Tuberculosis Notification Surveillance System Evaluation in Bulilima District Zimbabwe, 2020

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ABSTRACT

Introduction: The World Health Organisation (WHO) recommends the detection of 90% of WHO's estimated TB incidence. In 2020 Bulilima District detected 31% of Zimbabwe`s estimated incidence thereby failing to meet the WHO detection target. Low TB case detection negatively impacts patient management and TB programming. We assessed TB surveillance system attributes and determined the reasons for low TB case notification in Bulilima District. **Methods:** We conducted a descriptive cross-sectional study among 91 health workers involved in TB programming in all 16 health facilities in Bulilima District using updated US CDC guidelines for evaluation of the public health surveillance system, including document/records review and secondary data analysis. District Medical Officer, District Nursing Officer, District Pharmacist, District Environmental Health Technician, District Health Information Officer, District Laboratory Technician, Community Nurse, District Health Promotion Officer and the TB focal person were recruited as key informants. We used questionnaires to assess knowledge, a checklist to assess system attributes, and a key informant interviewer guide to assess reasons for low notification. We analyzed quantitative data using Epi Info 7 to generate frequencies and proportions and qualitative data was analysed manually. **Results:** All health facilities submitted quarterly reports timely and 46.2% (42/91) of health workers demonstrated good knowledge of the surveillance system. The surveillance system was simple, stable, acceptable, and useful. The district had one TB diagnostic laboratory providing service to the 16 health facilities and manned by one microscopist. This was the reason for low TB notification as results are often delayed or never received. **Conclusion:** The surveillance system was stable, simple, and acceptable and generated information which was used for public health actions. The district had limited TB diagnostic capacity which contributed to the low TB notification. We recommended filling of Laboratory Technicians and Laboratory Scientist posts at the diagnostic center.

Introduction

In 2014 and 2015, all United Nations (UN) and World Health Organisation (WHO) member states committed to ending Tuberculosis (TB) through the adoption of WHO´s End TB Strategy. WHO´s End TB Strategy aims at an 80% reduction in TB incidence rate by 2030, and a 90% reduction in the annual number of TB deaths by 2030 [1]. In addition, UN member states adopted UN Sustainable Development Goals (SDGs) which aim to end TB, AIDS, neglected tropical diseases, malaria, and combat hepatitis, water-borne diseases, and other communicable diseases by 2030 [2]. The WHO End TB strategy and SDGs include milestones and targets for reductions in the incidence of TB, the number of TB deaths, and costs faced by TB patients and their households [3,4].

In 2020, it was estimated that 9.9 million new tuberculosis (TB) cases were recorded; 5.5 million men, 3.3 million women, and 1.1million children [5]. Globally the Tuberculosis (TB) incidence is 127 cases per 100,000 and 220 cases per 100,000 in Africa [6]. Zimbabwe is one of the top thirty high TB/HIV burdened countries in the world and has a TB incidence of 193 cases per 100,000[6,7]. In 2017, Zimbabwe adopted WHO guidelines which recommend member states to detect at least 90% of the WHO estimated TB notification rate [8]. An analysis of the District Health Information System 2 (DHIS2) for Bulilima District revealed that from 2018 to 2021 Bulilima District failed to meet the WHO national TB notification rate of 193 cases per 100,000 [6,9]. In 2020 Bulilima District reported only 54 TB cases from an estimated population of 95,064 (57 per 100,000) which suggests a case detection rate of 31% against a target case detection rate of 90% [6,8,9].

Globally efforts to control TB are being made, however, TB case notification remains low in many countries. One potential contributor to low case notifications is the lack of a robust TB Surveillance System. Poor performance of the TB surveillance system leads to TB pretreatment loss to follow up which in turn leads to low TB case notification. Low TB case detection has a negative implication on patient management and TB programming which then hinders the achievement of the National TB Control Program objectives. We, therefore, evaluated the TB case notification surveillance system in Bulilima District to determine the reasons for low TB case notification and assess the surveillance system attributes of acceptability, stability, usefulness, timeliness, simplicity and completeness.

Methods

Study type and study setting

A descriptive cross-sectional study was conducted in all health facilities in Bulilima District. The district is located in Matabeleland South Province of Zimbabwe. Bulilima District has a total of 16 health facilities comprising one mission hospital, and fifteen rural health clinics.

TB surveillance data flow

The objectives of the TB surveillance system include guiding evidence-based decisions, monitoring TB incidence, assessing progress toward annual targets and benchmarks, and supporting data collection, and analysis [10]. The Tuberculosis Notification Surveillance System is embedded within the structures of the healthcare system from the primary care level to the central level. The purpose of the surveillance system is to track TB incidence, TB mortality, and morbidity. The objectives of the Tuberculosis Notification Surveillance System are to enable the policymakers, stakeholders, and implementing partners to monitor changes in disease trends and progress towards the annual targets, support data collection and analysis as well to guide evidence-based decisions. The TB surveillance system also aims for quality patient care, a continuum of care, information-sharing with patients, and transfer of information between health facilities to aid staff in providing adequate services to patients as well to allow managers at different levels in the National Tuberculosis Control Program to monitor program performance in a standard way and provide the basis for programmatic and policy development [11].

A presumptive TB case is a person who presents with symptoms or signs suggestive of TB, in particular, a cough of two weeks or more and cough regardless of duration in HIV patients. The tuberculosis cases are defined either as patients with a biological specimen that is positive by smear microscopy, culture, and WHO-approved rapid diagnostics (such as Xpert MTB/RIF) or as patients diagnosed with active TB based on X-ray abnormalities, histology, and extra-pulmonary cases without laboratory confirmation [8,10,11].

TB notification forms are filled as soon as a TB diagnosis is made, it is filled and sent to the district level within five working days.

Data are collected and reported using standardized data collection and reporting tools. Data collected is verified and routinely analyzed to inform decision-making at all levels which are the health facilities, the district level, the provincial level, and the national level [10,11]. Health facilities every quarter, compile quarterly notification and treatment outcome summary reports and submit them to the district level by the seventh day of the following month

after the end of the reporting quarter. The district consolidates the district quarterly notification summary report and quarterly treatment outcome and submits them to the province on the twenty-first of the following month after the end of the reporting quarter [10] The provincial office submits provincial reports and district reports to the national office on the twenty-eight of the following month after the end of the reporting quarter as shown in Figure 1.

Study population and study site

The health facility based study was conducted in Bulilima District which has a total population of 102,323 which is all rural and is served by 16 health facilities comprising of four government institutions, 11 rural health centres, and 1 mission hospital. The study population was all healthcare workers working in healthcare facilities in Bulilima District and involved in TB surveillance.

Sample size calculation

The sample size was calculated using Dobson´s formula n= z2p (1-p)/d2 with a prevalence (p) of 93.0% of the healthcare workers mentioned that they had notified TB cases from a study by Pamela Magande et al. (2016) at 95% confidence interval, precision (d) of 5% and power of 80 % [12]. The computed minimum sample size was 100 health workers.

Sampling

All the 16 health facilities in the Bulilima District were selected for the study. Study participants were selected using simple random sampling among healthcare workers responsible for TB surveillance who were on duty at each health facility on the day of the survey. The district TB focal person and eight other District Health Executive members, namely, the District Medical Officer, District Nursing officer, District Phamacist, District Enviromental Health Technician, District Health Information Officer, District Laboratory Technician, Community Nurse, District Health Promotion Officer were purposively recruited in the study as key informants.

Data management

Data was collected using a pretested interviewer-administered questionnaire and a pretested key informant interview guide. The questionnaire was designed in line with the Centre for Disease Control Guidelines on Surveillance of a Public Health System [13]. The questionnaire was used to assess knowledge, simplicity, acceptability, and stability. Checklists were used to assess their usefulness, timeliness, completeness, and stability. The key informant guide was used to verify data collected using questionnaires and to collect reasons for low-case notification. The key informant guide was used for collecting thematic data. The themes were short phrases and words common in the transcripts of KI interviews. Thematic data was analyzed by identifying patterns in the meaning of themes and categories in data collected from interviews. The common themes were compared to the total number of interviews conducted.

Usefulness was assessed by reviewing the objectives of the surveillance system, participant interviews, and reviewing records which include TB surveillance data meeting minutes for public health actions or decisions carried out or made based on the findings from data collected by the TB notification surveillance system. The system was useful if it was used to detect, treat, and handle contacts of affected persons appropriately, provide estimates of morbidity and mortality related to TB, detect the trend of TB in the district, and improve clinical and behavioural practices to help policymakers make informed decisions regarding TB prevention and control. Knowledge was assessed by asking about the objectives of the surveillance system (3 points), the TB detection methods (4 points), signs and symptoms (4 points), and whether participants have calculated the TB notification rate (1 point). A total score of 9-12 was graded as good, 6-8 as fair, and less than 6 as poor. Completeness was assessed by expressing as a percentage the number of completed fields on the TB surveillance data collecting tools (completed field /total fields). Simplicity was assessed by asking the participants their perceptions of the simplicity of the TB case notification surveillance system. Acceptability was assessed by asking participants their perceptions of the acceptability of the TB case notification surveillance system. Timeliness was assessed by determining the number of health facilities that send TB reports on time

Stability was assessed by determining the number of healthcare workers who were trained and the availability of resources required to use the TB notification surveillance system which included the previous TB case notification form stockouts, current notification form availability as well the methods used to transfer forms to the next level and the availability of time for filling in the form.

Data analysis

Data was captured and entered into Epi Info 7 TM (CDC, 2012) statistical package. The package was used to generate frequencies. Qualitative data were analyzed thematically. Thematic analysis of data involved identifying patterns in the meaning of themes and categories in data collected from interviews, verifying it, and then quantifying it. The themes are short phrases and words.

Ethical considerations

Permission to carry out the study was obtained from the Matabeleland South Provincial Medical Director, Bulilima District Medical Officer, and Health Studies Office within the Ministry of Health and Child Care. A detailed explanation of the study was given to the participants for informed decision-making to participate in the study, written consent was sought from the participant. For anonymity, the data collecting tools do not use participant's names. We used unique identifiers to maintain anonymity. Participants were informed that participation was voluntary and they could withdraw from the study and no monetary benefits would be provided. During data collection, privacy was observed. The study's ethical considerations were assessed and approved by the Health Studies Office within the Ministry of Health and Child Care.

Results

Participants´ characteristics

A total of 16 health facilities were visited and 91 participants were interviewed. The response rate was 100%. Fifty four percent (49) of the respondents were females and 46.2 % (42) were males. The majority 76% (69) were nurses, environmental health technicians and pharmacy technicians accounted for 13% (12) and 5% (5) respectively and one medical doctor (1%) as shown in Table 1. Most of the participants 68% (62) had more than ten years in service. The participants´ median years in service was 14 years (Interquartile range 10-14).

Knowledge of the TB notification surveillance system among healthcare workers in Bulilima District

The majority 77 (84%) of the healthcare workers had good knowledge of the objectives, 84 (92%) of TB signs and symptoms, and 77 (84%) of the methods used to detect TB. However, only 7 (8%) reported that they were able to calculate the TB case notification rate. Forty-six percent (42/91) of the healthcare workers demonstrated good knowledge as shown in Table 2.

Bulilima District Tuberculosis Case Notification Surveillance System Attributes

Usefulness

Eighty-three (91.2%) participants reported the system was useful, 56 (61.5%) reported that they were analyzing data monthly and 63 (69.2%) of health workers reported that they had received feedback after submitting data and used the data. The majority 69% (63/91) of the healthcare workers reported that they submit quarterly reports to the next reporting level.

Stability

The majority 78 (85.7%) of the healthcare workers were trained on the job on the TB Notification Surveillance System. Stock-outs of notification forms in the last six months were reported in all the 16 health facilities. To transmit information to the next level all 16 facilities had access to motor vehicles, motorcycles, and cellphones as shown in Table 3. Eight-three (91.2%) of the health workers reported that the motorcycles and cell phones were provided by partners. Ten of the 16 health facilities reported conducting TB meetings however the minutes for TB meetings were not available in all the health facilities.

Timeliness

A review of notification forms and TB registers showed that 93% (14/15) TB cases were notified within 24 hours. The majority 84 (92%) of the healthcare workers reported that failure to report to the next level on time was due to staff shortages and competing programs. All health facilities submitted TB quarterly reports in 2020 on time.

Simplicity

The majority 77 (84.6%) reported that the TB Case Notification Surveillance System was easy to operate and 67 (73.6%) indicated that they were able to fill the notification forms in ten minutes Table 2.

Acceptability

All 91(100%) health workers reported that their facilities were notifying TB Cases. The majority 63 (69.2%) of the health workers reported willingness to continue using the system and that the system should remain in place Table 2.

Data Quality and Completeness

All the eighty-six TB records (entries) in the Presumptive TB Register were assessed for data quality. Sixty-one out of 86 (71%) had all fields filled in, 20 (24%) of all entries assessed did not have the gender of the TB presumptive cases, and 12 (14%) did not have TB presumptive case numbers. There were fifteen positive TB cases detected but only 10/15 (67%) notification forms were filled in and the data was legible.

Reasons for low notification of TB cases

A total of 9 key informants were interviewed. The most cited reason for low TB case notification in Bulilima district was the long turnaround time for TB laboratory tests, the key infomants reported that

"The expected turnaround time for TB results is 48 hours. However results take more than three weeks or sometimes we do no receive them at all".

The other commonly cited reason was patient hesitancy to visit health facilities for fear of contracting Covid-19 with some saying,

"Patients are reporting that they delayed to present to the health facility because they were afraid of contracting Covid-19". The other reason was staff shortages. Key informants reported that: *"Our counterparts are leaving so we are understaffed".*

Six of the nine informants reported that the practice of prioritising other competing programs led to reduced time for contact tracing and contributed towards low TB case notification.

The other cited reason was health workers´ low TB index of suspicion among the patients. Key informants also highlighted that that low TB case detection was due to the district having only one TB detection center.

"We have only one TB detection center which has only one microscopist, it is often overwhelmed such that results are delayed or do not come at all".

The key informants suggested increasing the number of personnel and the number of cadres working at the TB detection center (**Table 4**).

Discussion

We evaluated the TB surveillance system in Bulilima District to determine the reasons for low TB case notification. The TB surveillance system is fairly useful as demonstrated by the number of health workers being able to use the information generated from the system to make public health actions which include contact tracing. Data captured from the surveillance system was being used to promote an understanding of disease risk factors and to track incidence rate thereby promoting effective targeted interventions and implementation of control measures. This finding is similar to findings by Frimpong-Mansoh RP et al. 2018 in Ghana and Alkalali et al. in 2018 in Yemen however it was not consistent with findings by Makurumidze et al. 2017 [14,15].

The low TB notification was due to prediagnosis leakage in the presumptive TB care cascade mainly becauses TB results were delayed and also not coming back. Tuberculosis case notification is increased when more TB cases are detected and notified. Patients' hesitancy to visit health facilities leads to a low number of TB cases detected as patients do not present themselves for diagnosis. Similarly low TB index of suspicion on patients by health workers, and reduced time for contact tracing leads to less number of cases being tested and notified which ultimately results in a low TB case notification [16].

A significant number of healthcare workers demonstrated knowledge of the objectives of the system, the signs and symptoms of TB as well the methods of detection. These findings could be because a fair number of the healthcare workers had been in service for a long time. However, only a few demonstrated that they had the knowledge to calculate the TB notification rate. This knowledge gap may be due to the omission of this topic during the on-job training done in most health care facilities. However, this finding was not consistent with the findings by Makurumidze et al 2017 [14].

The TB surveillance system was fairly stable, since most health workers were trained, most health facilities can transmit information by cell phone and the doner funded HIV program sample transport system riders. However, it was not sustainable because the cell phones and riders were donor-funded, and access to communication of health workers ensured transmission of TB data from one level to the other. All the health facilities in the district had TB surveillance tools. However, most health facilities were experiencing stockouts of specimen jars and stationery. These findings are similar to findings by Matambo et al 2016 in a study done in Harare City, Magande, et al in Mhondoro Ngezi, and Asif et al. 2016 in Pakistan, however, it was not consistent with findings by Makurumidze et al. 2017 [12,14,17].

The system was acceptable as indicated by most healthcare workers reporting willingness to continue participating. An acceptable surveillance system is more likely to remain in place. This finding though inconsistent with findings by Adomako et al. 2020 in Ghana [18] was consistent with findings by Asif et al. 2012 in Pakistan[19].

The healthcare workers indicated that the system was simple and they were able to fill in the TB data in less than ten minutes which is consistent with findings by Asif et 2012 [19]. A simple surveillance system entails that healthcare workers can use it with less difficulty, leading to faster completion of data entry and analysis thereby reducing the burden of overworked healthcare providers. However, key informants indicated that the system was not easy to operate due to complexities arising with a lot of steps including sample collection, testing, and final reporting. The key informants indicated the difficulties in operations were because the district had only one TB diagnostic centre and this affected the TB laboratory result turnaround time. A higher TB Laboratory result turnaround time contributes to prediagnosis leakages in the presumptive TB care cascade.

The data completeness was low as demonstrated by missing TB case numbers and patient gender. Data incompleteness has an impact on the ability to accurately monitor trends and make informed decisions about public health interventions and also an underestimation of the true burden of the disease and impedes the ability to plan and allocate resources effectively. This finding is similar to findings by Matambo et al 2016, Asif et al 2016, and Kwaghe et al in Nigeria [17,19,20] in Pakistan. However, this was not consistent with the findings by Makurumidze et al. 2017 and Alkalali et al. 2018 in Yemen [14,21].

Limitations

The responses were self-reported however we verified participant responses with records and key informant interviews. The study evaluated the surveillance system in an underperforming district we recommend a comparative study of an underperforming district and a well-performing district for detailed reasons for underperformance. The other attributes which included flexibility, sensitivity, positive predictive value and representativeness were not studied due to time and funding contraints.

Conclusion

The TB surveillance system was simple, acceptable, and stable. The surveillance system was found to be useful. Data quality was average as shown by average levels of completeness. Submission of TB quarterly reports was timely due to the availability of transport and cell phones in all health facilities. The TB surveillance system can be improved by conducting refresher training for health workers to improve data quality and completeness thereby allowing for accurate analysis which promotes effective interventions to be made. In addition, a shortage of TB laboratory request forms at some of the health facilities in the district could be reduced by improving the procurement and logistics management of TB request forms and TB specimen jars. Low TB case notification was due to prioritization of other competing programs, delayed laboratory TB results in turnaround time, Community TB risk communication, and education to reduce patient hesitancy to visit health facilities out of fear of contracting COVID-19.

The district had limited TB diagnostic capacity which contributed to the low TB notification because there was only one TB diagnostic centre manned by one microscopist serving all 16 health facilities.

Recommendations

We, therefore, recommended regular refresher training on the completion of TB missing data in the TB notification forms for easy case follow-up and a regular supply of TB surveillance material to health facilities to improve the surveillance system. In addition, we recommended, increasing the number of health cadres working at the TB detection centre to reduce the delayed Laboratory TB results turnaround time. Additional testing sites should be set up. In addition, we recommended intensified TB case finding, increased health education and promotion, TB risk, and TB awareness in the community to promote early presentation of TB cases to health facilities and to increase TB presumption and index of suspicion among health workers. We also recommended increased TB data monitoring and evaluation for the improvement of data quality management.

What is known about this topic

- TB surveillance depends on the laboratory detection of TB cases to inform TB programming such that low case detection negatively impacts TB patient management

What this study adds

- This study adds new information that delays in TB return of results reduce timely detections of TB cases, and TB contact tracing thereby causing leakages in the TB pre-treatment care cascade
- A decrease in TB notification is due to the hesitancy to visit healthcare facilities due to fear of contracting Covid 19

Competing interests

The authors declare no competing interests.

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Authors' contributions

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Tables and figures

Table 1: The demographic characteristics of healthcare workers in Bulilima District, Zimbabwe, 2020
Table 2: Knowledge of the TB notification surveillance system by healthcare workers in Bulilima District, Zimbabwe, 2020(n=91)
Table 3: TB Case notification surveillance system attributes for Bulilima District, Zimbabwe, 2020
Table 4: Reasons cited by key informants for low TB Case Notification in Bulilima District, Zimbabwe, 2020. (n=9)
Figure 1: Data Flow from Health Facility to National Level (showing reporting and feedback at all levels)

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Table 1: The demographic characteristics of healthcare workers in Bulilima District, Zimbabwe, 2020	
Variable	**Frequency n=91(%)**
Sex	
Female	49 (53.8)
Male	42 (46.2)
Health Cadres	
Registered General Nurse	44 (48.3)
State certified Nurse	25 (27.5)
Environmental Health Technician	12 (13.2)
Phamarcy Technicians	5 (5.5)
Microscopist	2 (2.2)
Health Information Clerk	2 (2.2)
Medical Doctor	1 (1.1)
Years in Service	
0-5	14 (15.4)
6-10	15 (16.5)
11-15	58 (63.7)
>15	4 (4.4)
Median years in service	14 (IQR10-14)

Table 2: Knowledge of the TB notification surveillance system by healthcare workers in Bulilima District, Zimbabwe, 2020 (n=91)	
Variable	**Frequency n (%)**
Knowledge	
Knew at least two TB detection methods	77 (84.6)
Knew the at least two objectives of the TB case nsurveillance system	77 (84.6)
Knew how to calculate TB case notification rate	7 (7.6)
Knew at least three signs and symptoms of TB	84 (92.3)
Knowledge rating	
Good	42 (46.2)
Fair	21 (23.1)
Poor	28 (30.7)
Simplicity	
Participants who indicated ease of operating the surveillance system	77 (84.6)
Participants who indicated that they fail to notify TB cases	46 (50.5)
Participants who indicated being able to fill the TB notification data in 10 minutes	67 (73.6)
Acceptability	
Participants who reported willingness to continue using the surveillance system	63 (69.2)
Participants who reported difficulties in reporting TB Data	61 (67.0)

Table 3: TB Case notification surveillance system attributes for Bulilima District, Zimbabwe, 2020		
Attribute	**Category**	**Frequency n (%)**
Simplicity (n=91)		
	Participants who indicated ease of operating the surveillance system	77 (84.6)
	Participants who indicated that they fail to notify TB cases	46 (50.5)
	Participants who indicated being able to fill the TB notification data in 10 minutes	67 (73.6)
	Participants who reported difficulties in reporting TB Data	61 (67.0)
Acceptability (n=91)		
	Participants who reported willingness to continue using the surveillance system	63 (69.2)
	Number of healthcare workers who participated in monthly analysis of data (Acceptability)	56 (61.5)
	Participants who used feedback information (acceptability and usefulness)	63 (69.2)
	Number of healthcare workers who were trained (simplicity and acceptability)	78 (85.7)
Stability n =16		n (%)
	Facilities with Secure storage of TB surveillance material	16 (100)
	Facilities with Facilities that experienced stock out in the previous six months	16 (100)
	Facilities with TB guidelines	16 (100)
	Facilities with TB surveillance tools	16 (100)
	Functional communication and transport services	16 (100)
	Number of facilities that conduct meetings to discuss the TB notification system (acceptability and usefulness)	10 (62.5)
	Number of facilities that shared information with stakeholders (acceptability and usefulness)	11 (68.8)
Usefulness		
	Participants who reported that the system is useful (n=91)	83 (91.2)
	Participants who used feedback information (acceptability and usefulness) n=91	63 (69.2)
	Number of facilities that received feedback from DHE (acceptability and usefulness) n=16	16 (100)
Data quality and completeness (n=15)		
	Number of positive TB forms with contact tracing forms (n=15)[data quality and completeness]	13 (86.7)
	Number of healthcare workers that submitted quarterly reports to the next reporting level (n=91)	63 (69%)
Timeliness		
	B cases were notified within 24 hours (n=15)	14 (93%)

Table 4: Reasons cited by key informants for low TB Case Notification in Bulilima District, Zimbabwe, 2020 (n=9)	
Reason	**Frequency**
Patient hesitancy to visit health facilities due to the effect of Covid-19	7
Staff shortages,	5
Prioritization of other competing programs leading to reduced time for contact tracing	6
Long TB laboratory turnaround times	9
Low health care TB index of suspicion in patients	3
District has only one TB detecton center	4

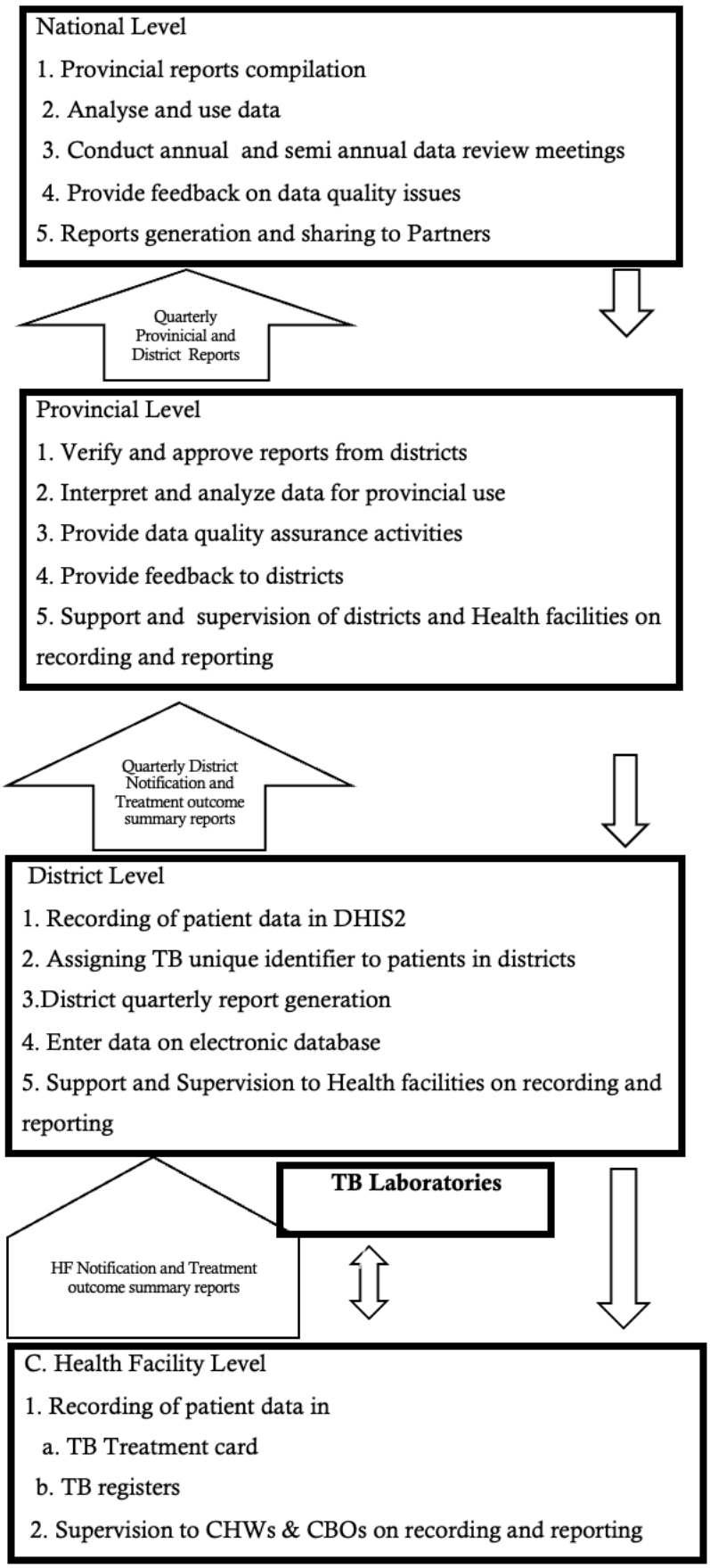

Figure 1: Data Flow from Health Facility to National Level (showing reporting and feedback at all levels)