

Research



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Exploring community-based surveillance in urban and peri-urban settings: case-study of the Limete and Nsele Health zones in Kinshasa, Democratic Republic of the Congo

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Abstract

Introduction: the Democratic Republic of Congo is the only country in the world to have experienced more than ten Ebola epidemics, highlighting the need for a functional surveillance system, especially at the community level. The objective of the study was to explore the community-based surveillance system in the provincial city of Kinshasa. **Methods:** a case study exploring the community-based surveillance system, supplemented by a document review, was carried out between March and July 2023 in two health zones in Kinshasa, Limete, and Nsele HZs. Community health workers and key informants (head and supervising nurse, provincial health and epidemiological surveillance division staff), selected by purposive sampling, were involved. Semi-structured interviews explored the essential functions of community surveillance, barriers and intersectoral collaboration. The weekly surveillance database for 2022 was also analyzed. Data were summarized in proportions, and a thematic analysis was carried out for the interviews. **Results:** fifteen semi-structured interviews were conducted. The 2022 weekly surveillance database reported 5,393,557 disease cases and health events in Kinshasa, with 260,812 cases in Limete and 171,675 in Nsele. Malaria was the most common disease reported by community-based surveillance. The analysis of the measles cases reported suggested that an epidemic was ongoing in Kinshasa in 2022. In each HZ, community health workers visited monthly required households, collected cases and events, and transmitted them to HZ officers directly or through Head nurses, suggesting that the community-based epidemiological surveillance was functional. Community members also participated in the

investigation as support for HZ and provincial officers. Barriers, including the absence of event monitoring registers, lack of continuous training, low remuneration, inadequate equipment, insecurity, and the absence of clear intersectoral collaboration at the community level, were highlighted. **Conclusion:** the community-based surveillance system is operational, but requires enhanced training for agents, adequate remuneration, and stronger intersectoral collaboration.

Introduction

Since January 2020, when the World Health Organization (WHO) declared the coronavirus outbreak a global health emergency, it has resulted in more than 760 million cases and approximately 7 million deaths [1]. Several epidemics continue to affect the world, including monkeypox, classified as a Public Health Emergency of International Concern (PHEIC) by the WHO since July 2022, along with cholera, measles, yellow fever, meningitis, and Ebola continue to affect the world [2-4]. Viral agents often spread through the human population before being detected [5].

The Democratic Republic of Congo (DRC) has been grappling with a monkeypox epidemic, which has been endemic in the country for decades. Since 2019, several waves of measles epidemics have also hit the DRC [6]. The country is unique in having managed more than ten Ebola epidemics. These epidemics cause significant deaths and economic damage. The shortening of detection intervals makes health prevention even more crucial. WHO surveillance strategies, such as SIMR, highlight the crucial role of community-based surveillance in the eradication of smallpox, Guinea worm, polio, and during the 2014-2015 Ebola epidemic. According to the WHO, countries without an effective community surveillance system will be unable to detect threats quickly or respond to them in time. Strengthening

surveillance at the community level is essential [7-9].

There are two types of community surveillance: indicator-based and event-based. In both cases, community health workers assist the nurses in charge by rapidly detecting alerts at source. Community-based surveillance involves regular home visits to identify the presence of priority diseases or deaths since the last visit [10]. When the community health worker detects an alert, they report it to the responsible health facility, which verifies the information. If the alert is found to be false, no investigation is conducted. In the case of a confirmed event, the person responsible notifies the health zone within 24 hours. A rapid response team, supported by the provincial health division, is then deployed to investigate.

The provincial health division team will also be supported by the national level during the investigation. The community surveillance focal point in the health area can directly notify the national level to verify the alert for investigation. Feedback is provided to ensure that community health workers can coordinate health education efforts and encourage community participation [10] (Figure 1). Research conducted in other countries has highlighted that community-based surveillance improves the early detection of epidemics and strengthens collaboration and community participation in health efforts [11,12]. These studies emphasize the importance of intersectoral collaboration, adequate training, formative supervision, and recognition of Community health workers' efforts (CHWs) by health authorities. As CHWs are volunteers, researchers have noted that their remuneration plays a significant role in their commitment to providing faster notifications [13-18].

In 2019, Mafuta *et al.* conducted a multiple case study in the DRC, describing the level of community preparedness for Ebola and other epidemic crises [19]. Other studies carried out during the Ebola epidemic underscored the importance of community surveillance in

controlling the outbreak, with a focus on rapid detection and in-depth knowledge of the Ebola virus as part of epidemiological surveillance. In the city of Kinshasa, no study has comprehensively described the process of the community-based surveillance system. The present study aims to fill this knowledge gap by exploring the community-based surveillance system in Kinshasa.

Methods

Study design: this case study used a mixed-methods (quantitative and qualitative) approach to explore the process of community-based surveillance in Kinshasa and was carried out between March and July 2023. This type of study allows for an in-depth, extemporaneous examination of a phenomenon in all aspects.

Sitting: the research was conducted in two Health Zones (HZ) of Kinshasa: Limete and N'sele, located in the Democratic Republic of Congo. Kinshasa, the political and administrative capital, is home to the Direction de Surveillance Épidémiologique. The city comprises both urban and rural health zones. Limete HZ, with 11 health areas, offers a representative view of Kinshasa's other urban zones. The N'sele HZ, urban-rural with 15 health areas, unique in Kinshasa, provides an insight into community-based surveillance in rural areas.

Participants: community health workers (CHWs) and Key Informants (KI) were used as statistical units in this study. A community health workers is a man or woman chosen by the community and trained to manage local health problems in collaboration with the health services [20]. Key informants are actors involved in disease surveillance, knowledgeable about community-based surveillance, and health agents [21]. They include Head Nurses (HN) of health areas, HZ's Supervisors Nurses (SN), as well as officials at the *Division Provinciale de la Santé (DPS)* and the *Direction de Surveillance Epidémiologique (DSE)*. During the literature review, the Kinshasa 2022 priority disease surveillance database was used,

with the authorization of the health information and epidemiological surveillance Office. This database lists disease cases reported by the surveillance system, including details on HZs, age, case-fatality rate, health phenomena, diseases, and epidemiological weeks.

Inclusion criteria: the inclusion criteria for CHWs were to be residents in Kinshasa in one of the selected HZs and have been actively engaged in community-based surveillance for at least three years. KIs included the HNs of the selected health areas, the SNs of the studied HZs, as well as the head of the Health Information Office and the head of the Epidemiological Surveillance and Disaster Management Unit.

Sampling strategy: sampling was carried out in several stages. In the first stage, the Limete and Nsele HZs were purposively selected. In the second stage, one health area was drawn from the sampling frame of Limete's areas, and one rural area was randomly selected from Nsele rural areas. In the final stage, nine community health workers were selected on a purposive basis according to the inclusion criteria. Six key informants were also selected based on their expertise in the field. Data from the database were integrated exhaustively.

Data collection methods and tools: two data collection techniques were used: document review and in-depth interviews. The document review, using an extraction sheet, collected data on notifiable diseases from the DPS epidemiological surveillance database. In-depth interviews, based on a pre-tested interview guide, explored the knowledge and practices of CHWs and KIs. These interviews were conducted mainly in French and Lingala (etymologically translated into French during transcription). The interviews, conducted by the principal investigator, lasted between 30 and 45 minutes and were held in a quiet, private place. A tape recorder was used with the consent of the study participants. The tools used were interview guides for the qualitative data and an extraction sheet for the quantitative data. One day

was devoted to pre-testing the methodology in a health area not involved in the study, in the N'sele and Limete HZs.

Variables: the key functions of community-based surveillance were explored, including case identification and registration, notification, participation in analyses and investigations, training, epidemic response, risk communication, monitoring and evaluation, and feedback. Obstacles, such as a lack of funding and equipment, as well as intersectoral collaboration, were also addressed. For the quantitative component, three variables of interest were selected: the number of cases of diseases under surveillance, the diseases monitored, and the epidemiological week.

Data processing and analysis: descriptive analysis was carried out by calculating the frequencies and proportions of categorical variables using SPSS version 25, after data processing on Excel 2022. The numerical variable (age) was summarized by median and interquartile range. The qualitative data were analyzed in several stages. First, audiotapes of in-depth interviews with CHWs and KIs were transcribed verbatim and in full, following a uniform format. The transcriptions were checked by listening to the audios again, while reading the transcripts to correct any errors. Next, a familiarization phase with the transcripts involved repeated reading to fully grasp their content. This allowed for adding first impressions, salient points, and divergent viewpoints in the margins. The third stage was coding. A coding guide was developed and used by the lead researcher and other experts, including anthropologists from UNIKIN and a master's degree holder in public health. Each researcher coded the same transcripts according to their approach, highlighting segments of text and adding labels or codes in the left margin to describe the content. The right margin was used to add detailed notes and reflections. The analysts then compared their codes and, by consensus, standardized and described the content of each code.

The fourth step was to develop an analytical framework. The analysts reviewed the codes, agreed on their content, and tested the coding guide. Categories were then created by grouping similar codes. The fifth step involved applying the analytical framework by coding each transcript with the Atlas-ti software. The sixth step involved summarizing the data in an analysis matrix for each code or category, using MS Excel. The rows represented the participants and the columns the codes, supplemented by verbatim quotes and relevant illustrations. Finally, the seventh step was to interpret the data by analyzing the matrix and identifying connections between transcripts, participants, and categories, while keeping the study objectives in focus.

Ethical considerations: the present study was authorized by the Ethics Committee of the Kinshasa School of Public Health (ESP/CE/072/2023) and by the political-administrative authorities of the City of Kinshasa. Ethical principles, including respect for the individual, privacy, and non-maleficence, were upheld throughout the study. Interviews were conducted in quiet locations at times agreed upon by the participants. Informed consent was obtained from participants before each interview.

Results

In this study, fifteen in-depth interviews were conducted to reach theoretical saturation. Nine were carried out with CHWs selected on a purposive basis: five in the Mikonga health area and four in the Mfumu-Mvula health area. Six interviews were conducted with KIs, including one head nurse per health area, one supervisor nurse per HZ, one agent from the Provincial Health Division, and one from the Epidemiological Surveillance Division. Half of the participants were under 56 years of age, with ages ranging from 27 to 65. The number of years of practice was around 10 years, ranging from 3 to 31 years. Over two-thirds were men. Among CHWs, age was around 57, with extremes of 27 and 65. Their length of

experience was around 9 years, ranging from 3 to 31 years. More than two-thirds of the CHWs were men, and the majority were in secondary school (Table 1).

Distribution of notifications in 2022 in the city of Kinshasa: from January to December 2022, 5,393,557 cases of illness or health events were notified in all HZs in Kinshasa after data cleaning. Of these, 260,812 and 171,675 cases were reported in the Limeté and N'sele HZs, respectively. Malaria accounted for 45% of cases. Notifications of vaccine-preventable diseases, including measles, exceeded the alert threshold, indicating an epidemic in the city, followed by acute flaccid paralysis, yellow fever, diphtheria, and whooping cough. In 2022, there were 138 maternal deaths in Kinshasa (Table 2) and (Figure 2).

Description of the essential functions of community-based surveillance

Identifying and recording cases of diseases, conditions, and public health events: the content analysis shows that each CHW must visit 50 households per month in urban areas and 25 in rural areas. During these visits, they may identify sick people or health events. All respondents confirmed that CHWs use community case definitions to identify diseases on the priority list. These definitions are transmitted to the DPS by the DSE, which makes them available to the health zones. When a suspect case or health event is identified, the CHW sends an alert to the health center by SMS or provides the individual with a token to go to the nearest center. Seven out of nine community health workers reported having a notebook to record the information collected. This data is then sent to the president of the Community Animation Cells (CAC), who gives it to the HN for registration at the reference health center. For suspected cases or health events, the CHW transmits the information to the President of CAC by telephone. In rural areas where the network is weak, he must travel by motorcycle or on foot to meet him within forty-eight hours. The

HN then forwards this information to the Health Zone Central Office (HZCO) for analysis. However, during our interviews, the health area HNs pointed out the absence of a register for information from the CHWs. Conversely, SNs report having notebooks to record cases and health events coming from the community, sometimes without going through the health care structures, but directly via the CAC. *“There is no register in which to record information coming directly from the community health workers, and this situation is very bad...”*. Key informant 5. This information is then forwarded to the DPS via DHIS2 or through a written report. CAC cases are also reported monthly at monitoring meetings by CAC presidents.

Notification of priority diseases, conditions, and events: the HN receives information from the CACs and forwards it to the HZCO so that the Health Zone Leadership Team (HZLT) can make decisions after analyzing the data. In some cases, the CHWs send this information directly to the HZCO via the CAC president, but the standard procedure is to go through the HNs. The DPS and SN verify this information during community supervisions. When a suspect case is identified, the CHWs, after recording the case in their notebooks, fill in a notification form during the visit, which is signed by the HN and the SN, in accordance with health recommendations. In emergencies, they prefer to use the telephone, which enables rapid communication about suspected illnesses in the community. *“At present, there are two or three possibilities: there is the possibility for the health zones and the province to use the tablets, and for the others, there are the notification forms. The CHWs notify the health area, and take the information to the head nurse, who in turn summarizes the information, classifying the illnesses and events, and may send it to the zone”*. Key informant 1.

Data analysis and interpretation: a key informant from the central level specified that community data analysis is first carried out at the base level, where the CHWs conduct the initial assessment

during Health Development Committee (HDC) meetings. At the HZCO, during monitoring meetings, the HNs analyze the data sent in by the responsibility centers, with the Health Development Committee president (HDCP) representing the community. At higher levels, they simply compile the information confirmed by the DPS. Rumors are not analyzed at this level. This approach guarantees the reliability of the data processed.

Investigation and response: key informants were unanimous in recognizing the crucial role of CHWs in investigations by facilitating health teams' access to the community. Accompanying teams on outreach missions reassures patients or suspects, as they feel safe thanks to the support and presence of community members they know.

Epidemic preparedness and risk communication: interviews revealed that HZTL organizes meetings with health area SNs. It provides follow-up to make the CACs operational, as well as training for all CAC members. However, the CHWs feel that this is not sufficient, as other subjects and themes have not yet been tackled to equip and empower them. Gaps remain in case definitions in the field, and some CHWs are still unable to identify the problem properly. There are more briefings than actual training courses.

Obstacles to improvements in community-based surveillance: the CHWs' greatest motivation is the well-being of their community because they are volunteers who prioritize community interests. However, there is no adequate funding to support their activities. They only receive sporadic support from the HZ for activities such as vaccination. Community health workers also receive free care when they or a member of their family is ill. Non-remuneration has been identified as the main obstacle to surveillance. Other challenges include people's refusals, conspiracy rumors, and socio-cultural resistance from certain churches and households. In addition, the Kuluna (street banditry) phenomenon complicates the access of CHWs to certain households, hampering their

work. The interviews suggest that it is crucial to ensure financial support for all community health workers. Although some facilities provide free care in the event of illness, adequate remuneration and coverage of transport costs would enable CHWs to make more home visits, thereby ensuring continuous and effective monitoring in the community. One key informant emphasized that financial motivation is essential to encourage the commitment of community health workers. He explained that without compensation, individuals are less inclined to provide information, as wasting time is problematic for those who live from day to day. To improve the situation, he suggests offering rewards such as badges, waterproof clothing, boots, and bags to motivate the community to engage, even in the absence of direct remuneration.

One health: collaboration between the animal, environmental, and medical sectors is still insufficient, rendering the One Health model non-operational at the community level. Only human health workers are involved in surveillance, while veterinarians, although present in some communities, feel demotivated by a lack of recognition and support from their superiors. Consequently, they do not engage other sectors in addressing human health issues. “[...] *The one health, yes, it's good, but for the moment, it's still a slogan. It should start from the bottom up. But for us, it's at the central level, and we're now thinking of doing the opposite. We really need to work, to raise awareness at the grassroots level, to put agents in every village to do this, whatever the situation, so that there are CHWs and the environment, so that there are people too. The information now comes from the grassroots. That can help us make decisions. But if it's coming from us here without any basis, we don't have any data*”. Key informant 1.

Discussion

This mixed-method study aimed to explore the community-based surveillance system in Kinshasa.

Two HZs: one urban and one urban-rural. Community-based surveillance implies that members of a community systematically detect and report events of public health significance. This is based on two approaches: firstly, CHWs use case definitions validated by the health hierarchy, and secondly, they report health events to the HN [10]. Analysis of suspected cases notified from January to December 2022 revealed that malaria was the most frequent pathology, followed by typhoid fever, influenza, acute respiratory infections, and diarrhea in children under five. Measles, which has been in continuous epidemic since 2019, was the main vaccine-preventable disease, and maternal death was the most reported event.

The eight essential functions of community-based surveillance were examined during the in-depth interviews. To identify and record cases of disease, illness, and health-related events, CHWs utilize community definitions during routine visits or at the community's request. They refer suspected cases to the nearest health facility and record the relevant information in a notebook provided to the president of the CAC. The majority of CHWs reported that the CAC chairperson provides the information to the HN, who should record it in a register. However, HN reported not having notebooks for this task. Supervising nurses receive information directly from the CAC chairpersons and HN, and then it is transferred from the HZCO to the DPS, and finally to the DSE.

Community health workers conduct both indicator-based surveillance using case definitions and event-based surveillance. Although the central level provides these definitions to the intermediate level, the analysis revealed that CHWs receive little training on epidemiological surveillance, often limited to briefings during outbreaks or vaccination campaigns. Following the successes of CHWs during the Ebola outbreaks in Sierra Leone, their training is now recommended to strengthen global health security and prevent outbreaks [22,23]. This study highlights the gaps in the implementation of community-based

surveillance, both at the community and health area levels, compared to SMIR3 standards. The supervisory role of HN is only partially exercised, which explains their lack of archives for information from community health workers, often directly transmitted to the HZCO [10]. Similar situations were observed in Sudan, where workers did not have an official register for rumors, complicating the monitoring of signals. In addition, non-standardized information notebooks limited reporting to only perceived signals, making it difficult to assess the overall situation [14].

Regarding the reporting of cases of diseases and health events, informants at all levels confirmed that data generally flow from the periphery to the central level. However, sometimes the president of the CACs directly transmits information to the HZ, bypassing the HN. Although this may reflect a desire for responsiveness, checking with HN ensures that the transmission chain is re-established, in accordance with the guidelines of SMIR, third edition [10]. Event surveillance analysis begins at the grassroots level, with the health area's HN. Community health workers compile their data at health area development committee meetings, and a representative then attends weekly HZCO meetings. These meetings are crucial for identifying increases in cases and assessing the quality of data collection tools.

Key informants highlighted the importance of CHWs in investigations, particularly by facilitating contact between investigation teams and the community. They build trust during raids and are often the first to report cases. CHWs also play a key role in providing feedback to the community. Their home visits enable active search for diseases under surveillance and awareness-raising, a model that has proven effective in reducing neonatal mortality in South Asia [24]. The well-being of the community is the main motivation of CHWs, who work on a voluntary and unpaid basis. Their commitment is reinforced by the satisfaction of seeing their community in good health. Although they occasionally benefit from support, such as free care for themselves and their relatives, as well

as small snacks during HZ activities, this remains limited. Studies in various contexts highlight that service to the community is the main motivation of CHWs [18,25-28]. In addition to this, the honor received from the community, recognition from their superiors, and altruism also play an important role. In addition, sporadic remuneration during vaccination campaigns is often mentioned in the literature [25]. The primary obstacle for community health workers is the lack of remuneration, which affects their motivation. Other obstacles include rumors, socio-cultural resistance linked to certain religions or sects, as well as the presence of gangs, often called "Kuluna" in the city.

The issue of remuneration of community health workers was raised in this study, with most respondents supporting a lump sum remuneration from the state or partners, paid periodically. This claim was corroborated by studies conducted in Tanzania, Ghana, Burkina Faso, and Ethiopia [18,25-27]. To address this issue, the WHO recommended in 2018 to include these workers in human resources for health for planning and budgeting [29]. Intersectoral collaboration within the framework of One Health, encompassing human, animal, and environmental health, exists only at the central level and sporadically. Community health workers observed cases requiring this collaboration, but often managed individually by each sector. This lack of integration has been reported in several studies, notably in Tanzania and Nigeria, where deficits in coordination and data sharing have been highlighted [30,31]. This situation arises from the absence of a flexible coordination structure between professionals from various sectors and stakeholders. According to Maltais *et al.* in their analysis of One Health initiatives in Guinea and the DRC, there is currently no such structuring in the DRC, although projects are underway to formalize these collaborations [32].

The results of this study can serve as a basis for decision-makers to establish remuneration and training policies for community health workers.

Conduct in-depth studies on factors associated with low intersectoral collaboration at the peripheral level of the health system. This study has several limitations. First, social desirability bias may influence responses, despite our in-depth interview approach and the use of direct and indirect probing techniques. Second, recall bias sometimes hampered the accuracy of participants' recollections. To increase generalizability, the study was conducted in two health zones with distinct characteristics and involved different categories of respondents, while using varied data collection methods to allow for triangulation.

Conclusion

This study aimed to explore the community-based surveillance system in the city of Kinshasa. The results show that the system is functional, with information flowing from the community to the health areas, then to the health zones, before reaching the Provincial Health Division. However, notable shortcomings were identified, such as the lack of registers for recording health events and insufficient feedback for community health workers. Factors influencing their motivation include lack of remuneration, under-equipment, and socio-cultural barriers. In addition, intersectoral collaboration between the human, animal, and environmental health sectors remains weak. To improve this system, it is essential to organize regular training courses to enhance agents' skills, ensure adequate remuneration, and promote an integrated approach (One Health) to include animal and environmental surveillance.

What is known about this topic

- *Community-based surveillance provides early detection of diseases and public health events;*
- *It strengthens community collaboration and participation;*
- *It is carried out by volunteers.*

What this study adds

- *This study provides additional information on community-based surveillance from the perspective of the stakeholders directly involved;*
- *Each of the elements identified in this exploratory study constitutes a path for further reflection, providing the elements needed to formulate hypotheses that will be tested by more in-depth studies, thus providing decision-makers with relevant elements for public health decision-making.*

Competing interests

The authors declare no competing interests.

Authors' contributions

Aaron Samba Ngandu and Eric Musalu Mafuta contributed to the study design and writing of the manuscript. Aaron Samba Ngandu did field data collection, data quality control, qualitative data transcriptions, analysis and writing of the first manuscript. The authors have read and approved final version of this manuscript.

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Tables and figures

Table 1: socio-demographic characteristics of study participants recruited at different levels of the epidemiological surveillance system in Kinshasa (DRC), from March to July 2023 (n=15)

Table 2: distribution of cases of diseases, affections, or health events notified in the city of Kinshasa (DRC), from January to December 2022

Figure 1: reporting structure for community alerts and verification (source: ISDR 3 guide)

Figure 2: trend in the number of measles cases notified by epidemiological week in the city of Kinshasa from January to December 2022

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Table 1: socio-demographic characteristics of study participants recruited at different levels of the epidemiological surveillance system in Kinshasa (DRC), from March to July 2023 (n=15)

Variable	Values
n=15	All data
Median age (IQR)	56 (48-58,50) years
Median years of experience (IQR)	10 (6-22) years
Gender	n
Female	4
Male	11
n= 9	Community health workers
Median age (IQR)	57 (38-59) years
Median years of experience (IQR)	9 (4,50-26) years
Gender	n
Female	2
Male	7
Education level	
≤ Primary	1
≥ Secondary	8

Table 2: distribution of cases of diseases, affections, or health events notified in the city of Kinshasa (DRC), from January to December 2022

Priority decreases under surveillance	Number of cases	Frequency (%)
Malaria suspected	2438704	45.22
Malaria confirmed	1776736	32.94
Typhoid fever	547595	10.15
Flu	422817	7.84
Acute respiratory disorder	103774	1.92
Diarrhoea WDH L5	43241	0.80
COVID-19	32022	0.59
Pneumonia	27065	0.50
Measles	868	0.02
Meningitidis	308	0.01
Maternal deaths	138	0.00
Acute flaccid paralysis	91	0.00
Small EFI	58	0.00
Yellow fever	56	0.00
Diarr with blood	27	0.00
Monkeypox	16	0.00
Diphtheria	15	0.00
Whooping cough	9	0.00
Cholera	4	0.00
Acute efi	4	0,00
Maternal tetanus	4	0.00
Neonatal tetanus	3	0.00
Rabies	2	0.00
Chikungunya	0	0.00
Dracunculiasis	0	0.00
Acute hemorrhagic fever	0	0.00
Total number of cases	5393557	100
EFI; WDH		

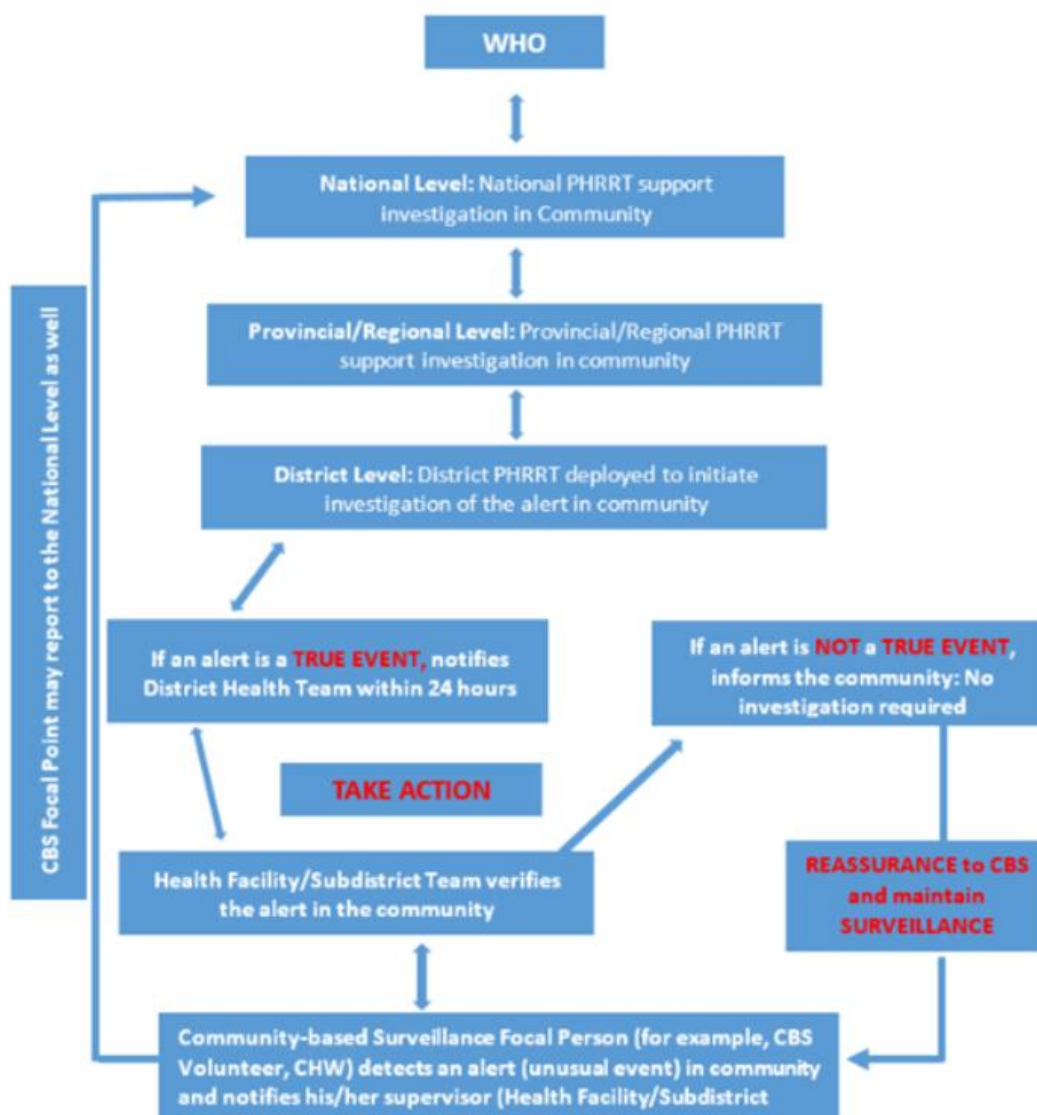


Figure 1: reporting structure for community alerts and verification (source: ISDR 3 guide)

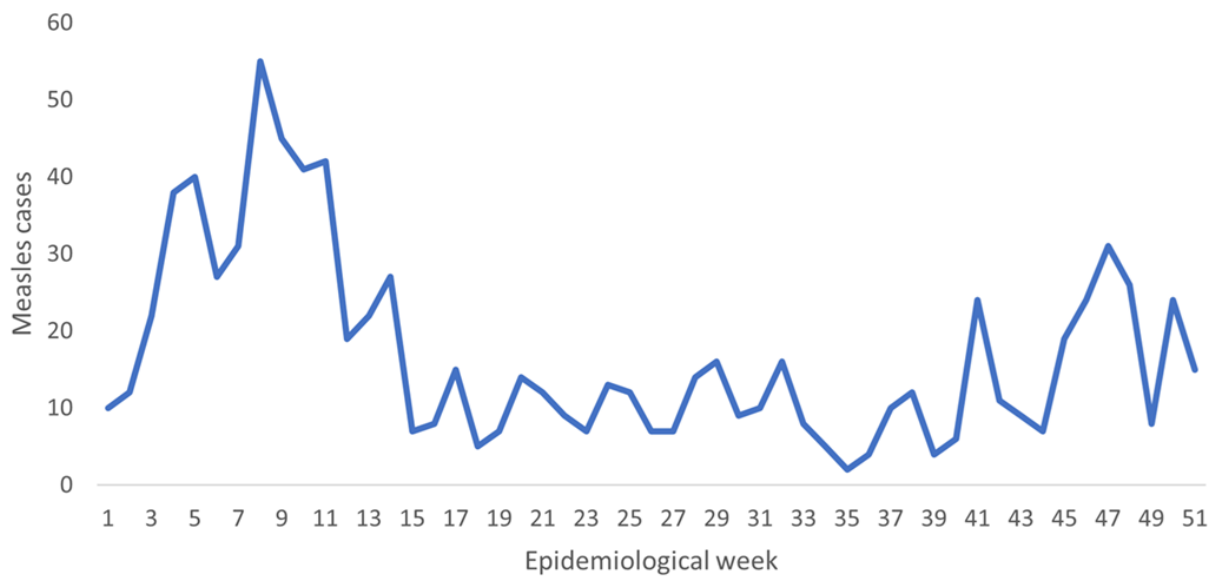


Figure 2: trend in the number of measles cases notified by epidemiological week in the city of Kinshasa from January to December 2022