Performance of COVID-19 Surveillance System as Timely Containment Strategy in Western Oromia, Ethiopia.

Afework Tamiru (afeworktam@yahoo.com)
Wollega University
Bikila Regasa
Wollega University
Tamirat Alemu
Wollega University
Zenebu Begna
Ambo University

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Abstract

Background: Since its occurrence in late December, 2019, in Wuhan, China; COVID-19 is rapidly spreading across the world nations. Case detection and contact identification remains the key surveillance objectives for effective containment of the pandemic. This study was aimed at evaluating the performance of COVID-19 surveillance in Western Oromia towns, Ethiopia.

Methods: CDC-update guideline for surveillance system evaluation and surveillance documents prepared by Ethiopian Public Health Institute were used as a benchmark. Qualitative interview of health workers and quantitative review of surveillance data were conducted. Semi structured questionnaire was used to interview 436 systematically selected local community to assess their awareness, perceived risk, health system utilization experience and current practices. We analyzed the data using descriptive approach by aligning the data from community, health facility and health authority along with suspect identification, case detection and reporting process of the surveillance system.

Results: One hundred seventy-nine (41%) of the participants believe they have high risk of contracting COVID-19 and 127 (29%) of them reported they have been visited by health extension worker. One hundred ninety-seven (45.2%) reported that they are not using health facilities for routine services during this pandemic. Except one hospital, all health facilities (92%) were using updated case definition. From March to July 30, 2020, there were 150 contacts, 116 suspects and 634 risk group tested for COVID-19 of which cases were found only from risk group testing, 10/521 (2%) in Nekemte and none from Shambu. Surveillance data was not being analyzed at all level.

Conclusion: In this study it is reasonable to conclude that community/risk group testing was more effective than suspect or contact testing. Surveillance data was not being used to identify group and/or area most exposed for guiding response strategy. Therefore, targeting risk group for testing can improve the effectiveness of COVID-19 surveillance in settings where mass testing is not feasible. Surveillance data analysis should be done to identify areas and groups at higher risk and investigate to avoid further crisis.

Background

On December 31, 2019, Chinese authorities alerted the World Health Organization (WHO) of an outbreak of a novel strain of coronavirus, causing respiratory symptoms. Coronaviruses have been identified in several avian hosts and in various mammals. The species pathogenic to humans were SARS-Cov and MERS-Cov that were emerged in China and Middle East, respectively. WHO announced a name for the new coronavirus, SARS-Cov2, and the disease: COVID-19 (Corona Virus Disease 2019) [1–4]. On March 11, the outbreak was characterized as a pandemic by WHO.

COVID-19 is believed to pass to human from animal, as 49–66% of the first identified cases have contact history with seafood market, where various kinds of living wild animals were on sale, including poultry, bats, and marmots [4]. According to WHO, the environmental samples taken from Huanan seafood

market were tested positive for SARS-CoV-2 [5]. Then the transmission gets its next breakthrough as the disease spread among human being (person to person transmission). Person-to-person transmission is thought to occur among close contacts mainly via respiratory droplets produced when an infected person coughs or sneezes [6]. Individuals can also be infected from and touching surfaces contaminated with the virus and touching their face (e.g., eyes, nose, and mouth). Current information suggests that people are generally susceptible to COVID-19 [7].

As of May 17, 2020, there were 4,529, 027 cases and 307, 565 deaths reported globally. America was the most affected country with 43.4% of global cases and 38.6% of global deaths from COVID-19. From Africa region a total of 58, 663 cases and 1, 710 deaths were reported. The leading country in Africa was South Africa with 14, 355 cases and 261 cases [8]. The pandemic first confirmed in Ethiopia on March 13,2020, 2 months after its occurrence in Wuhan, China and a month after the first case seen in Africa, Egypt. In Ethiopia, as of May 18, 2020, 352 cases and 5 deaths reported [9]. In such situation mitigation effort should focus on early identification of cases and quarantine of their contacts. In this regard, the role of surveillance is indispensable.

In Ethiopia, the first response to the pandemic was started by establishing a screening center at point of entries. Temperature of incoming individual will be assessed and if it exceeds 38^0C, the individual will be quarantined for 14 days and if developed symptoms sample will be collected and referred to South Africa for testing. As this process only based on thermal screening it cannot detect those who were exposed and most cases can be missed. Lessons from Singapore HINI-2009 public health measures indicated that thermal scanning at the borders successfully detected about 25% of imported confirmed cases of H1N1-2009 pandemic, mostly at the airport [10]. In the same way in Ethiopia, an index case of 48 years old Japanese has passed the thermal scanning on March 4, 2020 and confirmed as positive for Covid-19 on march 12, after having several contacts with community and business sites as well [11].

The early situation of the pandemic in Ethiopia was characterized by occurrence of significant cases without confirmed contact history and cases from dead body. Besides, cases are increasing owing to no travel restriction throughout the country including to and from Addis Ababa, the Capital and the epicenter of the epidemic in Ethiopia. The number of imported cases increased from day to day. Later, when most of the cases identified from the community with no contact and travel history, the parliament ratified a state of emergency that restrict individual and social activities, including school closure.

One of the public health responses of Ethiopia was establishing COVID-19 surveillance throughout the country, which also critical for detection of cases, including those who might escape from the point of entry. The surveillance system established in Ethiopia works within the existing Integrated Disease Surveillance and Response (IDSR) with enhanced approach to identify all cases. The entry to the surveillance is identifying suspects which will be investigated for further ascertainment. Suspected cases will be identified through rumor collection, community-Based Surveillance (CBS) and triage at health facilities.

Rumor is obtained from different ways: example, toll free teams, health Facilities (Governmental and Non-Governmental), screening sites (Airport and land crossings), hotels, investment areas, refuges and other sources. The rumor will be directed to the Rapid Response Team (RRT) for verification and investigation. If the reported rumor fulfills suspect case definition, the RRT will proceed with standard protocol for suspect management.

In the Community Based Surveillance (CBS), the main reporters are community members who detect and report cases that might be otherwise not be reported to health care facilities. Community volunteers will be identified to work with Health Extension Workers (HEW) at local level. Alert reported from community is investigated within 24 hours. The main strategy will be to establish and strengthen functional link between CBS and facility based Public Health Emergency Management (PHEM) system. A team with one HEW must visit at least 60 households per day at agrarian rural, 40 households per day for pastoralist areas and 120 households at per-urban& urban areas. The team must revisit the households twice a month in case of COVID-19. HEWs were responsible to coordinate over activities of CBS at kebele level.

In every health facility there will be a pre-triage arrangement whereby patients screened for fulfilment of established criteria for suspect. An individual suspected to have COVID-19 in a pre-triage area will be directed to triage designated area for further assessment and decision on referral. All the identified suspects (from rumor, CBS and triage) will be tested for COVID-19 by Real Time Polymerase Chain Reaction (RT-PCR). Nonetheless, laboratory results, Negative and Positive, are expected first to be reported to the federal authority and regional health bureau where they will be communicated to respective Rapid Response Team (RRT) for case management and contact tracing activities. [12].

The pandemic is the first of its kind since the establishment of modern Public Health Emergency Management (PHEM) in the country which may challenge the responding capability of the system, especially in case of such rapidly spreading pandemic. There are indicators of existence of unrecognized cases in the community; cases with unknown contact and cases from dead body. As of Jun 1, 2020, more than 448 (35.6%) cases were linked to neither travel history nor contact with confirmed cases [13]. This, combined with the prevailing occurrence of asymptomatic cases, plays the major role in spread of the disease without targeted for control and prevention measure [14].

Given the unprecedent increase in number of cases, the whereabout of the cases remain the most important piece of information critical for the containment of the epidemic. Hence, effective epidemiological surveillance system is required for management of the epidemic. Early case detection and isolation; tracing and monitoring their contacts are the two most crucial measures to control the spread of the disease [15]. The earlier patients and their close contacts are found, the more likely it is to control the development of the epidemic [16]. This requires functional surveillance system that enables rapid detection, isolation, testing, and management of suspected cases. Furthermore, functional surveillance system is important to detect and contain outbreaks among vulnerable populations. Surveillance also helps to monitor our epidemic response effectiveness in slowing the spread of the

epidemic [17]. Local control of SARS is important for global eradication that requires the early detection of new epidemics [18].

Singapore has shown evidence of a high sensitivity of case detection in the COVID-19 epidemic [19]. In Hong Kong, containment strategies that include enhanced surveillance and testing, has led to control of cases and prevention of a community-wide outbreak during the 4.5 months after the first case was reported [20]. Surveillance has also been used in Colombia to evaluate the effectiveness of COVID-19 control measures [21]. Surveillance data proofed to detect space time cluster [22].

Hence, it is timely and important to evaluate the surveillance system performance and utility in containing the epidemic. Therefore, we planned to evaluate the early performance of COVID-19 surveillance system in selected towns of western Oromia, Ethiopia, from August-September 2020. This will help all stakeholders to adjust their activities in the way better achieve the objectives of COVID-19 surveillance system in their local context.

Methods

Study Area

The study was conducted in two different town administrations called Nekemte and Shambu, Western Ethiopia. Nekemte town is a town administration of East Wollega It is found at East Wollega Zone, Oromia regional state to the west of Ethiopia at distance of about 328 kilometers from Addis Ababa. It is the center of Western Ethiopia serving as transient point for different zones and three regional states of the country. Total population of the town is 127,380 among which male constitutes 51.03%. There are one specialized hospital, one referral hospital, two health centers and seven health posts in the town. Shambu town is zonal town of Horro Guduru Wollega zone, one of the four zonal towns in Western Oromia. Total population of Shambu town is 24,711 of which 51.8% (12,850) are male. There are one general hospital, one health center and two health posts providing health service in the town.

Study design and period

We conducted community based and facility based cross-sectional descriptive study between August and September, 2020.

Study population

Public health facilities and residents of the two towns were the study population.

Study unit

Surveillance focal person at different level of the health system and residents of the towns fulfilling inclusion criteria

Sample size determination, Sampling procedure and techniques

Sample size for the community based study was determined using single proportion population with assumptions; prevalence of 50%, 95% confidence interval and 5% margin of error. Based on the assumptions and adding 15% non-response rate, the calculated sample size was 441. All health facilities and respective health authority in the towns were included in the study. Systematic random sampling was used to select households. We first determined the number of kebeles in each town and households in each kebele. Then the sample size was proportionally allocated for each kebele based on number of households. To determine the households to be included in the study we calculated K by dividing the number of total households to the number of allocated households for that kebele. In each kebele we have determined the first house hold by first identifying the center of the kebele and then determining the direction using lottery method. On the direction identified by lottery method, data was collected on every k^{th} house hold until the number of households to be interviewed in the kebele was completed.

Data collection methods

Data on suspect identification, rumor collection and investigation, testing and reporting was collected using a structure questionnaire. We assessed selected surveillance attributes using checklist customized from CDC surveillance system evaluation guideline. We have obtained surveillance data reported to the Regional Health Bureau (RHB) to calculate the positivity rate of samples collected from group. Community awareness and practice was assessed using a semi structured questionnaire to explain the role of community in the case detection and reporting.

Data Analysis

The data obtained from health facilities were analyzed using excel spreadsheet. And that of community was entered in to epi data 3.1 and exported to Statistical Package for the Social Sciences (SPSS) software window version 24 for analysis. We have used descriptive method to explain the findings of this study. Preparedness of health system, suspect identification and reporting, case detection and reporting and selected surveillance attributes were determined by performing proportion, mean and Standard Deviation (SD) by aligning health system performance and community engagement.

Results

Characteristics of respondents

Four hundred thirty-six study participants were involved in the analysis with response rate of 98.9%. The mean age of the study participants was 37.87 with standard deviation (SD) of 12.5 with females constitute 192 (44%). More than half (58.5%) were protestant followed by orthodox and Muslim constituting 25% and 15.4 % respectively. More than three fourth (83.5%) were married. Hundred seventy-seven (40.6%) of them achieved college and above level. Nearly one quarter (32.6%) of the total study participants were government and/or nongovernmental organizations' employees and 157 (36.0%) of them rely on their salary to live.

Community risk assessment and awareness

There are at high risk individual in 115 (26.4%) of the visited households (either age or underline medical condition). One hundred seventy-nine (41.1%) of the participants perceived they have high risk of contracting COVID-19. Four hundred two (92.2%) of the respondent knows how to protect oneself from COVID-19. Four hundred twenty (96.3%) of the respondent reported they get information about COVID-19 from TV/radio (**Table 1**).

Table 1: ***Community risk and awareness assessment among dwellers of selected towns, west Oromia, Ethiopia, Aug, 2020, (n=436)***

Variables and description		Number	%
Household (HH) members traveling from place to place	Yes	109	25
	No	327	75
Presence of health care worker in the HH	Yes	40	9.2
	No	396	90.8
Presence of highly mobile individual in the HH	Yes	135	31
	No	301	69
High-risk individuals in the HHs	Yes	115	26.4
	No	321	73.6
Perceived level of risk for contracting COVID-19	High	179	41.1
	Medium	107	24.5
	Low	134	31.7
	Do not Know	16	3.7
Visited by health extension workers (HEWs)	Yes	127	29.1
	No	309	70.9
Frequency of visit by HEW	Once	77	60.6
	Twice	38	29.9
	Three or more times	12	9.4
Ever heard about COVID-19	Yes	428	98.2
	No	8	1.8
Source of information about COVID-19	Television /radio	420	96.3
	Social medias	271	62.2
	Health professionals	208	47.7
	Religious leaders	141	32.3
	Community leaders	129	29.6
	Family members	98	22.5
What the participants know about COVID-19;	don’t know anything	38	8.7
	It’s a virus that can cause a disease	389	89.2
	It’s a government’s program	2	0.5

	It's a TV/radio campaign	2	0.5
	Other*	5	1.1
Kind of information gained	Protection methods	402	92.2
	Symptoms	384	88.1
	Transmission ways	366	83.9
	Actions taken when contract COVID-19	258	59.2
How dangerous COVID-19 is;	Very dangerous	353	81
	More or less dangerous	72	16.5
	Is not dangerous	7	1.5
	Other**	4	0.9
Possibility to be infected by COVID-19	Yes	287	65.8
	No	122	28
	Don´t know	27	6.2

Key: Other** (it is curse of God, is intentional product from other countries), **other* (it is fatal, it comes and go)*

Health system Preparedness

Two hospitals, three health centers, one town health office, one zonal health department and nine health posts were participated in the study. Only 1of 15 (6.7%) organization assessed have guideline/manual of COVID-19 surveillance. All health centers, hospitals and health offices were trained on COVID-19 surveillance system while 4 (44%) of the interviewed health extension workers reported they didn't get training. Three (33%) of the assessed health posts didn't have community volunteers. Rapid Response Team (RRT) has been established at all levels in the towns. Updated case definition is found in 14/15 (93.3%) of the visited facilities.

In both towns, preparedness with regard to implementing surveillance system from plan to community engagement is presented as follows (**Table 2**).

Surveillance performance

Suspect identification and reporting

Community experience and practices

Four hundred twenty-five (97.5%) of the participants reported that they will report to health system, either to local health unit or call 8335, if they suspect individual with COVID-19. From the total visited households, 182 (41.7%) reported that their health care visiting experience have been affected by the emergence of COVID-19. One hundred ninety-seven (45.2%) reported that they are not using health facilities for routine services during this pandemic. Among those who reported not using health facility during this pandemic, 132 (66.7%) were not using health facilities because they fear of contracting COVID-19 (**Figure 1**). Majority, 409 (93.8%) of the respondents reported that they are willing to be isolated if get infected (**Table 3**).

Table 3: Community experience and practices assessment towards COVID-19 in selected towns, west Oromia, Ethiopia, Aug, 2020, (n=436)

Variables	Description	Number	%
Experience during feeling ill health	Visit health facility	360	82.6
	Go to pray	47	10.8
	Purchase some medicine	23	5.3
	Eat foods believed to be remedy	4	.9
	Others[a]	2	.5
Access to health services affected	Yes	182	41.7
	No	254	58.3
Using health facilities during the pandemic	Yes	239	54.8
	No	197	45.2
Willing to be isolated if contract COVID-19	Yes	409	93.8
	No	27	6.2
Practices if contract COVID-19	I will take locally advised foods, garlic, ginger, soups etc..	227	52.1
	I will go to the hospital / health unit	400	91.7
	I will go to the neighborhood nurse	46	10.7
	I will buy medicines at the market	19	4.4
	I will look for the traditional healer	12	2.8
	I would stay in quarantine	161	36.9
Action to be taken on suspecting person with COVID-19 symptoms	Report to local health	256	58.7
	Call 8335 or local call center	169	38.8
	Do nothing	1	0.2
	do not know	10	2.3
heard someone died of COVID-19	Yes	13	3.0
	No	423	97.0
Heard neighbor died of COVID-19	Yes	9	2.1
	No	427	97.9

others include: do nothing, stay at home

Health system performance

House to house visit for risk group identification and suspect identification was done only between April to May, 2020. Between these periods, 12,012 of 25,413 (47.2%) households in Nekemte town have been visited by health extension workers to identify 7 suspects of which 3 became positive for COVID-19. In Shambu town, 3,012 of 3,931 (76.9%) households have been visited, but no data was available that indicate the number of suspects identified and tested.

At facility level, there was no screening service at triage in both towns. Individual will be suspected for COVID-19 when assessment is conducted at outpatient department. Up to now, 173 suspects have been identified from Nekemte town, none of which were positive. Whereas, 144 suspects have been identified from Shambu town of which 4 were positive. No rumor and cluster investigation practiced at both towns (**Table 4**).

Table 4: Suspect identification and testing by health system level, COVID-19 surveillance system evaluation, Western Oromia, Ethiopia, Aug, 2020.

Level	Town	Suspect identified	Suspect Tested	Result			
				Positive	Negative	Pending	Blank
Health post	2	7	7	3	4	0	0
	1	Data not available					
Health facility	2	124	124	0	121	3	0
	1	144	144	4	140	0	0
RHB (suspect investigation data)	2	35	35	1	29	5	0
	1	1	1	1	0	0	0
RHB (laboratory-based surveillance data)	2	115	115	0	115	0	0
	1	1	1	0	1	0	0

Case detection and reporting

Individual suspected for COVID-19 at health post or health facility level will be communicated to Rapid Response Team (RRT) of that catchment. The RRT will report to laboratory for sample collection and sample will be collected and transported to testing laboratory. Result will be communicated to the Regional Health Bureau and the Federal Ministry of Health, EPHI. The Regional Health Bureau is responsible to communicate result back to the RRT for necessary action.

From the Regional Health Bureau laboratory-based surveillance data, up to July 30, 2020, there were 150 contacts, 115 suspects and 521 risk group tested for COVID-19-from Nekemte town. Positive result was

found only from risk group testing, 10/521 (2%). From Shambu town 1 suspect and 114 risk groups were tested within the same time period, none of which turned positive.

Surveillance attributes

Data Quality

There is no consistency in reporting of date of testing, either Gregorian or Ethiopian calendar is in use. Individual suspected for COVID-19 can be tested several times without being recognized, as there is no control mechanism for repeated testing except for those under treatment.

Simplicity

Of the visited, 75% health facilities considered the variables on the report are simple to understand. Half (50%) of the health facilities reported that means of data collection is convenient for them.

Acceptability

More than half, 75% of the health facilities in both towns reported they have complaint on the surveillance system. The main reasons for complaint are lack of support from authority (100%), a lot of reportable variables (67%) and internet interruption (67%).

System usefulness

The laboratory-based surveillance is being used for contact tracing and case management. Data analysis was not being done at both towns to identify the most at-risk group and location. The health authorities in both towns are not using surveillance data for any decision making.

Discussion

In this study, we found that for the first five months of enhanced COVID-19 surveillance implementation, risk group testing was effective in detecting cases in the community. The main goal of surveillance during outbreak management is to detect cases early so as to reduce the transmission. This is possible by identifying more suspects, targeting at risk group and monitoring vulnerable groups. From a systems perspective, public health surveillance data are the result of a series of decisions made by patients about seeking health care and reporting rumors, health care providers about providing health care, and public health professionals about reporting cases or otherwise taking action that comes to the attention of health authorities.

One of the objectives of the surveillance is to ‘detect suspects, who fulfil suspect case definition, by event-based surveillance’. Event based surveillance requires implementation of community-based surveillance that engage the local community members in suspect identification. Both towns reported they have established Community Based Surveillance (CBS), whereas, one third of the HPs (all from Nekemte town) didn’t have community volunteers who help them in suspect identification.

Even though communities are aware about the disease and knows the disease is transmitted by direct contact with infected people, mainly obtained from TV/radio, there is no link between the community and the health system that enables the community report any rumor in their locality. As a result, health extension workers in Nekemte town identified just seven suspects for the two months they have been doing house to house visit while there was no data for Shambu town. Community participation in screening and follow up is very important for surveillance performance [18].

Major source of cases was screening risk group, as the majority of the infected will show no or moderate symptoms and cannot fulfil criteria for suspect. This is in line with the fact that majority (about 80%) of infected individual may show no or mild symptom in which they may not be suspected [13]. Besides, about 45.2% of the respondent reported that they are not using health facilities for routine services during this pandemic. However, in the early study of patients in Wuhan, China, contact tracing contributed to the primary detection of approximately half (53%) of COVID-19 patients [23]. This may possibly be explained by the early situation in the course of the epidemic when people may not be aware of most of the prevention measures and have social gathering where a single infectious individual may infect a dozen of susceptible individual.

Almost all of the individual in charge of running the surveillance are trained and are comfortable with the interpretation of reportable variables. Nonetheless, three forth of them have complaint on the surveillance system management. Their main concerns are: lack of support from authority, a lot of reportable forms and variables and internet interruption. These may contribute for the observed data discrepancy across the health system level.

Epidemic control requires knowing trends in disease frequency in different subgroups and locations. Surveillance system for COVID-19 is essential to understand the burden across the different strata of any health system and the population [24]. However, in our study we found that surveillance data is not analyzed and hence, not being used to identify the most at-risk group and location and to monitor the outcome of response activities in the local context. Furthermore, surveillance data analysis is important to identify cluster of cases to which leads to cluster investigation for the sake of understanding the main route of transmission in the local setting for containing locally acquired cases are critical to prevent widespread community transmission [25, 26].

Even though, this study is the first of its kind to evaluate the surveillance system of COVID-19 in the study area, we did not assess the actual prevalence of the disease in the community to compare the exact performance of the surveillance with the actual prevalence in the community.

Conclusions

In this study it is reasonable to conclude that suspect identification was not effective. Sensitivity of community/risk group testing was higher than that of suspect testing. The link between community and health system was poor, though community awareness with regard to suspect identification and reporting is good. Surveillance data was not being used to identify group and/or area most exposed for guiding

response strategy. Therefore, targeting risk group for testing can improve the effectiveness of COVID-19 surveillance in settings where mass testing is not feasible. Surveillance data analysis should be done to identify areas and groups at higher risk and investigate to avoid further crisis. Appropriate community engagement and support to encourage presentation and compliance is essential. The authorities' continuous support is also highly recommended for better performance of surveillance data quality.

List Of Acronyms/abbreviations

COVID-19……. Corona Virus Disease 2019

CDC……Center for Disease Control and Prevention

WHO……World Health Organization

SARS COV 2……Severe Acute Respiratory Syndrome Corona Virus 2

CBS……...Community Based Surveillance

PHEM……Public Health Emergency Management

FMOH……Federal Ministry of Health

RRT……Rapid Response Team

HEW……. Health Extension Worker

RT PCR…….. Real Time Polymerase Chain Reaction

RHB……. Regional Health Bureau

SD……. Standard Deviation

TV……Television

SPSS……. Statistical Package for the Social Sciences

Declarations

Ethical approval and consent

Wollega University Research Ethics Review Committee (WURERC) approved the study (Reference Number: **Ref/□/□/163 498 /□□ 26**). All study participants provided Verbal **Informed Consent,** according to Ethiopia National Research Ethics Review Guideline.

Consent for publication

Not Applicable

Availability of data and materials

The data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors have declared that they have no competing interests.

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Authors' contributions

AT prepared the proposal. **AT** and **BR** conducted data entry, analysis and interpretation. **AT** prepared draft manuscript. **BR**, **ZB** and **TA** reviewed the manuscript. **AT** made the final correction to the manuscript. All authors read and approved the final manuscript.

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Tables

Due to technical limitations, table 2 is only available as a download in the Supplemental Files section.