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Qualitative Analysis of Factors Influencing the Use of DHIS2 for Tuberculosis Surveillance: A Case Study in Guinea

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Abstract

Tuberculosis (TB) is a major public health problem in Guinea, where many cases are undetected and untreated. A robust health information system is needed to improve TB case detection and treatment outcomes. DHIS2 (District Health Information Software 2) is a web-based system that collects, analyses and reports data on TB indicators. However, its use and use in Guinea is affected by various factors. We explored these factors using a qualitative survey with health workers and managers who use DHIS2 for TB surveillance. We collected data through a survey with open-ended questions and analysed them using classical content analysis. We conducted a qualitative survey with 35 health workers and managers who use DHIS2 for TB surveillance at different levels of the health system in Guinea. We collected data through an online survey with open-ended questions and analysed them using classical content analysis with NVivo software. We identified four main themes: technical issues (such as internet connection, data synchronisation, and validation rules), data quality issues (such as data validation, data aberrations, and data completeness), training and support issues (such as data analysis techniques, online training, orientation on DHIS2), and organisational issues (such as integration of community data, standardisation of data elements, meetings for data validation). We discussed how these findings could inform the improvement of DHIS2 for TB surveillance in Guinea and other similar settings.

Keywords*: DHIS2, Health information system, Surveillance, Tuberculosis, Qualitative study.*

Introduction

Tuberculosis (TB) is a serious infectious disease that affects the lungs and other organs. It is caused by Mycobacterium tuberculosis, which can spread through the air when a person with active TB coughs, sneezes or speaks [1]. According to the World Health Organization (WHO), TB is one of the top 10 causes of death worldwide and the leading cause of death from

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a single infectious agent [2]. In 2020, an estimated 10 million people fell ill with TB, and 1.4 million died from it. TB also poses a major economic and social burden, especially for low- and middle-income countries, where most of the TB cases and deaths occur [3].

Guinea is one of Africa's high TB burden countries, with an estimated incidence rate of 175 per 100,000 population and a mortality rate of 16 per 100,000 population in 2021 [4]. However, only about 69% of the estimated 26,000 new TB cases in Guinea were detected and notified in 2021, leaving a large gap of undiagnosed and untreated cases [5]. This gap poses a risk of further transmitting and developing drug-resistant TB, which is more difficult and costly to treat [6]. To close this gap and achieve the global target of ending the TB epidemic by 2030, a robust health information system must be needed to collect, analyse and report reliable and timely data on TB indicators. Such a system can help monitor the performance and impact of TB interventions, identify gaps and challenges, and inform evidence-based decision-making and policy formulation [6].

DHIS2 is a web-based health information system that supports data collection, analysis, and reporting for various health programs [7]. It was developed by the Health Information Systems Program (HISP) at the University of Oslo in Norway and has been implemented in more than 70 low- and middle-income countries since 2006 [8]. DHIS2 allows users to design data entry forms, dashboards, charts, maps, reports, and indicators according to their needs and preferences It also enables users to access and share data across different levels of the health system using mobile devices or offline applications. DHIS2 has been used for various health programs, such as maternal and child health, immunisation, HIV/AIDS, malaria, and TB [9].

In Guinea, DHIS2 was introduced in 2015 as part of the national health information system reform [10]. It replaced several parallel and vertical systems that were used for different health programs. DHIS2 is now used for routine health data collection, analysis, and reporting at all levels of the health system in Guinea. It covers various health programs, including TB surveillance. However, little is known about how DHIS2 is adopted and used for TB surveillance in Guinea. Previous studies have identified various factors that influence the implementation and use of DHIS2 in different settings. These factors include technical issues (such as internet connectivity, data synchronisation, and validation rules), data quality issues (such as data completeness, timeline and ss, consistency), training and support issues (such as data analysis skills, online training), organisational issues (such as data integration, standardisation, dissemination) [11-13]. However, these factors may vary depending on the specific context, program, and user group. Therefore, there is a need to explore the experiences, challenges, and recommendations of health workers and managers who use DHIS2 for TB surveillance in Guinea.

Materials and Methods

Study Framework and Design

This study aimed to explore the factors influencing the utilisation of DHIS2 for tuberculosis (TB) surveillance in Guinea, a low-income country in West Africa with a significant public health challenge of TB. We adopted a qualitative design, using classical content analysis to analyse data collected through an online survey with open-ended questions. The survey was conducted between June and July 2021 with health workers and managers involved in TB surveillance at different health system levels (district, regional, and central).

Population and Sampling

The study focused on the managers of the health district statistics services and the health service managers as well as the central level in

Guinea responsible for TB surveillance as the target population. We used purposive sampling to ensure a comprehensive representation of individuals across different regions and levels within the health system. Out of the expected 51 respondents, a total of 35 participants successfully completed the online survey, which represents a response rate of 68%.

Data Collection

We collected data through an online survey using Google Forms, which allowed secure and efficient data collection and storage. We sent the survey link to the participants via email and gave them two weeks to complete it. We also sent reminders via phone and email to enhance the response rate. The survey comprised ten open-ended questions that aimed to elicit participants' experiences, challenges, and recommendations related to DHIS2 for TB surveillance. The questions covered topics such as the participants' background and role in TB surveillance, their experiences and satisfaction with DHIS2, the challenges and benefits associated with its use, and their suggestions for improvement.

Ethical Considerations

We obtained ethical approval from the National Health Research Ethics Committee of Guinea before commencing the study. We also obtained informed consent from all participants before they participated in the online survey. We ensured confidentiality and privacy by collecting and storing data securely and using numerical codes instead of names to identify participants.

Data Analysis

We followed a classical content analysis approach for data analysis, which consisted of six steps [10]. First, we formulated the research question that guided our analysis: What are the difficulties and suggestions for using DHIS2 for TB surveillance in Guinea? Second, we chose texts as the units of analysis and individual responses as the units of coding. A response could contain more than one code if it addressed multiple themes or subthemes. Third, we developed a coding frame based on the main themes emerging from the text, including technical issues, data quality issues, training and support issues, and organisational issues. We also identified subcategories for each theme, reflecting specific problems and recommendations provided by respondents. We refined the coding frame iteratively as new codes emerged from the data. Fourth, we applied the codes to each response, incorporating both manifest and latent content. For example, responses like "La connexion internet" were coded as T1 (technical issue) and T1a (internet connection), while "Renforcer le suivi de la saisie et de validation" was coded as DQ1 (data quality issue) and DQ1b (data validation). We assigned the codes using descriptive labels in French or English, depending on the language of the response. Fifth, we calculated and tabulated the frequency and percentage of responses falling into each category and subcategory. We also used descriptive statistics to summarise the distribution of codes across different groups of respondents, such as health workers and managers, or primary and secondary levels of care. Sixth, we interpreted and presented the findings in a tabular format, along with illustrative quotes from the respondents. We discussed the results in relation to the research question, the literature review, and the implications for practice and policy.

Trustworthiness and Rigor

To ensure the trustworthiness and rigor of our data analysis, we implemented several strategies as recommended for data quality improvement in DHIS2 Guideline [14-15]. We assessed inter-coder reliability using Cohen's kappa coefficient [16], which resulted in a kappa value of 0.82, indicating substantial agreement between two independent coders who coded a subset of responses. We resolved any discrepancies through discussion and

consensus. We conducted member checking by sharing a summary of the findings with some participants for confirmation or correction. We received positive feedback from six participants who agreed with the findings and provided additional comments. We utilised NVivo software [17] to facilitate data management, coding, and analysis, which aided in organising, categorising, querying, visualising, and reporting data in a systematic manner.

Results

We conducted a survey and gathered responses from 35 health workers and managers engaged in TB surveillance in Guinea, all of whom utilized DHIS2 across different health system tiers (district, regional, and central). Among the participants, there were 23 district-level staff (58%), 7 regional-level staff (19%), 3 central-level staff (15%), and 2 participants whose roles were unspecified (8%). We identified four main themes through classical content analysis [14]: technical issues, data quality issues, training and support issues, and organisational issues. The following table (Table) presents a summary of the content analysis results:

Table 1. Content Analysis Result

Category	Subcategory	Code	Frequency
Technical issues	T1 Internet connection	7	13%
	T2 Data synchronisation	1	2%
	T3 Validation rules	2	4%
	T4 Data entry forms	2	4%
	T5 User accounts	2	4%
	T6 Network disruption	1	2%
Data quality issues	DQ1 Data validation	4	8%
	DQ2 Data aberrations	2	4%
	DQ3 Data completeness	2	4%
	DQ4 Data consistency	1	2%
	DQ5 Data timeliness	1	2%
Training and support issues	TS1 Data analysis techniques	1	2%
	TS2 Online training	2	4%
	TS3 Orientation on DHIS2	2	4%
Organisational issues	O1 Integration of community data (HIV prevention)	1	2%
	O2 Standardization of data elements across departments	1	2%
	O3 Meetings for data analysis and validation	1	2%
	O4 Bulletins for data dissemination	1	2%
	O5 Collaboration among different departments	1	2%

The analysis revealed that technical issues were the most prevalent challenge (29%) reported by the respondents when utilising DHIS2 for TB surveillance. It was followed by data quality issues (20%), training and support issues (10%), and organisational issues (10%). Respondents also provided recommendations for improving DHIS2, including enhancing data quality (20%), addressing technical issues (16%), providing training and support (10%), and fostering organisational collaboration (10%).

To provide a more comprehensive understanding of the results, we summarised the main points raised by the survey participants and provided some illustrative

quotes. The quotes were referenced using a numerical system, and the corresponding sources can be found in the reference list.

Participants' perspectives shed light on several technical issues that hinder the effective utilisation of DHIS2 for TB surveillance in Guinea. Internet connectivity emerged as a major concern, with some participants reporting slow and intermittent connections. They also encountered challenges related to data synchronisation, validation rules, and system bugs. To address these issues, participants suggested implementing an offline backup system, rectifying system errors, and improving data synchronisation processes. One participant highlighted, "The internet connection is very slow and occasionally disconnects" [Participant 1]. Another pointed out, "Some validation rules are not working or are too restrictive" [Participant 4], while yet another participant recommended, "It would be beneficial to have an offline backup system" [Participant 2].

Regarding data quality issues, participants expressed concerns about the accuracy, completeness, consistency, and timeliness of the data entered and reported in DHIS2. They also mentioned data aberrations, duplication, and incomparability as challenges impacting data quality. Participants offered recommendations, including rectifying data entry errors, updating data regularly, validating, and analysing data through meetings, and standardising data formats and definitions. One participant remarked, "There are errors in the data entry forms that need rectification" [Participant 6]. Another expressed, "Some data values are too high or too low compared to the expected range" [Participant 9], and yet another participant emphasised, "Regular meetings should be conducted to validate and analyse the data" [Participant 4].

In terms of training and support issues, some participants felt that they lacked sufficient training and support to effectively utilise DHIS2. They identified gaps in knowledge and skills related to data analysis, reporting, visualisation, and interpretation. To address these concerns, participants requested more online training sessions, tutorials, manuals, and technical assistance. One participant shared, "I am unfamiliar with data analysis and generating reports" [Participant 12]. Another participant mentioned, "I do not know how to use the dashboard or create charts and graphs" [Participant 13], while another highlighted the need for more online training, stating, "There should be more online training sessions and tutorials on DHIS2" [Participant 15].

Organisational issues also surfaced as important factors influencing the utilisation of DHIS2. Participants highlighted challenges related to data integration, standardisation, dissemination, and collaboration across different departments and levels of the health system. They stressed the importance of harmonising community data, aligning data elements, sharing data reports, and enhancing coordination among various stakeholders involved in TB surveillance. One participant pointed out, "The community data on HIV prevention is not integrated into DHIS2" [Participant 18]. Another mentioned, "There are different data elements used by different programs or partners that are not aligned or mapped to DHIS2" [Participant 19]. To address these challenges, participants called for enhanced coordination and communication among various stakeholders involved in TB surveillance, with one participant stating, "There should be enhanced coordination and communication among various stakeholders involved in TB surveillance" [Participant 21].

Discussion

The findings of this study highlight the diverse range of factors that influence the use of DHIS2 for TB surveillance in Guinea. Technical issues, such as internet connectivity, data synchronisation, validation rules, data entry forms, user accounts, and network disruptions, were identified as significant barriers that affect the usability and reliability

of DHIS2. These technical challenges align with previous research on DHIS2 implementation [8, 9, 18, 19] and indicate that the technological infrastructure plays a crucial role in the successful use of the system. To overcome these technical issues, it is essential to invest in improving internet connectivity and addressing system bugs and validation rules. Additionally, providing adequate technical support to users can enhance their experience and confidence in using DHIS2.

Data quality issues, including data validation, aberrations, completeness, consistency, and timeliness, emerged as important factors impacting the usefulness and trustworthiness of DHIS2 data. Similar findings have been reported in other studies [11, 20, 21] emphasising the importance of maintaining accurate and reliable data for effective surveillance and decision-making. Addressing data quality challenges requires implementing robust data validation mechanisms, regular monitoring and validation of data entries, and standardising data elements and definitions across different health programs. Improving data quality assurance processes will enhance the credibility of DHIS2 data and contribute to evidence-based decision-making.

Training and support issues were also identified as influencing the competence and satisfaction of users with DHIS2. This finding is consistent with the previous as mentioned in literature review [8] and underscores the significance of providing adequate training and support to users to maximise the system's potential.

Online training sessions, tutorials, and orientation on DHIS2 can equip users with the necessary skills and knowledge to navigate the system effectively. Additionally, personalised accounts and subsidising connection costs can motivate users to engage with DHIS2 and promote its use.

Organisational issues, such as integrating community data (HIV prevention), standardising data elements, holding data analysis and validation meetings, disseminating data through bulletins, and fostering collaboration among departments, were identified as critical for enhancing the efficiency and effectiveness of DHIS2. These organisational challenges echo findings from other studies [9, 12] and emphasise the need for a coordinated and integrated approach to health information systems. Integrating all relevant data sources, standardising data elements, and encouraging collaboration among stakeholders can streamline data collection and improve the overall functioning of DHIS2.

Comparing our findings with existing literature, we observed similarities in the factors influencing DHIS2 use and use across different settings. This highlights the generalizability of these challenges and the need for context-specific strategies to address them effectively. Nevertheless, our study brings forth distinctive perspectives, encompassing challenges particular to internet connectivity, as well as the pivotal role of assimilating community data into TB surveillance in Guinea.

Conclusion

To sum up, this research imparts significant perspectives into the determinants that impact the adoption and application of DHIS2 for TB surveillance in Guinea. Tackling technical challenges, upholding data accuracy, furnishing training and assistance, and nurturing organizational synergy stand as pivotal steps toward harnessing DHIS2's potential in TB surveillance.

Our discoveries extend the existing repository of health information systems literature and hold the potential to guide policymakers and stakeholders in Guinea, as well as other resource-constrained contexts, in enhancing the efficacy of DHIS2 for public health surveillance.

Limitations

The study's limitation lies in the relatively modest participant sample size due to its

exclusive focus on individuals within the tuberculosis framework. Expanding the scope to encompass the entire healthcare sector would have yielded a broader perspective, offering more comprehensive insights into the determinants that impact the global use of DHIS2 for disease surveillance in Guinea.

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The Authors' Contributions

Magassouba Aboubacar Sidiki, Touré Almamy Amara, Niouma Nestor Leno, Diallo Boubacar Djelo, Sylla Younoussa, Diallo Mamadou Diao, Camara Gnoume, Issiaga Mohamed CAMARA, Aly Badara Nabé, Adama Marie Bangoura and Camara Adama contributed to the conception, design, data collection, and analysis of the study. Magassouba Aboubacar Sidiki drafted the manuscript, and all authors critically reviewed and approved the final version.

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Availability of Data and Materials

The data collected and analysed during the current study are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

Ethical approval for this study was obtained from the National Health Research Ethics Committee of Guinea. All participants provided informed consent before participating in the survey.

Consent for Publication

Participants provided consent for the publication of anonymised data and quotes.

Interest Competitions

The authors declare no conflict of interest relating to this study.

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