An evaluation of the acute flaccid paralysis surveillance system in Kadoma City, Zimbabwe, 2022

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ABSTRACT

Introduction: The Acute Flaccid Paralysis (AFP) surveillance system is a critical method for detecting poliomyelitis cases, which involves identifying AFP cases and confirming them through laboratory analysis of stool samples. A review of Kadoma City AFP surveillance data from 2018 to 2022 indicated that zero cases were detected in 2018 and 2021 against a target of two cases per 100,000 children under 15 years per year. An evaluation of the AFP surveillance system was done to assess knowledge of health workers, its usefulness and surveillance system attributes. **Methods:** A descriptive cross-sectional study was conducted in 2022 across all healthcare facilities in Kadoma, including both private institutions and council clinics, with interviewer-administered questionnaires to healthcare workers. Data were analysed for frequencies, medians and proportions to assess knowledge, usefulness, age, years in service and surveillance system attributes. **Results:** The majority of health workers (63.4%) had inadequate knowledge of the AFP surveillance system. Data quality was poor, with forms incomplete across three reporting categories. Furthermore, the system demonstrated low sensitivity, with zero reported AFP cases in 2018 and 2021, despite the target of two cases per 100,000 children under 15 years annually. **Conclusion:** The AFP surveillance system lacked sensitivity in detecting polio cases, was unstable, and suffered from poor data quality. These issues may be attributed to insufficient knowledge among healthcare workers. We recommend training for healthcare staff on case detection and reporting procedures, display of AFP case definitions at all facilities, and the inclusion of private institutions in surveillance activities.

Introduction

Poliomyelitis is a vaccine-preventable disease caused by the poliovirus, which is a member of the enterovirus subgroup, family *Picornaviridae*. The World Health Organization (WHO) Africa Region was awarded polio-free certification in 2020 after four years without a case. The last cases of wild poliovirus in the WHO Africa Region were detected in Malawi and Mozambique in 2022. However, the WHO Africa Region still maintains its polio free certification as the virus strain detected was traced to one that circulated in Pakistan in 2019 [1]. As of 5 November 2022, 322 cases of circulating vaccine-derived poliovirus had been recorded in Africa. Eighteen of those cases were from Mozambique, which borders Zimbabwe in the eastern side, three from Malawi and two from Madagascar, which are also part of Southern Africa [2].

Public health surveillance is one of the pillars of the Global Polio Eradication Initiative (GPEI). It is defined as the ongoing, systematic collection, analysis, interpretation and dissemination of data regarding a health related event for use in public health action to reduce morbidity and mortality and to improve health [3]. The focus is on surveillance of wild polio virus through reporting and laboratory testing of all cases of Acute Flaccid Paralysis (AFP) among children less than 15 years of age [4]. Acute Flaccid Paralysis defined as any case of hypotonic weakness in a child less than 15 years of age includes various causes one of which is poliomyelitis. The AFP surveillance system is the gold standard for detecting cases of poliomyelitis [5]. It includes identification of AFP cases, obtaining laboratory confirmation from stool samples which are collected within 14 days of onset of paralysis symptoms to obtain confirmation of the etiology [6]. The target for the AFP surveillance system is at least two cases per year per 100 000 population aged 15 years and below [6].

Maintaining AFP surveillance system presents a number of difficulties for nations, including a lack of funding, geographic obstacles, unstable political environments, and problems with public awareness [7]. Nonetheless, international best practices have shown success, including technological utilization, community-based strategies, integrated surveillance systems, and capacity-building programs [8]. Successful examples include Zambia's enhanced laboratory capacity and prompt sample transportation and India's combination of routine and active surveillance [7,9].

A review of Kadoma City AFP surveillance data from 2018 to 2022 indicated that five cases were detected, however, four of those cases did not have 60 day follow up done, one case had only one specimen taken, date of dispatch was not indicated in one case and all cases did not have laboratory results or final classification. Therefore, Kadoma City has not been meeting its targets. The evaluation of the AFP surveillance system was conducted to assess knowledge of health workers on AFP surveillance system, assess AFP indicators, assess usefulness, surveillance system attributes and to identify the reasons for not meeting surveillance targets.

Methods

Study design and setting

A descriptive cross-sectional study was conducted at Kadoma City in Mashonaland West Province, Zimbabwe. Kadoma City lies 140 km from the capital city, Harare, with an estimated population of 117,380 people [10]. Approximately 50,473 children under 15 years and targeted for the AFP surveillance.

Study population

Healthcare workers working in Kadoma City clinics or private institutions were interviewed. Case investigation forms of AFP cases from 2018 to 2022 were reviewed. The study unit was any healthcare worker who was involved in the AFP surveillance system who worked at Kadoma City clinics or private institutions in Kadoma City.

Sample size calculation

Sample size was calculated using the Dobson formula

$$n = \frac{z^2 \cdot p(1-p)}{\Delta^2}$$

at a 95% confidence interval, at 80% power, using a study by Bangure 2013 on the evaluation of AFP surveillance in Sanyati District, where the overall knowledge of healthcare workers on the AFP surveillance system was 82% and an expected response rate of 95% [11]. The minimum sample size calculated for the respondents was 239. However, Kadoma City has only 45 health workers in its five

clinics and seven private health facilities involved in AFP surveillance.

Sampling

All 12 healthcare facilities involved in the AFP surveillance system in the private sector and local authority clinics were included in the study. We recruited all healthcare workers involved in the AFP surveillance system in Kadoma City for primary respondents, and the key informants were the matron, the sister in charge and environmental health officers. All AFP case investigation forms from 2018 to 2022 were reviewed.

Data collection, capture and analysis

A pretested interviewer administered a questionnaire developed using the Integrated Disease Surveillance and Response (IDSR) guidelines to collect data on surveillance system usefulness and attributes, health workers' demographic characteristics, knowledge and reasons for not meeting the targets. The tool was pretested at Kadoma General Hospital. Knowledge was assessed by asking twelve questions on the AFP surveillance system and was graded using a 3-point bipolar Likert scale based on the correct responses. A key informant's guide was used to assess reasons for not meeting AFP target and usefulness of the surveillance system. A checklist was used to review records from January 2018 to September 2022 and assess the availability of AFP surveillance resources. We generated frequencies and proportions for categorical variables such as knowledge on AFP, usefulness and surveillance system attributes. We calculated medians for age and years in service. Sensitivity was calculated as the number of non-AFP cases detected per 100,000 population of children under the age of 15 years, and for timeliness, we used the GPEI, AFP surveillance indicators.

Ethical considerations

Ethical approval was obtained from the Kadoma City institutional review board. Permission to conduct the study was obtained from the Kadoma City Health Directorate and the Heads of private institutions. Written informed consent was obtained from the respondents. To ensure respondents' confidentiality, names of the respondents were not captured, data from case investigation forms were deidentified, and data collection tools were secured under lock and key.

Results

Out of the 45 healthcare workers recruited, 41 agreed to participate in the study giving a response rate of 91%. A total of 12 health facilities that were involved in AFP surveillance participated in the study: five from local authority clinics and seven private facilities.

Demographic characteristics of health care workers in Kadoma City, 2022

Twenty-six (63.4%) of the 41 health workers interviewed were females. The median age was 40 years (Q_1=36: Q_3=46) and the median years in service was 12 years (Q_1=6: Q_3=17). Most respondents were Registered General Nurses (RGN) 18 (43.9%), followed by midwives 15 (36.6%) then Environmental Health Technicians (EHT) 6 (14.6%) and a medical doctor 1 (2.4%).

Healthcare workers knowledge on the AFP surveillance system in Kadoma City, 2022

A total of 31 (75.6%) healthcare workers reported that stool was the type of specimen collected, 24 (58.5%) reported that the conditions in which the specimen was transported were at +2 to +8 degrees Celsius, and 22 (53.7%) reported that two specimens were supposed to be collected. Overall knowledge the respondents with good knowledge were 7 (17.1%), average knowledge 8 (19.5%) and the majority of the respondents had poor overall knowledge 26 (63.4%). The healthcare worker knowledge on the AFP surveillance system in Kadoma City is presented in Table 1.

Sensitivity of the AFP surveillance system in Kadoma City, 2022

In the period 2018 to 2022, five cases were detected; however, in 2018 and 2021, Kadoma City detected zero cases with a target of two cases per 100,000 population of children under the age of 15 years and only 2019, 2020 and 2022 had cases and met the surveillance targets. On review of facility registers for 2022, there was no case that met the AFP case definition that was missed. Out of the five cases investigated from 2018 to 2022, one case was detected in 2020, and it did not have adequate stools taken; therefore, Kadoma City failed to meet the WHO stool adequacy rate of at least 80% adequate stools in 2020. All stool specimens reached the national laboratory in good condition, against a target of at least 80% of stool specimens reaching the

laboratory in good condition with proper documentation. Kadoma City failed to meet the completeness of the follow-up target of 80% of cases having a 60-day follow-up examination. No single case out of the five cases detected had a 60-day follow-up examination done.

Timeliness of the AFP surveillance system in Kadoma City, 2022

In 2018 and 2021 no cases were detected. All cases that were detected in 2019, 2020 and 2022 were notified within seven days of onset of paralysis and were investigated within 48 hours of notification. Results for two cases in 2019 and one case in 2020 were received within 35 days of onset of paralysis. In 2022 the results for the two cases were not received yet however they were not yet due and they were still within the 35 days window period. The timeliness of the AFP surveillance system is presented in Table 2.

Sample quality

All stool samples for the five cases in 2019, 2020 and 2022 were of adequate quantity, which is 8-10 grams or the size of the adult thumb. The samples arrived at the laboratory without any leakage or desiccation and they were within the ranges of the recommended temperatures. The sample quality parameters are presented in Table 2.

Enterovirus detection

Results for the 2019 and 2020 case were received within the recommended timeframe and no enterovirus were isolated from the samples. The results for the 2022 cases had not yet been received. No 60 days follow up examinations were conducted in any of the cases detected in 2019 and 2020. The enterovirus detection is presented in Table 2.

Usefulness of the AFP surveillance system in Kadoma City, 2022

All the five local authority clinics out of 12 health facilities used AFP data to conduct public health actions. The public health actions were awareness campaigns, active case searches and community education on the AFP surveillance system, which were done during the polio Supplementary Immunization Activities (SIAs) program. Evidence of local use of AFP surveillance data was only produced by one facility out of five facilities which were using AFP data. These were reports on the number of active case searches, awareness campaigns, community education sessions and AFP surveillance meeting minutes. None of the 7 private facilities used AFP data for public health action.

Simplicity of the AFP surveillance system in Kadoma City 2022

A total of 30 (73.2%) respondents had never completed AFP case investigation forms out of the 41 respondents. Twenty-two (53.7%) respondents completed AFP case investigation forms during the interview and of those who completed the forms, 15 (68.2%) took less than 10 minutes, 4 (18.2%) took between 10-20 minutes and 3 (13.6%) took more than 20 minutes. All respondents indicated that they require additional training in surveillance.

Data quality on AFP surveillance system in Kadoma City, 2022

All five forms from 2018 to 2022 had sections that were not completely filled in. One had no date of dispatch of specimen indicated and two had no results indicated. All five forms had no 60 days follow-up examination section filled even though it was already due and only one form had no final classification. We used other records such laboratory records and nursing reports to fill in the areas which were not completely filled in. The results for the two forms which were not indicated in the case investigation forms were negative for enterovirus, the date of dispatch for other specimen was recorded in laboratory records and all 60 day follow up examinations were not done.

Representativeness of the AFP surveillance system in Kadoma City, 2022

All five clinics from Kadoma City Health are participating in the AFP surveillance system; however, private institutions which were visited were not participating. The private institutions indicated that they are willing to participate in the surveillance system if they are trained and given the required material for AFP surveillance, such as stool specimen jars and case investigation forms. There were also hard-to-reach areas in Kadoma City where religious objectors stay who do not believe in health care seeking in a catchment area of one clinic with a population of 5966 children under the age of 15 years.

Stability of the AFP surveillance system in Kadoma City, 2022

All healthcare facilities had an accessible road network, cellphone network reception and a working telephone. None of the healthcare facilities had AFP case definitions and AFP reporting procedures displayed. Specimen jars for stool collection and cooler boxes with ice packs were available in only five healthcare facilities. No healthcare facility had AFP case investigation forms; they indicated that they would request them from the district offices when they have a suspected case. Cold chain equipment was available in all facilities, and there were no disruptions in the cold chain maintenance. In the period under review, there were no strikes of healthcare workers that had an impact on the stability of the AFP surveillance system. The stability of the AFP surveillance system in Kadoma City is presented in Table 3.

Reasons for failure to report AFP cases in Kadoma City, 2022

Lack of training on the AFP surveillance system was indicated by 39 (95.1%) of the respondents, poor health worker knowledge on AFP by 33 (80.5%) and poor community knowledge on the AFP surveillance system by 33 (80.5%). There were hard-to-reach areas in communities that were in the catchment area of Kadoma City Health facilities, which may have contributed to the failure to report AFP cases. The reasons for failure to report AFP cases are presented in Table 4.

Discussion

Knowledge on AFP surveillance system was generally poor as less than half of the respondents knew the AFP case definition and the majority did not know the target age group. This is a major issue of concern since cases may be missed because the case definition is not known. Lack of knowledge on the target age group may result in health workers focusing on the wrong age group as some indicated that the target was the 0-5 years age group. As a result the 5-15 years age group may end up being left out of the surveillance system [12]. In a study on the evaluation of acute flaccid paralysis surveillance system in Mwenezi District 2018 the overall knowledge level was good among the respondents [13]. The same was also reported by (Savaroye 2015) where overall knowledge level was good among respondents in an evaluation of the AFP surveillance system in Zvimba District [14]. Low levels of knowledge could be attributed to the lack of training of healthcare workers on the surveillance system as most respondents in this study were not trained on the AFP surveillance system. In an evaluation of the Babies at Risk surveillance system in Rushinga District 2015, the lack of knowledge of healthcare workers was also attributed to lack of training on the surveillance system [15].

Most of the respondents indicated that the surveillance system was useful. This is important as healthcare workers are more likely to continue participating in the surveillance system if they perceive it as useful [11]. However, evidence on the usefulness of the system at the facilities was evident at only one facility where they had reports on active case searches and zero reporting of cases. This may indicate that the activities may or may not have been done. On the evaluation of acute flaccid paralysis in Gokwe North district, 2015 evidence of active case searches which were conducted was available, it is therefore important to document surveillance activities that are done and document minutes for surveillance meetings [16].

The AFP surveillance system in Kadoma City was not stable. Case definitions for AFP and reporting procedures were not displayed in all facilities due to unavailability. More than half of the respondents did not know the AFP case definition and the reporting procedure. This results in missing cases and not following the set procedures for reporting. This is however contrary to a study on the AFP surveillance system in Mwenezi District 2018 where all facilities had case definition charts displayed in outpatient departments [17]. Private facilities visited were not participating in the AFP surveillance system due to lack of training and knowledge on the surveillance system they however indicated that they would be willing to participate in the surveillance system. Some cases may have been missed in the private facilities. In a surveillance system evaluation in Sanyati District by (Bangure 2013) the private institutions were willing to participate if they were trained and given the required materials [11].

The Zimbabwe AFP surveillance target is to detect two non-polio AFP cases per 100 000 population of children under the age of 15 years. Kadoma City met its target in 2019, 2020 and 2022. It however, failed to detect cases in 2018 and 2021. The failure in these years may be attributed to low levels of knowledge on AFP surveillance, failure to conduct active case

searches and private institutions not participating in the surveillance system. This is supported by (Chirundu 2005) on evaluation of AFP surveillance system in Midlands Province where some respondents thought the target age group was under the age of five. Lack of knowledge on the target age group was reported as a possible reason for missing cases that were over the age of five years [12]. A study on evaluation of AFP surveillance in Gokwe North District cited inaccessible health facilities, communities not reporting cases and poor knowledge among health facilities as reasons for not detecting cases [16]. These may have been reasons that may have contributed to Kadoma City not detecting cases in some years.

The AFP surveillance system in Kadoma City was not representative as private institutions were not taking part in the surveillance activities. Participation of private institutions may help in the identification of AFP cases. This is consistent with results from (Bangure 2013) in a study on the AFP surveillance system in Sanyati District where the private institutions were not participating in AFP surveillance activities [11]. Kadoma City is part of Sanyati District hence no changes have been made seen since 2013. Therefore, there is need for follow up of recommendations and public health actions to make sure they are implemented.

Forms that were reviewed for data quality were not completely filled in all sections. The 60 day follow up section was not filled in all case investigation forms. Knowledge of the 60 day follow up was 20% among the respondents therefore this may be the reason it was not done. The date of dispatch was not indicated on one form and this made it difficult to determine whether the specimens were sent to the national laboratory within the recommended 76 hours. The results section and final classification sections were also not filled in some forms. Without the results, it will be impossible to know whether it was a polio or non-polio AFP case and final classification cannot be done. The implications for not having final classification include not knowing the true burden of polio and other causes of AFP. It can also lead to missed opportunities for prevention, control and eradication of polio. The credibility and quality of the AFP surveillance system may also be undermined. The same results were reported by (Bangure 2013), (Ningi 2018) and (Savaroye 2015) were data quality was poor as some sections on case investigation forms were not filled and demographic information had errors [11,14,18]. There is need for monitoring data quality in AFP surveillance to ensure it is recorded properly and there are no gaps on investigation forms.

Limitations

Small sample size was a limitation in this study and it could have reduced the statistical power of the results. Case investigation forms that were assessed had missing information, which could have biased our findings, although other sources of the same data were used to fill in the missing variables. Our study was descriptive in nature, and it did not have an analytic component, which would have made the conclusions more robust.

Conclusion

The AFP surveillance system in Kadoma City proved valuable as it informed public health actions. The timeliness on AFP surveillance indicators was satisfactory. However, health workers had poor knowledge about AFP surveillance system, leading to incomplete data collection with important sections like results, final classification, and date of dispatch often left blank. This data quality issue may have been caused by the low knowledge levels among healthcare workers about the AFP surveillance system. We also recommended conducting regular refresher training for healthcare workers, and improving the completeness of AFP case investigation forms by introducing a standardized checklist. Increasing engagement with private institutions through formal partnerships or incentives to encourage participation in AFP surveillance system and outreach efforts to remote and hard-to-reach areas, especially among communities with religious objections to seeking healthcare were also some of our recommendations. As part of our public health actions, we trained healthcare workers in Kadoma City on AFP surveillance system using IDSR guidelines on case detection, specimen collection, reporting and follow-up procedures. Provision of AFP case definitions and reporting procedures in all facilities including private facilities involved in AFP surveillance system was done. Implementation of active case searches and community education during immunizations and clinic visits were initiated.

What is already known about the topic

- Usefulness of the AFP surveillance system
- Representativeness of the AFP surveillance system

What this study adds

- The effect of healthcare worker knowledge on AFP surveillance
- Surveillance system in local authority healthcare facilities

Competing Interest

The authors of this work declare no competing interests.

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Table 1: Health Care Worker Knowledge on the AFP Surveillance System in Kadoma City, 2022, N=41	
Variable	**Frequency (%)**
What does the abbreviation AFP stand for	35 (85.4)
What is the target group for AFP surveillance	13 (31.7)
AFP case definition	20 (48.8)
How many forms are completed for each case investigated	14 (34.2)
What type of specimen is collected	31 (75.6)
How many specimens are collected	22 (53.7)
Intervals between specimens collected	11 (26.8)
At what temperatures is the specimen transported	24 (58.5)
The specimen should arrive at the national virology lab within what period	9 (22)
When should the results be expected	2 (4.9)
What is done at the 60 day follow up	8 (19.5)
What is the target for AFP surveillance	4 (9.8)
Grade (Correct Responses) for Overall Knowledge	
Poor (< 6)	26 (63.4)
Average (6-7)	8 (19.5)
Good (8-12)	7 (17.1)

Table 2: AFP surveillance system indicators in Kadoma City, 2022

Year	Approx Population <15 years	Cases expected	AFP Cases detected	Notified within 7 days of paralysis onset	Investigated within 48 hours of notification	Adequate stools collected within 14 days of paralysis onset	Stools collected 24 to 48 hours apart	Quantity of stool specimen (8–10 grams)	Sample condition: no leakage, desiccation or drying	Adequate sample temperature on arrival	Results received within 35 days of onset	Enterovirus detected	60-day follow-up done
2018	50 000	1	0	0	0	0	0	0	0	0	0	0	0
2019	50 000	1	2	2	2	4	4	4	4	4	2	0	0
2020	50 000	1	1	1	1	0	0	1	1	1	1	0	0
2021	50 000	1	0	0	0	0	0	0	0	0	0	0	0
2022	50 000	1	2	2	2	4	4	4	4	4	*0	0	0

** At the time of data analysis, two cases were still within the 35-day window period of reporting.*

Table 3: Stability of the AFP Surveillance System in Kadoma City, 2022	
System Requirements of health care facilities	**Frequency (N=12)**
Communication:	
Road network accessible	12
Cellphone network reception	12
Working telephone	12
AFP case definitions displayed	0
AFP reporting procedure displayed	0
Screw cap specimen jars for stool collection	5
Cooler boxes with ice packs	5
Laboratory request forms	12
Functional dial thermometers	12
AFP case investigation forms	0