

Qualitative Research on Yellow Fever Outbreak Responses in Wolaita Zone of SNNPR Region, Ethiopia

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Abstract: *Background:* Outbreak response basically entails preparedness which helps to establish arrangements in advance to enable timely, effective and appropriate responses to specific potential hazardous events or emerging disaster situations that might threaten society/environment. Researches about outbreak response or interventions that focus on post-incident communication have recently been published in a range of disciplinary journals, from organizational psychology to organizational communication one reason that the interventions are successful is because it provides team with a common time and place for purposeful discussion-based learning. *Objective:* To review outbreak response from the October 2018 Wolayta Zone yellow fever outbreak management in SNNPR, Ethiopia. *Methods:* Qualitative research approach, with Thematic Analysis. Purposive sampling method was used. Data were collected through FGDs, in-depth interviews, observation and document reviews. *Results:* However, it is worth-noting that the Review showed that despite late detection, a rapid response team was set up and was able to save the lives of many during the outbreak. The findings further showed there was good coordination among various stakeholders at different levels and with satisfying sharing of roles and responsibilities. *Conclusion:* The case was detected lately after one month of since the first case were detected and all case which admitted this period were miss-diagnosed of the cases and leading to some deaths. Even though there was a confusion on identifying the first case, after the confirmation of the first case, the case management went as per the standard guideline and SOPs, helping save so many lives through availing the service free of charge.

Keywords: Outbreak Response; Yellow Fever, After Action Review

1. Background

According to ECDC [50] outbreak response depends upon the extent of the outbreak and a description of the Population at risk for outbreak transmission. In order to provide some context for when emergency responses might be initiated, a working definition of a public health emergency is useful. Our yellow outbreak response is framed within the framework of

the definition of a public health emergency as ‘an unexpected event that has a noticeable impact on society (disruption, trauma, injury/loss of life, and damage/impact on infrastructure) and where public health played a significant role in the response [28].

Outbreak response basically entails preparedness which helps to establish arrangements in advance to enable timely, effective and appropriate responses to specific potential hazardous events or emerging disaster situations that might

threaten society/environment. As Beck, Littlefield, & Weber [2] and Scott *et al.* [18], argue, the knowledge and capacities developed by governments, response and recovery organizations, communities and individuals to anticipate, respond to and recover from the impacts of likely, imminent or current disasters. Researches about outbreak response or interventions that focus on post-incident communication have recently been published in a range of disciplinary journals, from organizational psychology to organizational communication. One reason that the interventions are successful is because it provides team with a common time and place for purposeful discussion-based learning.

Thus, outbreak response is very important in our thematic scope in the current AAR report. We will show how our review report compares with the international standards in terms of response as it happened during the yellow fever outbreak intervention.

Recently, yellow fever suspected cases were notified on 21 August 2018 in Wolayita Zone, Ethiopia and total of 35 cases with 10 deaths were reported. After confirmation of yellow fever, a reactive mass vaccination campaign was conducted from 13-20 October 2018 in six identified *kebeles* for 31,565 high risk populations. Following epidemiological, virological and entomological field investigation evidences, the Ethiopian Ministry of Health and international community decided to vaccinate 1,335,865 populations dwelling in nine *woredas* and institutions; seven from Wolaita and two from Gamo Gofa Zones. The institutions included Universities, colleges, prisons and other camps. This ring campaign was conducted from 16-22 November 2018 plus two additional

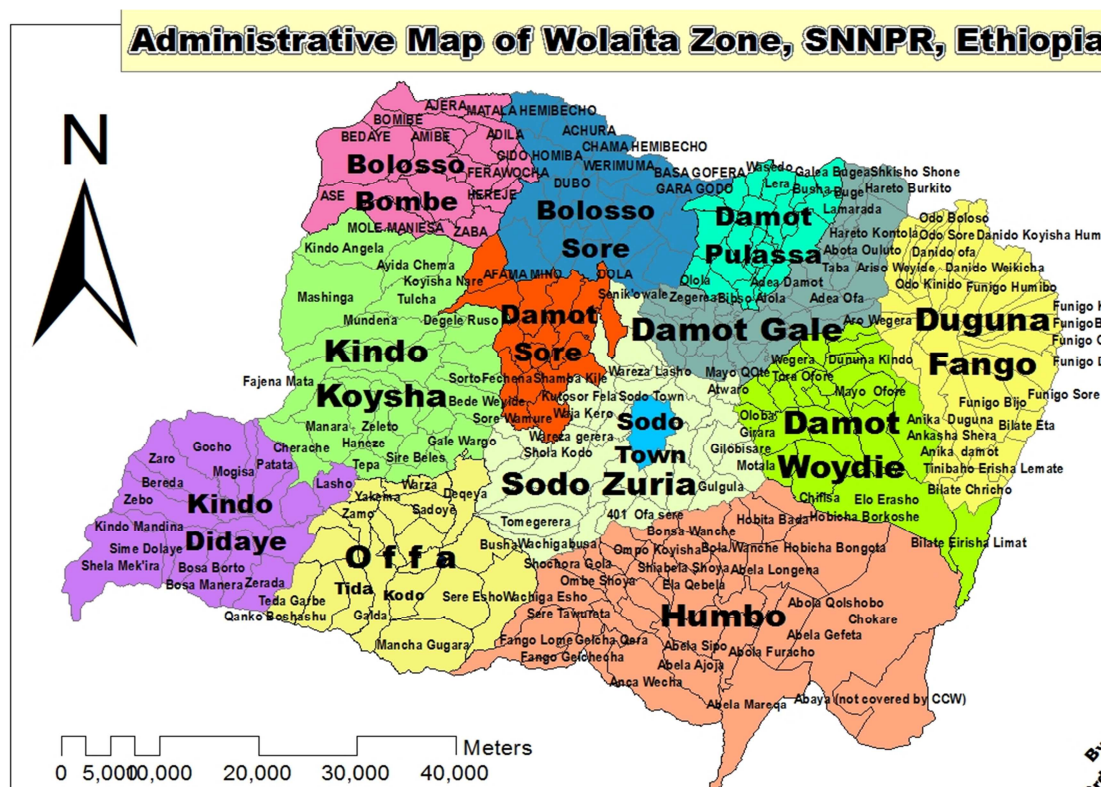
days for mop up. Experts from partner organizations (WHO, UNICEF, MSF, IRC, AMREF and CDC) had supported government institutions on field to accomplish the vaccination effectively. The campaign was officially finalized on 24 November 2018.

The assessment was undertaken employing qualitative methodology over an extended period of fieldwork involving collection of data through interviews, discussions, observations and archival reviews. The Review yielded important insights and the findings of this review are presented and discussed in this report. Before going to this, we first present in some detail a brief review literature on the benefits and scope of AAR followed by the objectives and methodology employed in this study.

2. Method

Study setting and population

This research was been conducted in two *woredas* of Wolaita Zone, SNNPR, Ethiopia. Purposive Sampling Method was employed, commensurate with qualitative research approach. A total of 310,454 households were counted in this Zone, which results in an average of 4.84 persons to a household, and 297,981 housing units found at a distance of 157 Km and 338 Km from Hawasa City and Addis Ababa respectively. It has twelve rural *woredas* and three Town administrations. There are 324 rural and 28 urban 368 *kebeles* in the zone there are five governmental hospital two NGO and private hospital, 68 health centers, 152 private clinics, and 353 health posts in the zone.



Source: Wolaita zone Administrative.

Figure 1. Administrative Map of Wolaita Zone, Ethiopia.

Study Design

The present study employed Qualitative research approach, with Thematic Analysis. Purposive sampling method was used. Data were collected through face-to-face FGDs, in-depth interviews, observation and document reviews and Also Additional Field note were also taken. A total of eleven FGDs were conducted: one FGD per affected *woreda* for RRT members; one for health professionals comprising clinicians, pharmacist/pharmacy technicians and laboratory technologist/technicians and one for selected community members. In addition, there were one each FGD for Zonal, regional and national level. An FGD session contained 6-8 participants. Digital audio voice recorder was used to record conversations.

Method and Data Collection

FGD

Before the initiation of every FGD it was started with by introduction, by setting ground rule, and by disclosure of the objective of the study. 7 men's and 4 women's FGDs were conducted. The FGD session were took maximum of 120 and minimum of 60 min. The size of group participants varied from 8 to 12. Four FGDs were conducted at the community level (near to their residence) and the rest 7 FGD were conducted from the health facilities to national level (workplace). Overall, 84 men and 16 women participated in the discussion, making a total of 100 participants from the 3 *kebeles*, 2 *woredas*, 1 zone, 1 region and national. No refusal were seen in all FGD session.

Individual Interview

4 individual interviews from *woreda* health office and administration head conducted from each and 2 from health center, 2 from each *woreda* head and 3 from Zone, Region and National head 1 from each. Data were collected through FGDs, in-depth interviews, observation and document review. Data collection tools, interview guide and semi structured checklist were prepared to generate data from RRT members, health professionals and selected community members.

For individual interviews, thirteen key informants from relevant offices in the health sector, at all level, *Woreda* to Federal. Were interviewed. Individual informants included *Woreda* health office heads, ZHD PHEM Unit, RHB PHEM leads, national PHEM unit and purposively selected RRT members at each level.

Observation

The verbal data from interviews were further corroborated with visual data, Patient card review at health facilities; Review of daily and weekly reports at *woreda* HO and Zonal health department; and Outbreak investigation report by zonal PHEM and other supportive document like EPRP (Emergency Preparedness and Response Plan).

These data were linked to such important dimensions as to check the right coordination, surveillance response were in place. Observation was supported with visual documentation, using a digital still photo camera.

Data analysis

The data were recorded using a digital voice recorder. Translation from Amharic to English language and Transcription, transcripts returned to participants for comment &/or correction, the analysis were done after the provision of feedback from participants. Management and analysis were done using NVivo Version 11 (QSR International). The data were content-coded for thematic analysis. Initial coding activity was based on prior conceptual categories and further coding concepts were derived from the data. Explorations of coded data were done to make further analytical activities such as querying the data to find out frequently occurring concepts and themes, relationships among codes and themes. The analysis came up with three salient themes.

3. Result and Discussion

In the following sections, the major findings of the Review are presented and discussed. Following scientific approach to report structure, we shall first present the result and then discuss the result in light of comparative standards and norms. Result and discussion will follow the thematic scope approach, beginning with surveillance followed by response and coordination.

3.1. Result

(i) The Response Thematic Area

'Response' which is used to describe whether the right response was put in place or not in all aspects of interventions from case management, prevention & control and vaccination campaign. This is requisite, so as to manage the case effectively. This theme is divided into 5 sub thematic areas, based on the idea raised either in key Informant Interview (KII) and Focus Group Discussion (FGD). When we review reports from our informants regarding response in general, at national level, as higher officials at EPHI stated: "...immediately we established an RRT, activated and deployed timely and additional staff also deployed to support response activity and outbreak investigation as well" (EPHI DDG, 2019).

Regarding the overall response implementation, discussion with FGD participants from regional level showed that during outbreak response there was a coordination at all levels. This was confirmed by key informant interviews. According to an Internist at Sodo General Hospital, "All *Woreda* and Zonal leaders, HEW and health workers got involved in response activities..." (KII Sodo General Hospital, 2019).

In the following paragraphs, we will present results on the prevention and control measure that were taken including vaccination campaign, outbreak investigation, and Entomological and vector control as key sub-thematic areas under response.

(ii) Outbreak Investigation

Key ideas regarding outbreak investigation include case and entomological investigation in relation to the

investigation of yellow fever case. One of the main ideas raised by our FGD participants regarding outbreak investigation was how it followed appropriate measures and protocols. For example, it was disclosed by a participant during discussion at Offa Woreda with RRT: *“.....Even though its late detection, a rapid response team was set up to save the lives of many regardless of time or speed during the outbreak....”* Another participant also mentioned that *“.... the team deployed and the suspect cases were being identified for treatment... the team conducted as early as the epidemic was detected and conducted to verify the disease first....”* A further statement from another participant showed blood samples were collected from febrile cases and effort was made to *“...conduct as early as epidemic was detected to verify the disease first....”* (FGD_Offa Woreda RRT, 2019).

Further, regarding entomological investigation it was mentioned that *“.....The Aedes mosquitoes was identified from water under false banana by the entomologist.....”* (FGD_Gesuba_HC – RRT).

(iii) Vector Control and Entomological Investigation

Regarding entomological investigation, it was reported that efforts were made to identify the vector *Aedes mosquitoes* causing the yellow fever. It was further noted that *“Even though the laboratory confirmation did not arrive, we submitted and that was mandatory, we identified YF causing vector, Aedes mosquito”* (EPHI DDG KII, 2019).

Likewise, supporting ideas from a local community FGD was obtained; participants noted: *“Health workers provided us with a medicine and they also took water sample from ponds/stagnant water for further investigation, from the place where the first suspect person was....”* (Kodo Kebele community FGD, 2019). Likewise, local people further reported that *“... In addition, indoors residual spray, anti-mosquito spraying chemical was done properly* (FGD_Kodo Kebele_Offra community, 2019).

(iv) Vaccination Campaign

The main issues raised regarding vaccination campaign are the status of vaccination, coverage, resource mobilization, targeted group, mass mobilization, AEFI and other related events. One of key ideas mentioned regarding vaccination campaign was reported by a senior officer at EPHI who noted that *“the option we have in hand was to provide reactive mass vaccination even if we're not dead sure, if we respond there would be a tendency to save life in process....”* (EPHI DDG KII, 2019, 2019). Similarly, it was also noted by another participant who said: *“...As long as the case definition met and we have one laboratory test read positive if we vaccinate thinking its yellow fever we can save life..... we decided to give this six kebele selective reactive mass vaccination,”* (EPHI DDG KII, 2019).

Ideas raised during local level discussion about the vaccination campaign further show that the vaccination campaign was declared and then was conducted immediately, as reported one of the participants. Another participant from the same group further said that *“First 10,000 doses of yellow fever reactive vaccine was delivered for six most affected kebeles, following one positive case then*

it was decided to give for all kebeles.....” (FGD_Gesuba_HC – RRT, 2019).

Information obtained at zonal level discussion further corroborate this as claimed by a participant, who noted: *“..... We visited homes and checked who has taken the vaccine and who has not in the vaccination post. By this time, everyone has been vaccinated against the yellow fever,”* (Wolaita Zone YF FGD). Another participant from the same group noted *“.....Regarding the vaccine, it was done in rapid manner in 6 kebeles. Its coverage was about 95%...”* (ibid., 2019). A participant from one of the affected kebeles also provided supporting statement, saying, *“.....Regarding vaccination, I am sure every person from children to older ones were vaccinated by HEWs”* (Tomi Gerera Kebele community FGD participant, 2019).

(v) Prevention and Control

This sub-thematic area is mainly focused on the intervention which was in place during yellow outbreak. In this regard, a salient issue was poor prevention activity. As an internist at Sodo Hospital noted, *“.....The prevention activity did not begin as early as possible by both the government and the partners....”* (KII Sodo General Hospital Internist, 2019).

At community level a range of prevention activities were reported as disclosed during an FGD. One of the participants said *“..... In the community, we conducted awareness creation on bed net utilization, crushing and destroying of stagnant water sources....”* Another also reported that *“..... The prevention methods that we used for malaria were also applied to prevent yellow fever..... Further still, a third participant provided an insightful statement on this, saying: “.....We agreed that a committee that would work to prevent and control until this problem would be identified. Next, we went into action on how to deal with the case and by setting up of disease surveillance teams* (FGD_Gesuba_HC – RRT, 2019).

(vi) Logistic & Supplies

Regarding logistics and supply, information obtained at all levels show a worrying scale of limitation. An informant at SGH noted: *“..... We requested budget for different prevention activity.....The woreda cabinet discussed it and approved 100,000 Birr budget for various activities* (KII Sodo General Hospital Internist). This financial supply, although served well to address the crisis, was not obviously sufficient enough... A major logistics and supply issue was discernible from what higher officers at EPHI reported: *“...It took a month to request ICG and process the vaccine and epidemiological and entomological investigation. While doing so, we decided to give selective reactive mass vaccination to seven kebeles”* (EPHI DDG KII, 2019). He further mentioned that *“.... Covering human cost and operational cost and taking vaccine from routine vaccine stock after letting a supply enough for a month to re stock after the ICG process ends* (ibid.) [40]

(vii) Challenges and Gaps

As a sub-theme under ‘Response’, the research team gathered information on the challenges and gaps from all

levels. Data obtained through interviews and group discussions were corroborated by observation and document reviews. A salient challenge and gap, highly decried during the fieldwork was the deficient laboratory standard. This was emphatically noted by FGD and KII participants. A senior officer at EPHI noted: “..... *Our laboratory is not confirmatory at this level and nationally our laboratory is not a yellow fever lab.....*” (EPHI DDG KII, 2019).

Another equally troubling challenge was delays in responses. Participants during FGD stated that “.... The challenge during this was the delay response after detection, the result of the sample took more time; two months passed between first case disease onset and response.....” A third major challenge was shortage of qualified health professionals as discussion participants said: “.... There was shortage of health workers to conduct outreach activities to assess the disease”.

The scale of the problem and the magnitude of people requiring attention was a fourth major challenge, as an informant reported: “..... There were so many pregnant mothers, who did not receive the vaccine, and there was unvaccinated children whose age less than 9 months of age...”

The elusive nature of the disease itself was a fifth challenging problem. This was emphasized by many informants. For example, one informant said: “*There was a challenge to differentiate yellow fever from other VHF, hepatitis B and other disease*”. A related challenge was that there was little or no expectation of this disease happening as it was thought long eradicated: “*Moreover since this epidemic were occurred 50 years ago we were panicked, which we have not seen in our life.....*” FGD_Offra Woreda RRT, 2019). Finally, there was a serious gap in capacity building, as it was noted by regional officers: “..... *From diagnosis side we have a problem in case of capacity building.*” (Regional FGD, 2019).

Overall, even though the response activities from national/federal to *woreda* level were late and insufficient, it has been noted from all participants that the response activity was coordinated and it was in place as per the standard intervention/response protocols. Discussion.

3.2. Discussion

The public health emergency response focuses on rapid assessment of outbreaks, outbreak investigations, implementing control and prevention measures, and monitoring of the interventions. The benefits of a rapid and effective response are numerous. Rapid response limits the number of cases and geographical spread, shortens the duration of the outbreak and reduces fatalities. These benefits not only help save resources that would be necessary to tackle public health emergencies, but also reduce the associated morbidity and mortality. It is therefore important to strengthen epidemic response, particularly at *woreda* and community levels. Attention needs to be focused on response strategies and continuous monitoring and evaluation of these activities [30].

Draft for Yellow Fever vaccination campaign guideline (2013) stipulates that to reduce the risk of outbreak two main strategies are being promoted; one is risk assessment and surveillance, which mainly implemented by identifying the population at risk and the other detect the outbreak early. The second one is vaccinating and outbreak response that include contain outbreaks through emergency response (reactive campaign); the other prevent outbreaks through massive vaccination (preventive) and finally the other is to protect children through routine immunization.[29]

As it was presented above in the result section all the above-mentioned responses mechanisms, rapid assessment of outbreaks, case management, outbreak investigations, implementing control and prevention measure were not in place as per the standard; i.e., the case management was implemented after the detection of the first case. Prior that all the case been ruled out either as it was severe malaria, or other VHF diseases, but since after the case were knows as Yellow fever, all the investigations were in place, like outbreak investigation, Entomological investigation and also interventions like vaccination campaign, vector control and general control activities were implemented in all affected *kebeles*.

Regarding outbreak investigation, after report of the first yellow fever case on 21 August 2018, by Wolaita Zone Health Bureau, the team from EPHI were deployed, comprising one field epidemiologist, one medical doctor, one public health specialist and one Entomologist to undertake the outbreak investigation activities. This was done in collaboration with zonal and *woreda* health and other sector staffs. All in all, a total of 35 cases with 10 deaths were recorded. The last case was detected on 16 October 2018. All cases and deaths were from Wolaita Zone; 34 from Offa and 1 from Sodo Zuria *woredas*. Epidemiological, virological and entomological field investigation evidences confirmed this [28].

According to PHEM guideline Health staff should promptly investigate the problem and respond to the immediate cases. Some health events require investigation to start as soon as possible. *Woredas* should aim to investigate suspected epidemics within 3 hours of notification. The Guideline further stipulates that suspected outbreak of these diseases (immediately reportable disease) should be notified from level to level within 30 minutes of identifications follows: and also the immediately reportable disease should be investigated with is 3hour of notification. [40]. Against this standard, as presented above, it was late for notification and also to undertake investigation or intervention/response, which took more than one month. When it was compared WHO standard either from notification to identification (30minute) or notification to investigation, which is 3 hours. In light of this standard, the case was notified or investigated after it was been more than a month [30].

As far as vaccination campaign is concerned, prompt detection of yellow fever and rapid response through emergency vaccination campaigns are essential for controlling outbreaks, as standard norms require. However,

underreporting is a concern – the true number of cases is estimated to be 10 to 250 times what is now being reported. WHO recommends that every at-risk country have at least one national laboratory where basic yellow fever blood tests can be performed. A confirmed case of yellow fever in an unvaccinated population is considered an outbreak. A confirmed case in any context must be fully investigated. Investigation teams must assess and respond to the outbreak with both emergency measures and longer-term immunization plans [31].

As it was observed in documents at each level, all documents similarly stated that the vaccination campaign were in place in two rounds, in six affected *woredas* ring reactive vaccination with 95% coverage from the target population and in nine *weredas*, two from *wolayita* zone and two *Gamo Gofa* zones, respectively. Immediately after confirmation of yellow fever, a reactive mass vaccination campaign was conducted from 13-20 October 2018 in six identified *kebeles* which benefited 31,565 (95% of targeted population) high risk populations. Following epidemiological, virological and entomological field investigation evidences, the Ethiopian Ministry of Health and international community have decided to vaccinate 1,335,865 (103% of the Target). Populations dwelling in nine *woredas* and Institutions; seven from *Wolaita* and two from *Gamo Gofa* Zones Institutions include University, colleges, prisons and other camps. This ring campaign was conducted from 16-22 November 2018 plus two additional days for mop up. The campaign is officially finalized on 24 November 2018 [29].

When we see the yellow fever occurrence and its management in Wolaita Sodo, it seems to fall short of the national and international protocols, although it was mentioned at national level, the RRT were activated and deployed timely to support and guide the local response team. The fact that the detection was reported one month after the detection shows such failure as the accepted standards show that yellow fever is immediately reportable disease according to PHEM national guideline.

The mis-diagnosis of the cases lead to clinical mismanagement as sever malaria when the patients visited the HC. They didn't get improvement; as a result, they were referred to Referral hospitals.

In general, even though there was a confusion on identifying the first case, as all FGD and KII mentioned and the document reviewed also show, since after the confirmation of the first case, the case management went as per the standard guideline and SOPs it also saved so many lives and it was also free of charge. Vector with respect to control and entomological investigation, since vector control is a cross-sectorial activity, coordination across ministries (i.e., health, sanitation, environment, education) was necessary. Vector surveillance and control programs were intensified to curtail viral transmission. A key component of yellow fever eradication, vector control measures targeted high-risk environments that were conducive to mosquito breeding [24].

The density of *Ae. luteocephalus* and *Ae. africanus* vectors were high as assessed by human landing and larval collection in rural villages as compared to urban area of Offa district, and Monkeys were frequently present around homes and farmlands. Thus, it suggested that the outbreak probably was sylvatic in nature. Similar studies show, these vectors ensured YF virus transmission despite its low vector competence reported by Miller *et al.* (1988). Finally, we note that the estimated risk of yellow fever outbreak is possible in the assessment areas of this district if the YFV was introduced. [28].

Regarding Vector control and entomological investigation, as mentioned above, all major interventions that could take to control malaria were in place showing that this is more or less comparable to excepted norms.

As mentioned in result section, all the intervention methods that were used to control malaria, like proper bed net utilization, avoiding mosquito breeding sites, disturbing stagnant water and others were also implemented; all parties including communities were engaged. Mosquito control is vital until vaccination takes effect. The risk of yellow fever transmission in urban areas can be reduced by eliminating potential mosquito breeding sites and applying insecticides to water where they develop in their earliest stages. Application of spray insecticides to kill adult mosquitoes during urban epidemics, combined with emergency vaccination campaigns, can reduce or halt yellow fever transmission, "buying time" for vaccinated populations to build immunity. Mosquito control programs targeting wild mosquitoes in forested areas are not practical for preventing jungle (or sylvatic) yellow fever transmission [33].

The main gaps and challenges hampering yellow fever response action, as presented above are often seen persistent ones in the country as observed in other similar contexts. The challenges of substandard laboratories, inexperienced health workers, lack of facilities, and poor coordination are further observed in similar comparable contexts in the country and beyond. The laboratory, reporting, facility, and expertise standards in SNNRPS, as might be the case in other regions in the country do not meet the national norms.

4. Conclusion

The aim of this assessment was to investigate the challenges, gap, practices and lesson learned from the outbreak management. The information was generated from FGDs, KIIs, observation and document reviewed to assess the efficacy and robustness of the five key dimensions of AAR; namely, surveillance, coordination, and response.

As per the PHEM guideline, yellow fever is one of the immediately notifiable diseases. But the surveillance system was weak to detect occurrence of yellow fever outbreak in Offa district of Wolaita Zone, southern Ethiopia; the system couldn't notify and immediately report to the IDSR weekly report. Yellow fever outbreak was not timely detected and hence active case search and contact tracing were conducted even after the outbreak was over. The link between health

facilities with health offices of different level was not adequate.

The causes of the outbreak were detected lately, and the notification of the outbreak was rapid as far as time of detection was considered. Detection was done after deaths reported and additional cases with similar symptoms were there. The reason for delayed detection was due to the lack of knowledge and experience of the health professionals and community about yellow fever and weak communication between the health facilities and PHEM structures.

The outbreak could be detected /confirmed at EPHI and regional reference laboratory though the referral system was too tedious and much delayed. Entomological assessment was conducted to assess and identify natural and artificial breeding sites of the vector. Assessment of human landing results indicated the higher density of Ae. Mosquito in rural areas compared to urban areas of the Offa districts and the movement of monkey around the areas might be evidenced that the Yellow Fever outbreak was sylvatic in nature.

The response of yellow fever outbreak started lately as the result of laboratory confirmation took much time since there was no pre-informed set-up for sample shipment to accredited laboratory following late detection of the case. Moreover, yellow fever surveillance system was not strongly enough to detect and notify as well as communicate early in spite of national PHEM guideline that proclaimed yellow fever as immediately reportable disease.

Regarding coordination, it was seen and observed from the assessment that, even though the coordination started lately after the confirmation of the first case and about three month later after the first notification, it has been considered as a good and well organized coordination with in the health system, and horizontal inter-sectorial collaboration and the

required partner and stakeholders with full commitment and engagement. The TWG from national to *woreda* level were established, activated and roles and responsibilities also shared as well, the required RRT from federal/EPHI to *woreda* level were activated and deployed timely and they also meet regularly.

Regarding response, the most important conclusion is that the case was detected lately after two months of since the first case were detected and all cases which were admitted in this period were mis-diagnosed of the cases and leading to some deaths. However, once the case was confirmed, the response to the crisis was fairly commendable. All the actions taken were as per the standards and they have been effective in saving of many lives.

In general, based on the foregoing results and discussions we can conclude as follows:

- 1) There was a big gap on the communication parts, like taking the media as an opportunity for communication on the situation;
- 2) Early warning, environmental health risk, and the risk communication for the community were not done properly.
- 3) It is not the right way to focus only on selected diseases, it behooves us to think beyond the scope
- 4) However, one positive aspect worth-noting is that the coordination at all levels, horizontally or vertically with all stakeholders and partners was strong and exemplary in that it was multi-sectorial composition of professionals and there was high political engagement during the outbreak management. Thus, the coordination to manage the outbreak should be considered as a good practice or strength of the system and hence may be scaled up.

Abbreviations

AEFI	Adverse Effect Following Immunization
AMREF	African Medical and Research Foundation
AAR	After Action Review
CDC	Center Disease Control
DDG	Deputy Director General
EPHI	Ethiopian Public Health Institute
EPRP	Emergency Preparedness and Response Plan
FGD	Focus Group Discussion
FMOH	Federal Ministry Of Health
FDRE	Federal Democratic Republic of Ethiopia
HC	Health Center
HO	Health Office
IRC	International Rescue Committee
IDSR	Integrated Disease Surveillance and Response
KII	Key Informant Interview
MOH	Ministry Of Health
MSF	Médecins Sans Frontières
PHEM	Public Health Emergency Management
RHB	Regional Health Bureau
RRT	Rapid Response Team
SNNPR	Southern Nations and Nationalities People Region

SITREP	Situational Report
SOP	Standard Operating Procedure
TWG	Technical Working Group
WHO	World Health Organization
UNICEF	United Nation International Children's Emergency Fund
YF	Yellow Fever
YFV	Yellow Fever Virus
VHF	Viral Hemorrhagic Fever
VRAM	Vulnerable Risk Assessment and Mapping
ZHB	Zonal Health Bureau

Declaration

Ethics approval and consent to participate

According to Federal *Negarit Gazeta* of FDRE Regulation No. 301-2013 EPHI establishment council of Ministry of Regulation page 7175, 20th year 10 Addis Ababa 1st January 2014 Ethiopia Public Health Institute have a power and duties conduct, during epidemics or any other public health emergency or public health risk, on sight investigation when deemed necessary, verify outbreaks, issue alert, provide warning and disseminate information to the concerned organs, mobilize or cause the mobilization of resources, support the response activities carried out at *weredas*, zones and regional levels as deemed necessary;. And “implement international health regulations on grave public health emergencies having implication of international crisis; Article 14 and 16, respectively.

This study has been done in conformity with the ethical codes clearance approved by the Ethiopia Public Health Institution (EPHI, ref: 3.10/446/11) to SNNPR and Preceded by the permission request letter from SNNPR health bureau 33-/86/261/11 written to the zonal health bureau then to *Gessuba* health centers and Christian hospital and explaining the study objectives and its significance.

The qualitative study was informed by, among other things, respect for culture, local norms, privacy and principles of honesty, truth and beneficence. Audio-visual recording was done obtaining permission from the participants. The participants were reciprocated through cash payment of 100 ETB (roughly 3.44 USD) per head for the time they spent in the sessions.

And consent were read for each FGDs' participated and the discussion were continued with the approval of each participants, based on the FGD tools in AAR templates.

Consent for Publication

Not Applicable.

Availability of Data and Materials

The datasets generated and/or analyzed during the current study are not publicly available due this data mainly contain countries' secret health policies and strategies, but are available from the corresponding author on reasonable

request.

Competing Interests

The authors declare that they have no competing interests.

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Authors' Contributions

YA, YF, WM, MA, MM, SH, ZD and BW have different experience in conducting qualitative research and their credentials were PhD, Assistance professor, MD, MPH and MSc were been participated in all part of the work, including data collection tools development, participated in each FGD and KII as facilitator and interviewer facilitated fieldwork logistics, analyzed and interpreted the data; and the other, SH, DS, AT, SK were been assisted/contributed in translation, transcription and analysis the, ZA, FR and others were participated in reviewed the manuscript and prepared the draft manuscript. And, ZD were give special Assistance and contribution in data analysis, thereby helping in the drafting process. And finally, all authors were read and approved the final manuscript.

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