectors involved in implementing the "One Health approach" in Cameroon. Data were collected with a structured questionnaire using a self-administered approach. Statistical analysis using the Ki Square test was conducted to identify associations between variables.

Results: The findings revealed that stakeholders in Cameroon lacked prior training on the One Health approach, primarily due to its absence in their academic programs. However, ad hoc trainings during public health emergencies were effective in involving various sectors. Limited communication and collaboration between different sectors, often operating in silos, posed significant challenges. Stakeholders with previous collaborative experiences and existing relationships demonstrated a greater propensity for multisectoral collaboration. The involvement of environmental health professionals in collaboration activities was limited, highlighting the need for improved engagement. Strong leadership, supported by coordination structures and platforms, played a critical role in facilitating collaboration during public health emergencies. Communication channels, such as regular multisectoral meetings, were essential in fostering relationships and trust among stakeholders. However, financial constraints hindered cross-sector cooperation.

Conclusion: To enhance multisectoral collaboration in public health emergency management, there is a need to prioritize training on the One Health approach and promote cross-sector communication and collaboration. Strengthening coordination structures and platforms, improving resource allocation, and fostering a culture of accountability and trust are crucial for effective implementation. This study provides insights into the challenges and opportunities in implementing the One Health approach in Cameroon and offers valuable lessons for other countries seeking to enhance their multisectoral response to public health emergencies.

1. Introduction

In May 2005, the 58th World Health Assembly adopted the International Health Regulations (IHR), mandating States Parties to develop and maintain capacities to prevent, detect, and respond to Public Health Emergencies of International Concern (PHEIC) [1]. Addressing the complexity of such emergencies requires collaboration across multiple sectors, as the health sector alone cannot adequately address all aspects [2,3]. The One Health approach, grounded in the interconnectedness of

humans, animals, and ecosystems [4,5] is crucial for building IHR capacity. The devastating impact of the COVID-19 pandemic serves as a stark reminder of the necessity for collective capacity across human health, animal health, and environmental sectors [6].

While the utilization of the One Health approach in activities has intensified in many countries, effective sector alignment and collaboration between relevant structures and disciplines remain limited [5,7]. Challenges persist in the design and implementation of One Health interventions, including conflicts between sectors and disciplines, power

---

struggles, and conflicts of interest [8]. Multisectoral collaboration has been recognized as a fundamental aspect of the One Health approach, highlighting the need for coordinated efforts [6,8]. Weak institutions, fragmentation, and inadequate political commitment further hinder progress [9].

The absence of joint preparedness and established collaborative mechanisms can result in disorganization and delays in response interventions, ultimately leading to poorer health outcomes. Coordinated planning, information sharing, evaluation, and control activities across sectors are essential for effective health program implementation. However, studies and reporting on the successes, challenges, and outcomes of the One Health approach in responding to public health emergencies remain limited, indicating the need for improved research efforts [10]. The identification of factors and conditions facilitating the effective implementation of the One Health initiative is crucial for informed decision-making and the improvement of policies, partnerships, and practices [10]. While previous studies have described the institutionalization process of multisectoral coordination mechanisms, few have explored the factors influencing successful implementation of the One Health approach, limiting the ability to learn from past experiences [11–14].

In Cameroon, despite efforts and progress since the adoption of the National One Health Strategy in 2012 [23], operationalizing the approach remains challenging [7]. A mapping exercise conducted in 2021 identified weak coordination of multisectoral and multidisciplinary activities due to the absence of a coordinating structure responsible for monitoring and evaluating One Health themes. Outdated regulatory texts in various sectors, such as wildlife, environment, and agriculture, fail to explicitly integrate the One Health approach, hindering engagement. There are inconsistencies between sectoral strategies, a lack of multisectoral workforce planning, and insufficient partnership development projects. Moreover, the implementation of One Health activities is concentrated at the central level, leading to delays in triggering multisectoral collaboration [7]. Therefore, this study aims to explore the institutional, individual, and network factors influencing the implementation of the One Health approach among International Health Regulations actors in Cameroon for responding to public health emergencies.

2. Methods

Operational research was conducted using a cross-sectional study design. The study targeted public health professionals working in key ministries involved in the implementation of the One Health approach in Cameroon at both the central and decentralized levels. The ministries included were the Ministry of Public Health, the Ministry of Livestock, Fisheries, and Animal Industries, the Ministry of Environment, Nature Protection, and Sustainable Development, the Ministry of Higher Education, the Ministry of Agriculture and Rural Development, and the Ministry of Defense. A non-randomized sampling technique was employed to select participants for the study. Public health professionals serving in the targeted ministries at the time of the study and who provided their informed consent were included in the study. Respondents who did not provide consent to participate in the study were excluded. A total of 44 public health professionals were targeted to participate in the study. Data was collected through a structured questionnaire consisting of 50 questions (open and closed) divided into four parts: respondent identification, individual factors, network factors, and institutional factors. The questionnaire was developed based on the framework developed by Errecaborde [10] and was auto-administered. The questionnaire was given to respondents during a workshop and collected three days later, from December 5th to December 7th, 2022. A pre-test of the questionnaire was conducted on August 11, 2022, in Yaounde, involving five public health professionals working at the central level in the ministries responsible for public health, animal health, and environmental health. Feedback from the pre-test was used

to improve the clarity and understanding of certain questions. Data entry was performed using Excel software, and statistical analysis was conducted using SPSS 2.0 software. The Chi-square test was used to assess the association between qualitative variables, with odds ratios and confidence intervals used to quantify the strength of the associations. A significance level of p-value ≤ 0.05 was considered statistically significant.

2.1. Ethical considerations

Ethical clearance was obtained from the Regional ethics committee of the Centre Region Public Health Delegation before data collection. All participants provided informed consent by signing a consent form, indicating their voluntary participation in the study. A note explaining the study's purpose and confidentiality was provided to each respondent.

3. Results

3.1. General information about the study population

In our study population, the average age was 41 years, with a range of 23 to 56 years. A significant majority of respondents (56.7%) were aged 40 years or older. Regarding gender distribution, 69% of the participants were female. Furthermore, 55.2% held at least one executive position within the administration, indicating their senior roles and responsibilities. In terms of professional backgrounds, 40% of the respondents came from the environmental health sector. It is noteworthy that all participants in the study were employed in the public sector, and a majority (67.7%) worked at the central level of the government, suggesting their involvement in high-level decision-making and policy implementation (Table 1).

Individual Factors: Our analysis revealed that 50% of respondents had not received prior training on the One Health concept before their collaborative experience. Additionally, 69.2% of respondents had no previous collaborative experience, and 52% did not have formal or informal multi-sectoral relationships prior to their involvement in responding to public health emergencies.

In terms of training during the public health emergency, only 32% of respondents received ad hoc training. The topics covered included risk communication, COVID-19 case management, cholera response, COVID-19 response, mpox response, Incident Management System, community resilience, and integrated disease surveillance and response. Among those who did not receive training, 66.6% cited the absence of a training plan and 33.3% mentioned the program's focus on other profiles as reasons for their lack of participation. Out of those who received ad hoc training, 71.42% reported the involvement of other sectors. Additionally, 66.6% of respondents did not receive any supervisory team support during their training.

Network Factors: Prior to the public health emergency, several

Table 1
Demographic and professional characteristics of respondents.

Variable	Modality	Frequency	%
Age (year)	<40	13	43,3
	≥ 40	17	**56,7**
Gender	F	9	31
	M	20	**69**
Position	cadre	16	**55,2**
	Deputy Director	13	44,8
Discipline	Environmental health	12	**40**
	Animal health	8	26,7
	Human health	10	33,3
Sector	Public	31	**100**
	Private	0	0
Level of intervention	Central	21	**67,7**
	Regional	10	32,3

mechanisms and structures for multi-sectoral coordination/collaboration were in place in Cameroon. The majority of respondents (72.22%) stated that these coordination mechanisms operated based on a ministerial decree with terms of reference, and 89.47% indicated that the aim of these mechanisms was to achieve common objectives among stakeholders. Around 73.68% of respondents mentioned that these coordination mechanisms had qualified human resources for effective operation. However, 83.3% of respondents reported insufficient financial resources for coordination activities. Despite this, all respondents acknowledged the political will in Cameroon to facilitate the development and institutionalization of effective collaborative structures.

According to respondents, 73.68% identified a leading agency or institution responsible for leading the coordination mechanism during the public health emergency. About 66.6% considered the leadership to be strong and committed, attributing this strength to adherence to the administrative hierarchy, respect from all stakeholders, and support from the Governor, who engaged all relevant sectors. Joint actions carried out within this mechanism included information sharing, decision-making, joint planning, and strategic risk communication with sector authorities.

Regarding coordination approaches during public health emergency management, 52.63% of respondents reported regular (informal) multisectoral meetings, while 26.31% mentioned the established coordination mechanism, structure, or platform. Strategies for managing the coordination mechanism involved developing and sharing guidance, engaging in technical discussions with the community, raising awareness about the coordination platform, sharing data and reports among stakeholders, implementing joint public communications, and promoting behavior change among involved actors.

Approximately 55% of respondents considered the coordination mechanism's communication during the public health emergency to be timely and contextualized. The coordination platform, periodic multisectoral follow-up meetings, and periodic reports were identified as the most frequently used communication channels.

Respondents noted that stakeholder engagement was maintained during the public health emergency by reflecting the needs of the community and involving the community in the planning process. The bottom-up approach was also utilized.

About 68.75% of respondents reported the existence of a monitoring and evaluation process during the management of the public health emergency. This process aimed to track objectives, assess the effectiveness of sensitization efforts, and demonstrate the advantages of interventions. Methods such as meetings, supervision, surveys, and intraaction reviews were cited as the primary means of monitoring and evaluation.

According to respondents, material resources were allocated through designated supply locations and a subcommittee for supply management. Human resources were deployed through staff assignments to strengthen the workforce.

4. Discussion

4.1. Individual factors

The findings of our study indicate that approximately 50% of respondents stated that they had not received training on the One Health concept before their participation in public health emergency management. This lack of training can be attributed to the concept not being addressed in their academic programs or a lack of opportunities for inservice training. These findings align with the research conducted by Lokossou, which reported limited awareness of the One Health collaboration among technical and political actors in the West Africa region [15]. Interestingly, a statistically significant association (P-value = 0.025) was found between the One Health approach and training before the onset of the public health emergency, suggesting that prior training plays a crucial role in promoting the implementation of the approach.

This is supported by a study conducted in Uganda, which found successful implementation of the One Health approach in specific colleges at Makerere University [16,17]. However, challenges remain in implementing the approach across other university departments, possibly due to the misconception that One Health only addresses animal and human ailments [8,18]. In addressing this gap, experts have emphasized the need for One Health education as a foundation for the practice of medicine and global health [19]. Customizable One Health training modules have been developed to transfer knowledge and skills to a multidisciplinary audience and can be integrated into existing courses and curricula. These modules cover a wide range of topics and are utilized at both the initial and continuing education levels [20]. To strengthen policy support and financing, it is crucial to have qualified and trained professionals who can effectively communicate the One Health approach to policymakers and the general public [8]. This was demonstrated in a study conducted in Kenya, where staff training on the One Health approach enhanced outbreak investigations [21].

During the management of public health emergencies, stakeholders received ad hoc training on various topics, including risk communication, COVID-19 case management, cholera response, mpox response, Incident Management System, community resilience, and integrated disease surveillance and response. These findings complement the results of a mapping of One Health activities and policy analysis in Cameroon, which identified prevention, surveillance, and response as important training topics [7]. The lack of training on the One Health approach was attributed to the absence of a training plan. However, the availability of open online courses and educational materials on the One Health approach has increased, providing individuals with greater access to high-quality content [19]. The lack of knowledge and training in the human health sector and the absence of comprehensive training programs are reported as barriers to the implementation of the One Health approach [12]. Therefore, there is a need for increased sensitization and awareness among One Health stakeholders regarding the existing training opportunities to enhance their capacities. During the management of public health emergencies in Cameroon, it is noteworthy that other sectors actively participate in ad hoc trainings, a practice supported by several authors [12,17,18,22]. The lack of communication between sectors and the "siloed approach" has been identified as a significant constraint to the successful implementation of the One Health approach [15,18,23–25].

Before their involvement in public health emergencies, stakeholders had established official or informal multisectoral ties, with a statistically significant association between previous collaborative experiences and existing relationships (P-value = 0.022) [26]. However, workers in environmental health have limited prior collaboration experience, indicating a barrier to the implementation of the One Health approach (P-value = 0.048) [15]. Indeed, only 1% (2/225) of One Health activities had been carried out by the Ministry in charge of the environment [7]. Notably, there were no significant associations between the One Health approach and age, sex, position, or level of intervention (P-value >0.05). Central-level personnel have been more involved in One Health operations compared to regional-level employees, reflecting the ongoing process of institutionalizing the approach (P-value = 0.028), especially with regard to the development and revision of legal frameworks, policies, processes, and procedures for collaboration, which are the central level's responsibility [7]. The findings emphasize the need for improved intersectoral collaboration and decentralized implementation of the One Health approach in Cameroon.

4.2. Network factors

During the management of public health emergencies in Cameroon, it is evident that the involvement of other sectors in ad hoc trainings is considered a good practice [12]. The "siloed approach" and lack of communication between sectors have been identified as significant constraints to the successful implementation of the One Health approach

[12,18,28]. To address these challenges, it is crucial to establish a solid network of stakeholders with a robust coordination structure and strong leadership [10]. The existing network architecture in Cameroon, including the International Health Regulation National Focal Point (IHR-NFP), the National Program for the Prevention and Control of Emerging and Remerging Zoonotic Diseases (NPCERZD), the National Health Emergency Operations Center (NHEOC), and the national committee for the fight against epidemics, provides a foundation for effective collaborative actions among institutions [10]. These network structures have facilitated formal relationships at all levels and improved communication approaches and coordination during crises [10,27,30]. Similar successful examples of coordination and communication have been observed in Kenya at the sub-national level, with One Health functional units enhancing collaboration among key ministries and stakeholders [21].

Effective network leadership and management processes play a critical role in multisectoral response efforts to public health emergencies [10]. Assigning a lead agency with strong and committed leadership has proven effective in coordinating meetings, mobilizing resources, and facilitating communication among all parties involved. Regular multisectoral meetings and the development of network-wide management rules and protocols have been identified as good practices that promote collaboration [10].

Timely and contextualized communications from the primary coordinating agency, conducted through various channels such as coordination platforms, multisectoral follow-up meetings, and periodic reports, have fostered relationships and trust among stakeholders [10]. Regular and frequent communication that involves all stakeholders at different levels is crucial for effective collaboration [10]. Monitoring and evaluation are essential for analyzing collaborative processes, outcomes, and performance during response [10]. However, challenges in monitoring and evaluation hinder interest and political support for the One Health approach [8].

The primary coordinating agency operates based on a ministerial note containing terms of reference, aiming to fulfill shared objectives among relevant parties [27]. This approach enhances multisectoral coordination and strengthens existing relationships while ensuring community involvement [26,27]. Lack of transparency can hinder collaboration by leading to protectionism and underutilization of network services [26].

Qualified human and professional resources are essential for effective coordination mechanisms during public health emergencies. Mobilizing human resources through staff assignments helps augment the workforce. However, limited financial resources impede cross-sector cooperation and pose challenges to achieving efficient collaboration [15,26]. Financing priorities and imbalances in resource allocation among sectors are observed as limiting factors [18,21,25,28]. Demonstrating the cost-effectiveness of the One Health approach through economic analysis and research can help garner support from policymakers [24]. Proper allocation and management of physical resources along the supply chain are crucial for successful material resource management [10].

Stakeholder engagement has been maintained during the management of public health emergencies by reflecting the needs of the community and involving them in planning. The bottom-up strategy employed in emergency management has contributed to maintaining stakeholder engagement throughout the response. However, no significant associations were found between the One Health approach and network factors before and during public health emergencies, possibly due to the study's small sample size and low statistical power (*P*-value >0.05) [10].

4.3. Organizational factors

The organizational factors that influence the One Health approach play a role in both the initial conditions and the collaborative activities.

Stakeholders with previous collaboration experiences emphasized the significance of structures, policies, protocols, systems, organizational cultures, and human resources in the success of the One Health approach. However, there was no significant correlation found between the One Health approach and organizational characteristics (*P*-value >0.05), possibly due to the study's limited statistical power. This contrasts with previous literature that highlights the importance of organizational factors for effective collaboration within the One Health context [10].

Organizational structures are crucial in facilitating effective collaboration within the One Health approach. Technical guidelines, standard operating procedures, and management, response, and communication strategies and protocols are identified as success factors [10]. High-level political commitment and adequate resources and budgets are also important for successful implementation [12,29,31]. Alignment of terminology, priorities, and concepts across disciplines and sectors, clarity in policies and guidelines, and addressing uncertainties and inputs are additional factors that need to be considered [28,32].

Organizational culture plays a significant role in supporting the successful implementation of the One Health concept. A culture of accountability, ownership, cultural participation, diversity, trust, and credibility is crucial [10]. Challenges such as lack of uniformity in incorporating research findings into government policy, staff resistance to change, and legal or structural barriers to cooperation can impede implementation [12,28], 18]. Restricted access to data, conflicts of interest, and self-interest are additional limiting factors [12,25]. Establishing a data-sharing policy can help overcome barriers and promote collaboration [31].

Regarding human resources, ongoing training is essential to ensure the capacity of personnel involved in coordination mechanisms and platforms. Professionals should have well-defined roles and responsibilities and be able to mobilize their efforts at the network level [10]. Factors such as available human resources, capacity building, shared vision, and strong decision-making capacity contribute to the success of the One Health approach at the organizational level [27].

4.4. Study limitations

The non-random selection of participants from specific ministries involved in the One Health approach may limit the generalizability of the findings and the ability to extrapolate them to the broader population engaged in IHR implementation in Cameroon. However, to minimize this limitation and enhance the strength of the findings, various measures were implemented. The selected participants held key positions within their respective departments, providing valuable qualitative data on the factors influencing the One Health approach in Cameroon. Participant selection was diversified to capture diverse perspectives and experiences, and the findings were validated through comparisons with existing data sources. Another limitation arose from potential information bias associated with the questionnaire data collection method, given the questionnaire's length and limited response timeframe. To mitigate this bias and strengthen the findings, the questionnaire design was carefully developed, pilot tested, and supplemented with clear instructions. A follow-up strategy and rigorous data validation were employed, and other data sources were considered for triangulation. These steps helped minimize potential biases and maintain the robustness of the findings.

5. Conclusion

It was observed that stakeholders in Cameroon lacked specific training on the One Health approach before their involvement in the response to public health emergencies. However, continuous training and in-service learning were utilized to enhance the capacities of professionals. The study revealed that collaboration experiences and existing relationships among stakeholders prior to public health

emergencies contributed to the advancement of the One Health collaboration in Cameroon. Network structures and coordination mechanisms, such as the IHR-NFP, the NPCERZD, the NHEOC, and the local forum of public service managers, played a crucial role in fostering formal relationships and facilitating collaboration. Strong and dedicated leadership within the lead agency proved essential in coordinating multisectoral efforts and promoting effective communication and decision-making. Organizational factors, including structures, culture, and resources, were identified as key determinants of successful collaboration. Technical guidelines, standard operating procedures, and management strategies were crucial in promoting collaboration and aligning priorities across sectors. However, challenges such as the lack of uniformity in policy implementation, resistance to change, and barriers to data sharing were noted. Human resources were found to be critical for effective coordination. Ongoing training and capacity building were necessary to ensure that professionals had the necessary skills and knowledge to contribute to the One Health approach. Strong decision-making capacity, shared vision, and a culture of accountability and trust were identified as favorable organizational factors. Despite the presence of coordination mechanisms and qualified human resources, the lack of adequate financial resources posed a significant challenge to coordination operations in Cameroon. Insufficient funding hindered the implementation of the One Health approach and limited resource allocation between sectors. To further strengthen the One Health approach in Cameroon, it is recommended to enhance training programs, establish a national platform for promoting and monitoring the approach, foster a culture of collaboration and trust across sectors and address financial resource constraints by advocating for increased investment in One Health initiatives through awareness raising about the interconnectedness of human, animal, and environmental health. Indeed, highlighting the potential benefits and cost savings of adopting a One Health approach can attract additional funding and support.By addressing these factors, Cameroon can enhance its multisectoral coordination efforts and improve its overall public health emergency response.

Ethical considerations

An ethical approval was obtained from the Regional ethics committee of the Centre Region Public Health Delegation. Written informed consent was obtained from all subjects. All methods were performed in accordance with the declaration of Helsinki.

Funding

CRediT authorship contribution statement

Viviane Ndoungue Fossouo: Conceptualization, Methodology, Writing – original draft, Data curation, Writing – review & editing, Supervision. **Mohamed Moctar Mouiche Mouliom:** Conceptualization, Methodology, Writing – review & editing.

Declaration of competing interest

None.

Data availability

Data will be made available on request.

Acknowledgments

References

[1] WHO, International Health Regulations, 3rd edition, World Health Organization, Geneva, Switzerland, 2005–2016. Accessed: Apr. 05, 2021. [Online]. Available: https://apps.who.int/iris/bitstream/handle/10665/246107/9789241580496-eng.pdf;jsessionid=1FD446DFBDAC5C7E37C780DE387C0574?sequence=1.

[2] WHO, Expert Roundtable-Development of a Guide for Multisectoral Preparedness Coordination for International Health Regulations (2005). Meeting report, Paris, France, 4–5 October 2018, World Health Organization, Geneva, 2020. Accessed: Jul. 20, 2021. [Online]. Available: https://apps.who.int/iris/bitstream/handle/10665/331191/WHO-WHE-CPI-CME-2020.2-eng.pdf?sequence=1&isAllowed=y.

[3] S. De La Rocque, et al., One health operations: a critical component in the international health regulations monitoring and evaluation framework, Rev. Sci. Tech. 38 (1) (2019) 303–314, https://doi.org/10.20506/rst.38.1.2962.

[4] CDC, One Health Basics'. https://www.cdc.gov/onehealth/basics/index.html, 2022 (accessed Feb. 18, 2022).

[5] FAO/OIE/WHO, 'High-Level Technical Meeting to Address Health Risks at the Human-Animal Ecosystems Interfaces. Mexico City (2012).', Mexico city, Accessed: Apr. 12, 2021. [Online]. Available: https://apps.who.int/iris/handle/10665/78100, 2012.

[6] S. de la Rocque, et al., Operationalisation of consensual one health roadmaps in countries for improved IHR capacities and health security, BMJ Glob. Health 6 (7) (2021) e005275, https://doi.org/10.1136/bmjgh-2021-005275.

[7] NPPCERZ, Cartographie des activités et analyse des politiques « Une Seule Santé » au Cameroun, Yaoundé (2021).

[8] S. Ribeiro, L.H.M. van de Burgwal, B.J. Regeer, Overcoming challenges for designing and implementing the one health approach: a systematic review of the literature, One Health 7 (2019) 100085, https://doi.org/10.1016/j.onehlt.2019.100085.

[9] J. Spencer, E. McRobie, O. Dar, et al., Is the current surge in political and financial attention to One Health solidifying or splintering the movement? BMJ Glob Health 4 (2019) e001102 https://doi.org/10.1136/bmjgh-2018-001102.

[10] K.M. Errecaborde, et al., Factors that enable effective one health collaborations - a scoping review of the literature, PLoS One 14 (12) (2019) e0224660, https://doi.org/10.1371/journal.pone.0224660.

[11] A.Y. Kitua, et al., Building a functional national one health platform: the case of Tanzania, One Health Outlook 1 (1) (2019) 3, https://doi.org/10.1186/s42522-019-0003-0.

[12] N.M. Cediel Becerra, A.M. Olaya Medellin, L. Tomassone, F. Chiesa, D. De Meneghi, A survey on one health approach in Colombia and some Latin American countries: from a fragmented health organization to an integrated health response to global challenges, Front. Public Health 9 (2021) 649240, https://doi.org/10.3389/fpubh.2021.649240.

[13] S. Agbo, et al., Establishing National Multisectoral Coordination and collaboration mechanisms to prevent, detect, and respond to public health threats in Guinea, Liberia, and Sierra Leone 2016–2018, One Health Outlook 1 (1) (2019) 4, https://doi.org/10.1186/s42522-019-0004-z.

[14] B.Z. Katale, et al., One health approach in the prevention and control of mycobacterial infections in Tanzania: lessons learnt and future perspectives, One Health Outlook 1 (1) (2019) 2, https://doi.org/10.1186/s42522-019-0002-1.

[15] V.K. Lokossou, et al., Operationalizing the ECOWAS regional one health coordination mechanism (2016–2019): scoping review on progress, challenges and way forward, One Health 13 (2021) 100291, https://doi.org/10.1016/j.onehlt.2021.100291.

[16] E. Atusingwize, et al., Application of one health approach in training at Makerere University: experiences from the one health workforce project in Uganda, One Health Outlook 2 (1) (2020) 23, https://doi.org/10.1186/s42522-020-00030-7.

[17] M. Peyre, C. Khoury, European-southeast-Asian experts one health in action workshop: from one health theory to reality: practical challenges, impacts of one health initiatives and gaps in research, Policy Note. (2016), https://doi.org/10.13140/RG.2.2.13632.02568.

[18] P.M. Rabinowitz, L.A. Conti, One health successes and challenges, in: A. Yamada, L.H. Kahn, B. Kaplan, T.P. Monath, J. Woodall, L. Conti (Eds.), Confronting Emerging Zoonoses, Springer Japan, Tokyo, 2014, pp. 241–251, https://doi.org/10.1007/978-4-431-55120-1_12.

[19] C. Machalaba, et al., Applying a one health approach in Global Health and medicine: enhancing involvement of medical schools and Global Health centers, Ann. Glob. Health 87 (1) (2021) 30, https://doi.org/10.5334/aogh.2647.

[20] H. Amuguni, W. Bikaako, I. Naigaga, W. Bazeyo, Building a framework for the design and implementation of one health curricula in east and Central Africa: OHCEAs one health training modules development process, One Health 7 (2019) 100073, https://doi.org/10.1016/j.onehlt.2018.08.002.

[21] P.M. Munyua, et al., Successes and challenges of the one health approach in Kenya over the last decade, BMC Public Health 19 (S3) (2019) 465, https://doi.org/10.1186/s12889-019-6772-7.

[22] K.R. Manlove, et al., 'One health' or three? Publication silos among the one health disciplines, PLoS Biol 14 (4) (2016) e1002448, https://doi.org/10.1371/journal.pbio.1002448.

[23] I. Johnson, A. Hansen, P. Bi, The challenges of implementing an integrated one health surveillance system in Australia, Zoonoses Public Health 65 (1) (2018) e229–e236, https://doi.org/10.1111/zph.12433.

[24] O. Ayobami, G. Mark, Z. Kadri-Alabi, C.R. Achi, J.C. Jacob, COVID-19: an opportunity to re-evaluate the implementation of a one health approach to tackling

emerging infections in Nigeria and other sub-Saharan African countries, J. Egypt. Public Health Assoc. 96 (1) (2021) 26, https://doi.org/10.1186/s42506-021-00085-y.

[25] C. Pettan-Brewer, et al., From the approach to the concept: one health in Latin America-experiences and perspectives in Brazil, Chile, and Colombia, Front. Public Health 9 (2021) 687110, https://doi.org/10.3389/fpubh.2021.687110.

[26] H. Alderwick, A. Hutchings, A. Briggs, N. Mays, The impacts of collaboration between local health care and non-health care organizations and factors shaping how they work: a systematic review of reviews, BMC Public Health 21 (1) (2021) 753, https://doi.org/10.1186/s12889-021-10630-1.

[27] S. Yasobant, W. Bruchhausen, D. Saxena, T. Falkenberg, One health collaboration for a resilient health system in India: learnings from global initiatives, One Health 8 (2019) 100096, https://doi.org/10.1016/j.onehlt.2019.100096.

[28] K. Kromerová, V. Bencko, One health approach - concept, benefits and challenges of its application, Hygiena 66 (4) (2021) 131–136, https://doi.org/10.21101/hygiena.a1794.

[29] S. Bennett, D. Glandon, K. Rasanathan, Governing multisectoral action for health in low-income and middle-income countries: unpacking the problem and rising to the challenge, BMJ Glob. Health 3 (Suppl. 4) (2018) e000880, https://doi.org/10.1136/bmjgh-2018-000880.

[30] L. Allal, et al., From four-way linking to a one health platform in Egypt: institutionalisation of a multidisciplinary and multisectoral one health system, Rev. Sci. Tech. 38 (1) (2019) 261–270, https://doi.org/10.20506/rst.38.1.2958.

[31] Q. Li, C. Guo, H. Hu, J. Lu, Towards one health: reflections and practices on the different fields of one health in China, Biosafety and Health (2021), https://doi.org/10.1016/j.bsheal.2021.12.004.

[32] F.A. Asaaga, et al., Operationalising the "one health" approach in India: facilitators of and barriers to effective cross-sector convergence for zoonoses prevention and control, BMC Public Health 21 (1) (2021) 1517, https://doi.org/10.1186/s12889-021-11545-7.