

Weekly disease surveillance system evaluation in Chimanimani District, Zimbabwe, 2023: A descriptive cross-sectional study

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ABSTRACT

Introduction: A weekly disease surveillance system (WDSS) monitors trends of diseases of public health importance on weekly basis. Chimanimani District recorded poor timeliness of the system during weeks 8, 9, 10 and 11 of 2023 and data discrepancies for some health facilities were observed. We evaluated the district's surveillance system to determine the reasons for poor timeliness and data discrepancies. **Methods:** A descriptive cross-sectional study was conducted using the United States Centre for Disease Control and Prevention (CDC) updated guidelines for evaluating public health surveillance systems. Fifty-four health workers were recruited and information on the surveillance system's attributes and reasons for poor timeliness was collected using an interviewer-guided questionnaire. Data analysis was performed using Epi Info 7.2 to generate frequencies, proportions and medians of health worker knowledge and system attributes. **Results:** Of the 54 participants, majority were women 41 (76%) and Primary Care Nurses 38 (70%). Most of them 38 (70%) had good knowledge of the surveillance system. Surveillance data analysis was done by 53 (98%) of the health workers. The system was simple for 53 (98%) of the participants and accepted and considered sensitive by all health workers. Majority of participants, 40 (74%) were trained on WDSS. Among the 20 clinics, 11 (55%) had all disease case definitions and 14 (70%) had adequate resources. The major reason given for poor timeliness in reporting was poor internet network. **Conclusion:** Health worker knowledge was good, the surveillance system was useful, simple, acceptable, sensitive, flexible and representative and data quality was good. However, timeliness was poor and was mainly attributed to connectivity challenges.

KEYWORDS: Surveillance system, evaluation, system attributes

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Introduction

Public health surveillance is “the ongoing, systematic collection, analysis, and interpretation of health-related data essential to planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those responsible for prevention and control”[1]. For effectiveness, collection of surveillance data must be standardized at all levels, from national to community level whilst ensuring its accessibility. Surveillance system data is used to evaluate the effectiveness of control and preventative health measures, monitor changes in infectious agents, support health planning and the allocation of appropriate resources within the healthcare system. It is also used to identify high risk populations or areas to target interventions and provide a valuable archive of disease activity for future reference [2,3].

When predefined alert or action thresholds of a certain disease are surpassed, the system should trigger rapid response activities to combat both further spread and mortality [4]. Over 100 infectious diseases outbreaks and other public health emergencies occur every year in Africa. A conducive environment for these is created by factors like large human populations, global movement, civil unrests and conflicts, economic challenges and environmental and climate change. Challenge of resources faced by most countries in Sub-Saharan Africa hinders progress in early detection, identification and quick action. This results in the widespread of diseases or health conditions and high case fatality rates [5–7]. Re-emergence of cholera, meningitis, yellow fever and measles in West Africa prompted WHO African countries in 1998, to make a call for countries to improve their surveillance and response capacity for timely detection and response to outbreaks and other public health emergencies [5,8].

Weekly disease surveillance system (WDSS) is a part of a public health surveillance system that provides an early warning of potential public health threats by monitoring trends of diseases of public health importance on a weekly basis [9]. An early warning system is crucial for communicating information about impending health risks which enable action to be taken to minimize potential devastating effects and if possible, prevent the diseases from occurring [10].

Weekly disease surveillance system was adopted in Zimbabwe in 1992 [11]. Data on epidemic prone diseases and conditions is collected from health facilities and the community on a weekly basis. This includes data for cholera, measles, anthrax, diarrhea, malaria, typhoid, dog bites, snakebites, maternal deaths, Acute Flaccid Paralysis (AFP), Influenza, meningococcal meningitis, neonatal tetanus (NNT), dysentery, Covid-19 and mumps. Health facility and community-based surveillance data are combined to produce one data set that is sent to the district health information office on a weekly basis. The reporting week starts on Monday at 00:01hrs up to Sunday at 24:00hrs and health facilities should send their weekly data set by Monday morning to the district health information office. The District Health Information Officer (DHIO) then enters the data from health facilities into DHIS2 on the same day and once data is entered it can be viewed at district, provincial and national levels from Tuesday midday [11]. Data should score at least 95% for both completeness and timeliness. Flow of information in WDSS (**Figure 1**).

Chimanimani District recorded poor timeliness of WDSS in 2023 particularly during weeks 8, 9, 10 and 11. Timelines of a surveillance system is crucial in public health for early detection and control of outbreaks, failure of which may result in widespread of the disease or condition of concern and hence high case fatality rates. This also consequently imposes huge costs to the health care system, which might be difficult to counteract in resource limited settings. Data discrepancies in terms of incorrect entries resulting in different figures between source registers and weekly reports were also noted in some health facilities for the same period. Data discrepancies may lead to underestimation of disease caseload resulting in incorrect estimates of disease incidence, prevalence and trends. It may also result in late detection and response to outbreaks and misallocation of resources. We evaluated and assessed the surveillance system for health worker knowledge, system usefulness and attributes and determined reasons for poor timeliness for the defined period.

Methods

Study design

A descriptive cross-sectional study using updated United States of America Centre for Disease Control

and Prevention (CDC) updated guidelines for surveillance system evaluation [12] was conducted.

Study setting

The study was carried out in Chimanimani District in Manicaland Province of Zimbabwe, located some 143 km southeast of the provincial capital, Mutare. Chimanimani District has a total population of 153620 served by 38 health facilities. The district is bordered to the east by Mozambique, to the north and northwest by Mutare District, to the west by Buhera District, and to the south by Chipinge District. Chimanimani District has 23 administrative wards, and Chimanimani Rural District Council (CRDC) is the local authority responsible for the overall administration and development of the district.

Study population

Health care workers were interviewed, and these included nurses, Environmental Health Technicians (EHTs), District Health Information Officer (DHIO) and District Health Executive (DHE). Patient registers and reporting forms (Rapid Disease Notification System (RDNS), Integrated Management of Neonatal and Childhood Illness (IMNCI), Rapid Diagnostic Test (RDT) registers) were reviewed.

Sampling

Dobson's formula was used to calculate sample size based on a study by Madamombe et al., (2022) where acceptability of WDSS was 96.3%. The calculated sample size was 54 at 95% confidence interval and 5% precision. The sample size constituted nurses and environmental health technicians (EHTs). Simple random sampling was done to select the health facilities and study participants whilst purposive sampling was done for key informants. Assuming that on average there are two nurses and one EHT at a health facility, we randomly selected 20 health facilities (out of 38 health facilities) using the lottery method where each health facility had an equal chance of being drawn for inclusion in the study. Three health workers per health facility who were on duty were randomly selected for the interviews. For the district hospital, the EHT and nurses one from each of these four departments: family and child health (FCH), maternity, male and female wards were randomly selected and interviewed.

Data collection

We pre-tested our data collection tool, and a few changes were made on questions regarding health worker knowledge in order to get more meaningful and comparable answers. An interviewer-administered questionnaire was used to collect information on health worker demographics, knowledge of the weekly surveillance system, reasons for poor timeliness and the system attributes. A checklist was also used to check for data quality and other system attributes (predictive value positive, completeness, data quality and representativeness).

Definition and how the variables were measured

Healthcare worker knowledge: Healthcare worker knowledge was used to assess the individual level of understanding of the weekly disease surveillance system. It included knowledge of WDSS objectives, diseases currently under surveillance, responsible person for data collection, compilation and reporting as well as timeliness of reporting. Percentage of those who got each question right were compiled. A set of six questions on knowledge of the WDSS were asked and a 3-point Likert scale was used to assess the knowledge level of each participant. Zero (0) to 2 correct answers was considered poor knowledge, 3 to 4 correct answers fair and 5 or 6 correct answers was considered good.

Usefulness: Usefulness of a surveillance system refers to any action or decisions taken because of findings from the surveillance system to prevent and control diseases and conditions of public health importance. It was measured by asking questions on whether data analysis was done, surveillance meetings were held, if and how surveillance data was used for public health actions and whether feedback was received from the district as well as checking if meeting minutes were available. Reports of the activities done in response to findings that were obtained were also checked.

Simplicity: Simplicity refers to the system's structure and ease of operation. It was assessed through asking the participants if the surveillance system was simple, determining time taken to consolidate data and send a report to the district, challenges ever faced with WDSS and the means of reporting WDSS data.

Acceptability: Acceptability is the willingness of persons to participate in the surveillance system. It was measured by asking the participants if they were willing to participate in weekly disease surveillance

and if the system was important in detecting outbreaks. Participants were also asked about the person responsible for the verification and reporting of data and responding to public health events.

Sensitivity: Sensitivity refers to the proportion of cases of a disease detected by the surveillance system. It was determined by asking the respondents if the system was able to monitor changes in the number of cases over time. Sensitivity was also determined by calculating the proportion of cases of disease detected by the system.

Flexibility: Flexibility is the ability of the system to adapt to changing information needs and operating conditions with minimal additional cost. It was assessed by asking health workers if the system was flexible and had been able to adapt to any changes and accommodate new and emerging diseases and conditions. This was also confirmed by checking the new diseases that were included in the system.

Stability: Stability is the ability of a surveillance system to collect, manage, and provide data without failure and be operational when needed. It was determined by checking if the health workers had received any form of training on weekly disease surveillance, had ever failed to report and if case definitions for diseases under surveillance were available, as well as resources to operate the system.

Timeliness: Timeliness reflects the delay between steps in a surveillance system and the availability of information for control of the disease under surveillance when needed. It was determined by asking health workers if they received data from the community on time and if they sent their reports to the district on time. Timeliness was also checked by checking the DHIOs report compiled on timeliness by the health facility.

Data quality and completeness: Data quality is the completeness and validity of the data collected through the surveillance system. It was assessed by checking for completeness, correctness of data and checking for any data discrepancies between data collection tools and reports. Completeness was assessed by checking if all data fields on data collection tools were completely filled out.

Representativeness: Representativeness is the extent to which the system accurately describes the

occurrence of the disease over time and its distribution in the population by person, place and time. It was assessed by checking records for variables like date, address, age and sex of patients which should not be missing from data collection tools.

Data analysis

Data collected using hard copy questionnaires was captured in an electronic questionnaire created in Epi Info 7.2. Data cleaning was done prior to analysis where missing information was obtained from the hard copy questionnaires and from the concerned participants through calls. Epi Info 7.2 was also used for data analysis to generate frequencies, proportions and medians of demographic characteristics, system usefulness and attributes and reasons for poor timeliness.

Permissions and ethical considerations

Permission to carry out the investigation was obtained from the Manicaland Provincial Medical Director (PMD), Chimanimani District Medical Officer (DMO) and the Health Studies Office (HSO). The study's ethical considerations were assessed and approved by the Health Studies Office (HSO) within the Ministry of Health and Child Care. We obtained informed consent from study participants, interviewed them in private and ensured data confidentiality by keeping the questionnaires under lock and key.

Results

Demographic characteristics of health workers

A sample of 54 health workers from the 20 health facilities in Chimanimani District were interviewed. Most 41 (76%) of the interviewed health workers were females, with the majority of them, 38 (70%), being primary care nurses (PCNs). The median age of the participants in service was 17 years ($Q_1=15$, $Q_3=32$). The demographic characteristics of the participants (**Table 1**).

Health worker knowledge of WDSS

At least 70% of the interviewed health workers could answer four out of five asked questions related to objectives of the weekly disease surveillance, diseases currently under surveillance, persons responsible for data compilation and reporting as well as the deadline for sending reports. The majority 38 (70%) of the respondents had good knowledge of

WDSS, whilst 14 (26%) had fair knowledge and 2 (4%) had poor knowledge

Usefulness of WDSS

A majority 53 (98%) of the participants reported that they are able to analyze their own data and hold meetings, 51 (94%) to discuss the surveillance data with differences in the frequency of the meetings. Minutes of the meetings were available and accessed by only six (30%) of the 20 health facilities visited. Surveillance data was being used in awareness campaigns, health education and investigations. The majority 51 (94%) of the 54 participants also reported receiving feedback from the higher level particularly when there is an increase in number of cases beyond the thresholds. The usefulness of the system is shown in **Table 2**.

Simplicity of WDSS

The surveillance system was reported to be simple by all 54 (100%) respondents and it took them less than 45 minutes to consolidate the data and send a report. Fifty-nine percent (32/54) revealed that they sometimes face challenges with the system especially concerning connectivity due to poor network as reported by 40 (74%) of the respondents and the majority 48 (89%) indicated using WhatsApp for receiving data and sending reports.

Acceptability of WDSS

All interviewed health workers were willing to participate in weekly disease surveillance. A third (18/54) specified that it is the duty of the sister in charge to verify data and send the report whilst 40 (74%) highlighted that it is every health worker's duty to respond to public health events. The WDSS was reported to be important in detecting outbreaks by 53 (98%) of the respondents.

Sensitivity of WDSS

All the interviewed health workers revealed that the system is sensitive in detecting cases of diseases under surveillance and in monitoring changes over time. The system was able to detect the cholera outbreak, where 494 cases were recorded in 2023. Review of malaria registers at the health facilities showed that most of the suspected malaria cases 83/96 (86.5%) were positive.

Flexibility of WDSS

The system was reported to be flexible by 53 (98%) of the health workers as it was able to adapt to any

changes and accommodate newly emerging diseases and other health conditions. Covid-19 and mumps were the added diseases that were seen in the registers and the DHIS2. All the interviewees indicated that the system is easy to integrate with other systems.

Timeliness of WDSS

Timeliness was a problem indicated by 30 (56%) who received data from Community Health Workers in time and 28 (52%) who always sent their data to the district on time. Review of the DHIO's timeliness reports of the visited health facilities showed that only 6 out of the 20 health facilities (30%) reported on time.

Stability of WDSS

The majority of the respondents 40 (74%) reported that they received some form of training on WDSS either formal or on job training. Case definitions for all diseases and conditions under surveillance were at the disposal of health workers in 11 (55%) of the 20 health facilities. Resources to perform weekly disease surveillance were available at 14/20 (70%) of the health facilities, with a few 6/20 (30%) reporting that they usually face challenges of shortages of airtime/data and test kits. The stability attribute (**Table 3**).

Data quality, completeness and representativeness

Data quality for 18/20 of the health facilities was good with some gaps and discrepancies noted in the remaining two facilities after comparing source registers and weekly reports and 2/20 health facilities had data discrepancies in terms of different figures. All the fields that showed representativeness on all data collection tools namely date, address, age and sex of the patient were filled in at all health facilities.

Reasons for poor timeliness of WDSS

Poor network connectivity was predominant amongst the reasons for poor timeliness of WDSS followed by inadequate resources as shown by 48 (89%) and 23 (43%) of the 54 respondents, respectively. Six (11%) indicated that they face staff shortages and one (2%) reported poor health worker knowledge on WDSS and poor motivation as reasons for poor timeliness.

Results from key informants

Key informant interviews revealed that the major cause of poor timeliness of weekly disease

surveillance system is poor network for some health facilities especially those that are located in the mountain valleys. The key informants mentioned that health workers were currently being trained on job and high attrition rate has increased the need for continuous training.

Discussion

Our study aimed to evaluate the weekly disease surveillance system in Chimanimani District with respect to health worker knowledge, the system's attributes and reasons for poor timeliness. The results revealed good health worker knowledge and that the system was useful, simple, acceptable, sensitive, flexible, representative and data quality was good but the system was unstable. Good health worker knowledge can be attributed to the fact that most study participants had received some form of training on weekly diseases surveillance at various stages of their career. Training capacitates health workers to carry out the requirements of WDSS as they would understand how it operates and what is expected. Our results contradicted with those by Chipendo, et al., (2022) who found poor knowledge among the health workers due to lack of training on WDSS [9].

Usefulness of the weekly disease surveillance system in Chimanimani could be ascribed to the fact that it was able to detect the cholera outbreak and that the majority of the health facilities used findings from the system for action. If the system is useful, everyone will be willing to continue participating in it yielding the expected results. Our results were consistent with those by Alemu, et. al., (2019) who found out that the system could determine the magnitude of morbidity and mortality due to diseases under surveillance as well as assess the effectiveness of prevention and control measures for each priority disease. [4]. However, Madamombe, et. al., (2022) discovered that the system was not useful due to lack of evidence of data analysis, usage and feedback although health workers had reported that it was useful [11].

Simplicity of WDSS in Chimanimani District might have been due to health workers having been trained on the system and experience gained through continued participation. This can contribute to continued participation by health workers to ensure sustainability and more accurate and useful results

will be produced. Our results concurred with those by Randriamiarana, et. al., (2018) in Madagascar, who also found out that the system was simple [13]. On the other hand, results by Ario, et. al., (2022) indicated that the system was not simple as there were two reporting tools for two different channels [14] whereas our system was one way.

Our results showed that the system was acceptable in Chimanimani District. Acceptability of the system contributes to active participation by health workers to achieve the system's objectives as well as to its sustainability. This agreed with what Chipendo, et. al., (2022) discovered in Makonde District where health workers were willing to continue participating in the surveillance system. The system was considered as part of everyday duties that had to be fulfilled by every health worker [9]. Madamombe et. al., (2022) also found the system to be acceptable in Makonde District as respondents mentioned that compiling and submitting surveillance system data was part of their job description [11].

Good system sensitivity aids in detecting and controlling outbreaks early to prevent deaths. Ario, et. al., (2022) reported the same where the system could pick up cases and detect outbreaks [14]. However, Adokiya et. al., (2015) in Ghana discovered the opposite where case detection was poor and ineffective rendering the system insensitive [15]. Our result that the WDSS was flexible agreed with findings by Alemu, et. al., (2019) who mentioned that the weekly reporting format could be used for new health events that were not listed as there was a blank column for other diseases and conditions. It was also highlighted that the system could easily adopt new technology and use electronic reporting formats [4]. Flexibility of the system contributes to its simplicity and acceptability. Weekly disease surveillance system's stability could have been due to the fact that the majority of health workers were trained on the system and resources to operate it were available at most of the health facilities. Stability of the system facilitates its continuation at achievement of its objectives. Contrary to our results, Chipendo, et. al., (2022) found the system to be unstable. It was reported that the DHIS2 was frequently down, affected by power cuts and poor connectivity [9]. As opposed to our study that was carried out in health facilities where data was easily sent via WhatsApp or text messages,

Chipendo, et. al., conducted their study in districts where there was need to enter data into DHIS2.

In concurrence with findings by Nansikombi, et al., in Uganda (2023) where health facilities were performing below 80% target for timeliness [16], the weekly disease surveillance system in Chimanimani District was also not timely. In our study, the reasons for poor timeliness were WI-FI disruptions in some health facilities; poor staff motivation due to poor remuneration which resulted in high staff turnover leading to staff shortage. Additionally, some health workers were not trained on WDSS which could have caused late reporting as they did not know how to compile the reports. However, shortage of resources did not seem to affect timeliness as the health facilities could have reported on just what they were able to carry out. Poor timeliness results in late detection or missing of outbreaks, which may cause widespread of the disease or condition of concern and high case fatality rates. Results by Alemu, et. al., (2019), however, showed good timeliness of the system where it was above the national and international targets. Mobile networks and Wi-Fi connectivity were reported to be good in their study [4].

The data were complete and data quality was good in Chimanimani District. Data accuracy avoids missing of cases of diseases and hence outbreaks. This agreed with Chipendo et. al., (2022) who found out that all the data fields for the analysed weekly disease surveillance forms were completed [9]. However, Adokiya, et. al., (2015) in Ghana discovered poor completeness as there were huge data discrepancies between weekly totals due to lack of training of health workers [15].

Chimanimani data were also representative. Diseases and other health conditions could be easily identified by person, place and time. This aids in describing the disease patterns to generate hypotheses for further studies as well as allocation of health resources and planning interventions. In contrast to our results, Alemu et. al., (2019) found out that the format for weekly report did not have some important epidemiological variables like sex and age, making the system unrepresentative [4].

Limitations of the study

We could not find an adequate representation of EHTs as they were conducting indoor residual

spraying (IRS) for malaria control; hence, our study was more centred on nurses. Another limitation was the likelihood of response bias due to reliance on self-reported data.

Conclusion

Health worker knowledge on weekly diseases surveillance system in Chimanimani District was good with 70% of the participants exhibiting good knowledge. The system was useful, simple, acceptable, sensitive, flexible, representative and data quality was good with scores of at least 90% for all these attributes. However, the system was untimely (52%) compared to the recommended 90% and not stable. Timeliness of the system is imperative in ensuring early detection and control of outbreaks, and system stability ensures its continuity. Poor timeliness was mainly attributed to connectivity challenges.

We recommended a thorough follow-up of health facilities to ensure timely reporting and to provide the required resources at all health facilities. We also recommended maintenance and timely repair of malfunctioning Wi-Fi at health facilities.

What is already known about the topic

- Lack of timeliness of WDSS in Chimanimani District.
- Timely reporting of WDSS data helps detect outbreaks early to allow immediate implementation of control measures.

What this study adds

- The weekly disease surveillance system in Chimanimani District was threatened by a poor network and a shortage of resources.

Competing Interest

The authors of this work declare no competing interests.

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Authors' contributions

MC, MM and GM: Conception, design, data collection, analysis, interpretation and manuscript drafting.

AC, TPJ, NTG and GS: conception and reviewing of all drafts of the manuscript for intellectual content.

MT had oversight of all stages of the research and critically reviewed the final draft. All authors read and approved the final manuscript.

Tables & Figures

Table 1: Demographic characteristics of health workers, Chimanimani District, Zimbabwe, 2023

Table 2: Usefulness of weekly disease surveillance system, Chimanimani District, Zimbabwe, 2023

Table 3: Stability of the weekly disease surveillance system, Chimanimani District, 2023

Figure 1: Flow of information in the Weekly Disease Surveillance System, Zimbabwe

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Table 1: Demographic characteristics of health workers, Chimanimani District, Zimbabwe, 2023

Variable	Frequency N=54 n (%)
Sex	
Male	13 (24)
Female	41 (76)
Designation	
Registered General Nurse	11 (20)
Primary Care Nurse	38 (70)
State Certified Nurse	1 (2)
Environmental Health Technicians	4 (7)
Median age in years	44 years (Q1=41, Q3=49)
Median years in service	17 years (Q1=15, Q3=32)

Table 2: Usefulness of weekly disease surveillance system, Chimanimani District, Zimbabwe, 2023

Variable	Frequency n (%)
Analyze data (N=54)	53 (98)
Hold meetings to discuss WDS data (N=54)	51 (94)
Frequency of meetings (N=51)	
Weekly	33 (65)
Monthly	9 (18)
Fortnightly	1 (2)
Quarterly	0
Whenever there is a problem	8 (16)
Meeting minutes available (N=20)	
Number of health facilities	6 (30)
Usage of WDS data* (N=54)	
Awareness campaigns	3 (6)
Health education	45 (83)
Investigations	11 (21)
Feedback received from higher level (N=54)	51 (94)
Frequency of receiving feedback (N=51)	
Weekly	9 (18)
Monthly	11 (21)
Quarterly	4 (8)
When there is a problem	27 (53)
<i>*Multi-response question so total percentage is greater than 100%</i>	

Table 3: Stability of the weekly disease surveillance system, Chimanimani District, 2023

Variable	Frequency (%)
Ever trained on WDSS (N=54)	40 (74)
Ever failed to report WDSS data (N=54)	0 (0)
Case definitions for diseases under surveillance were available at health facility (N=20)	11 (55)
Resources to perform weekly disease surveillance were available at health facility (N=20)	14 (70)

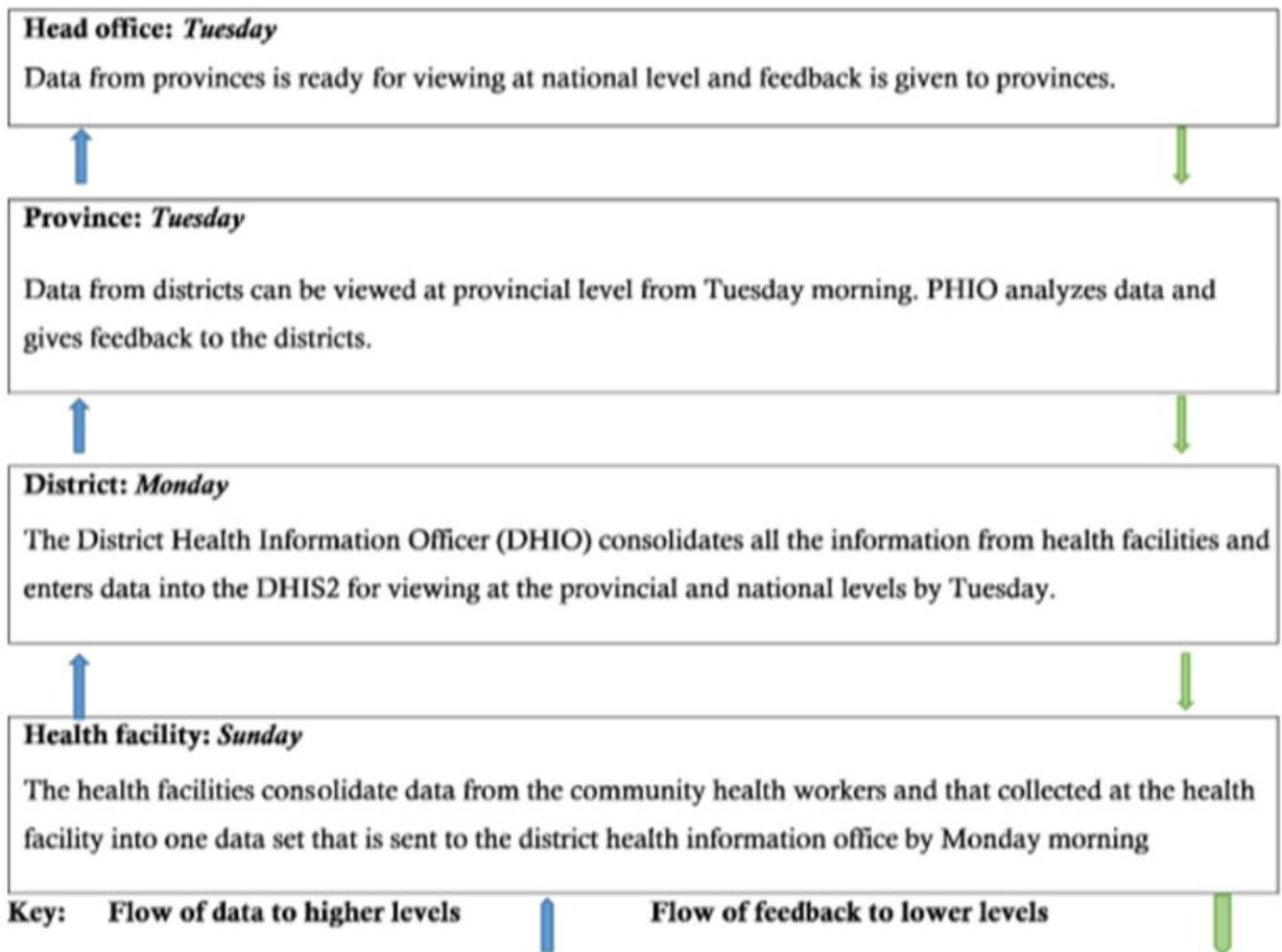


Figure 1: Flow of information in the Weekly Disease Surveillance System, Zimbabwe