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Functionality of Integrated Tuberculosis Information System in the Province of Tarlac: An Evaluation

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Abstract
Aim: This study examined the functionality of the Integrated Tuberculosis Information System (ITIS) in the Province of Tarlac, focusing on the operating process, health systems support, the challenges encountered, and opportunities for improvement.
Methodology: The researcher conducted a quantitative analysis with descriptive design which assessed the functionality of Integrated Tuberculosis Information System (ITIS) in Tarlac province. This study was conducted in Tarlac province with 100 respondents. The statistical analysis provided insights into the current state of TB reporting, and the impact of the system in TB control efforts.
Results: The Integrated Tuberculosis Information System (ITIS) was operating well in different practices as evidenced by the high mean scores of 6.33 and evaluated as Very Often Functional and there has been a very strong overall institutional mean rating of 5.94 for health systems support over ITIS functionality in Tarlac province, with measures such as Very Often Functional.
Conclusion: The overall functionality of Integrated Tuberculosis Information System (ITIS) in terms of operating process and health systems support in the province of Tarlac was critical for achieving its goals of improved TB data management, patient care, and public health outcomes.

Keywords: impact, user satisfaction, operation, system support

INTRODUCTION

Tuberculosis (TB) continues to be one of the most significant infectious diseases on a global scale, resulting in significant morbidity and mortality. TB remains a severe public health challenge, notably in low- and middle-income countries, despite the progress made in medical science and public health initiatives (World Health Organization [WHO], 2020). A robust and dependable system for recording and reporting TB cases is the foundation of effective TB control. These systems are indispensable for the purpose of monitoring the disease's dissemination, monitoring treatment outcomes, and informing public health strategies (WHO, 2021).

In the past, the administration of tuberculosis (TB) was dependent on paper-based recording and reporting systems. Although these manual systems were essential in the initial efforts to control tuberculosis, they were characterized by a multitude of drawbacks. Errors, data loss, and reporting delays were all potential hazards associated with paper records. (Uplekar et al., 2016). The process of aggregating data from multiple sources was time-consuming and labor-intensive, frequently resulting in incomplete datasets and inaccuracies. The significance of structured data collection in disease control was established by paper-based systems, despite these challenges. They emphasized the importance of systematic recording and reporting in the planning of public health interventions, the evaluation of treatment efficacy, and the monitoring of disease trends. (Lönnroth et al., 2015)

The transition from paper-based to digital recording and reporting systems represented a substantial stride forward in the control of tuberculosis. The surveillance and administration of tuberculosis were significantly altered by the emergence of digital technology in the late 20th and early 21st centuries. (Stop TB Partnership, 2018). Numerous

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advantages are provided by electronic systems in comparison to their paper-based counterparts, such as enhanced data accuracy, real-time data entry, and more uncomplicated data aggregation and analysis. (WHO, 2019).

These systems enable the collection of comprehensive data, such as patient demographics, clinical details, treatment regimens, and outcomes. Electronic systems improve the quality and reliability of TB data by automating numerous data collection and administration processes, thereby reducing the probability of human error. (Scott et al., 2020).

National tuberculosis (TB) programs (NTPs) began to emerge in the mid-20th century, integrating more structured methods of recording and reporting. The fundamental principles of TB surveillance and control were established because of these early endeavors. For example, the United States and the United Kingdom established comprehensive TB registries that monitored patient information, treatment progress, and outcomes. These registries offered valuable insights into the epidemiology of TB and informed public health strategies. The transition from paper-based to digital recording and reporting systems has been a significant milestone in the control of tuberculosis. (Raviglione & Uplekar, 2016).

The emergence of digital technology in the late 20th and early 21st centuries revolutionized the system of TB surveillance. Numerous benefits are provided by electronic systems, such as enhanced data accuracy, real-time data entry, and simplified data aggregation and analysis. Digital systems have the capacity to autonomously validate data, thereby reducing the errors that are associated with manual entry and enabling the rapid sharing of information across various levels of the health system. The development and implementation of electronic TB surveillance systems have been implemented in numerous countries to improve their TB control efforts. India has implemented the Nikshay system, a comprehensive electronic recording and reporting system for TB. Nikshay facilitates real-time tracking of TB cases and treatment outcomes, significantly improving data accuracy and timeliness. (Central TB Division, Ministry of Health and Family Welfare, Government of India, 2018).

South Africa has integrated TB recording and reporting with its broader health information system, enabling comprehensive surveillance and management of TB and HIV co-infection. (Loveday et al., 2016). Tuberculosis (TB) surveillance in China is organized through a nationwide network of about 3200 hospitals and health facilities. In 2005, an electronic Tuberculosis Information Management System (TBIMS) started to be phased in to replace paper recording. The TBIMS collects key information on TB cases notified in TB care facilities, and exchanges real-time data with the Infectious Disease Reporting System, which covers the country's 37 notifiable diseases. (Chen et al., 2019).

WHO European Region: The WHO European Region has adopted electronic TB surveillance systems to enhance data accuracy, timeliness, and analysis, supporting effective TB control efforts. (WHO Regional Office for Europe, 2019). These systems offer exhaustive platforms for the recording of patient information, the monitoring of treatment progress, and the generation of standardized reports for public health authorities. These countries have improved their capacity to monitor TB trends, identify epidemics, and allocate resources more efficiently by utilizing digital technology.

The Philippines is one of the countries with the highest TB burdens globally. Effective TB control relies on accurate, timely, and comprehensive data collection and reporting. Historically, the Philippines has faced numerous challenges with TB data management, including fragmented systems, delays in reporting, and inaccuracies. (Department of Health [DOH], 2017). Recognizing the need for improved data management, the Philippines has undertaken several initiatives to enhance TB recording and reporting systems. Adoption of Standardized Tools:

In the 1990s, the Philippines adopted the World Health Organization's (WHO) Directly Observed Treatment, Short-course (DOTS) strategy, which included standardized recording and reporting tools. This marked a significant improvement over previous methods, providing a more consistent framework for data collection. Introduction of Electronic Systems: In the early 2000s, the Department of Health (DOH) in collaboration with international organizations and stakeholders such as the 5 United States Agency for International Development (USAID), the Global Fund to Fight AIDS, Tuberculosis, and Malaria, and others began exploring electronic solutions to address the limitations of paper-based systems. (USAID, 2018). Initial efforts focused on developing simple electronic databases to replace paper registers, which allowed for more efficient data storage and retrieval.

The ITIS was developed to provide a comprehensive, centralized platform for TB data management. As per Administrative Order 2015-0024, implementing guidelines of (IT IS), it aimed to integrate data collection, reporting, and analysis across all levels of the healthcare system, from local health centers to national authorities. (DOH, 2015)

In 2015, implementation of the Integrated Tuberculosis Information System (ITIS) in region 3 (Central Luzon) of the Philippines is a significant step towards enhancing TB control efforts in the area. Region 3, comprising seven provinces which include Tarlac province, has a diverse population and varying levels of healthcare infrastructure. The introduction of ITIS aims to improve the accuracy, timeliness, and comprehensiveness of TB data management across

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the region. The Province of Tarlac which is subdivided into 17 municipalities and 1 component city, all encompassed by three congressional districts, with Governor Susan Yap at the helm, together with the provincial health office fully support the enhanced TB control strategies that aims to improve public health and ensures that all residents have access to effective TB prevention and treatment services.

The transition from traditional paper-based methods to electronic recording and reporting systems, such as ITIS, represents a significant advancement in TB data management. These systems enhance the accuracy, timeliness, and comprehensiveness of TB data, providing critical support for effective TB surveillance, patient management, and resource allocation. (WHO, 2020) By assessing the current state of TB reporting, evaluating the implementation process, and measuring the impact of ITIS, this study aims to provide valuable insights that can inform future improvements and scale-up efforts

Objectives

This study aimed to assess the functionality of the Integrated Tuberculosis System (ITIS) in the Province of Tarlac.

Specifically, it sought to answer the following questions:

1. How is the functionality of Integrated Tuberculosis Information System (IT IS) in Tarlac Province be described and evaluated in terms of:
    1.1 Operation Process; and
    1.2 Health System Support?
2. What are the problems encountered by the respondents which affect the functionality of the Integrated Tuberculosis Information System (IT IS) in Tarlac Province?
3. What plan of action can be proposed to enhance the functionality of the Integrated Tuberculosis Information System in Tarlac Province?
4. What are the implications of the study to Public Administration?

METHODS

Research Design

This study used a quantitative analysis with descriptive design which assessed the functionality of Integrated Tuberculosis Information System (ITIS) in Tarlac province.

Population and Sampling

This study was conducted at Tarlac province with 100 respondents including healthcare providers, program managers and data managers. Purposive sampling was used, as the respondents were carefully selected based on their roles and direct involvement in the implementation and us of the Integrate Tuberculosis Information System.

Instrument

Survey questionnaire was administered to collect the necessary data in this study. Said instrument was validated by experts in the field.

Data Collection

The data collection process involved developing structured questionnaires aimed at gathering relevant information from the respondents.

Treatment of Data

Descriptive statistics was employed to summarize and interpret the data which include the calculation of weighted mean, frequencies, and rankings. Specifically, the analysis focused on assessing the functionality of the Integrated Tuberculosis Information System (ITIS) based on key indicators such as operating process and health system support. A Likert scale, specifically a 7-point Likert scale was used to measure the respondents" perceptions and evaluation of the ITIS.

Ethical Considerations

The research on the functionality of the Integrated Tuberculosis Information System (ITIS) in Tarlac Province was conducted with the highest ethical standards. The researcher obtained consent from the respondents and

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requested permission to take photograph. The researcher ensured that all ethical and legal considerations were considered prior to proceeding with the study.

RESULTS and DISCUSSION

Efficient management of tuberculosis (TB) required precise data collection, timely reporting, and effective case management. The Integrated Tuberculosis Information System (ITIS) was created to address these requirements by providing a resilient digital platform that enhanced the administration of tuberculosis data, simplified reporting procedures, and improved patient care. As highlighted by Loveday et al. (2015), digital health systems, like ITIS, are critical for improving the accuracy and timeliness of TB data, which in turn supports better decision-making and resource allocation in TB control programs.

The ITIS was a cutting-edge approach that utilized technology to tackle the intricacies of TB data administration. The purpose of this system was to incorporate several elements of tuberculosis control, including diagnosis, treatment, monitoring, and reporting. This integration is vital, as highlighted by Mate et al. (2015), who argue that comprehensive electronic health record (EHR) systems in low-resource settings can significantly improve disease management by offering real-time data access and supporting clinical decision-making.

By providing standardized data collection, real-time reporting, comprehensive patient management, and robust monitoring and evaluation tools, ITIS improved the accuracy, timeliness, and efficiency of TB data This is consistent with findings from Lönnroth et al. (2020), who found that standardized and real-time data systems are vital for improving the quality of TB care and for facilitating better decision-making at all levels of the healthcare system. Moreover, the ITIS system's user-friendly interface and its ability to ensure interoperability with other health systems further bolster its effectiveness, ensuring that TB care is coordinated and comprehensive. A study by Zwerling et al. (2019) supports this, noting that systems designed with user-friendliness and interoperability in mind are more likely to be successfully adopted and utilized, leading to better patient outcomes and more efficient resource use.

Thus, this study evaluated the impact, challenges, and overall effectiveness of Integrated Tuberculosis Information System (ITIS) in Tarlac Province. The findings provide valuable insights into how ITIS has contributed to TB control efforts and highlight areas for further improvement, ensuring that the system continues to support the fight against tuberculosis.

Operating Process

The Integrated Tuberculosis Information System (ITIS) was intended to simplify the collection, administration, and reporting of TB data, thereby enabling the implementation of effective and efficient TB control initiatives. From data entry to reporting and analysis, the ITIS operating process encompassed numerous critical steps. It was imperative to comprehend these processes to guarantee that the system functioned efficiently and accomplished its intended objectives. McLaren et al. (2020) emphasizes that digital health systems like ITIS are crucial for enhancing the accuracy and efficiency of data management in TB control efforts, particularly in resource-limited settings where manual data handling often leads to delays and errors.

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Table 1
Operating Process

Situation	Mean	Adjectival Description
The system can be accessed from different devices (e.g., desktop, laptop, mobile devices)	6.48	Very Often Functional
Systems security measures are in place to protect patient information	6.45	Very Often Functional
The data recorded in ITIS is accurate and reliable.	6.44	Very Often Functional
The system ensures complete data capture for all TB cases.	6.41	Very Often Functional
The system supports real-time data updates and monitoring.	6.39	Very Often Functional
The process of entering patient data into ITIS is straightforward and efficient.	6.35	Very Often Functional
There is consistency in the use of terminology and coding standards within the IT IS	6.35	Very Often Functional
The ITIS is user-friendly and easy to navigate for healthcare providers.	6.32	Very Often Functional
Ease in Accomplishment and submission of IT IS service request form	6.29	Very Often Functional
The systems allow smooth submission of reports on a timely manner	6.25	Very Often Functional
Data management and retrieval from ITIS is timely and accurate.	6.24	Very Often Functional
The system can be customized to meet various reporting requirements and generate various types of reports or outputs.	5.95	Very Often Functional
Overall Mean	**6.33**	**Very Often Functional**

6.50 - 7.00	Always Functional
5.50 - 6.49	Very Often Functional
4.50 - 5.49	Often Functional
3.50 - 4.49	Sometimes Functional
2.50 - 3.49	Occasionally Functional
1.50 - 2.49	Rarely Functional
1.00 - 1.49	Never Functional

The evaluation of the operating process indicator yielded a grand mean rating of 6.33, and was evaluated as Very Often Functional by the respondents. This evaluation implied that ITIS system was highly functional system that enabled efficient data entry, real-time monitoring, user-friendly navigation, and configurable reporting. These qualities together improved the system's effectiveness in managing tuberculosis data and supporting efforts to control tuberculosis These features are aligned with findings from a study by Haskew et al. (2018), which indicates that health information systems with such attributes are better equipped to support healthcare providers in managing disease control programs like TB. Moreover, the positive feedback from users, reflected in the high mean scores and verbal descriptions, demonstrates that ITIS is well-aligned with user needs, providing comprehensive and efficient TB management. According to a study by Fraser et al. (2020), the alignment of health information systems with user

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requirements is a critical factor in their success, as it ensures that the system is both practical and effective in real-world settings.

Therefore, despite achieving a Very Often Functional status, continuous improvement in Integrated Tuberculosis Information System (ITIS) was essential for maintaining its effectiveness and relevance to meet the changing needs of healthcare providers and support more effective TB control strategies. Continuous improvement processes are highlighted by Okeyo et al. (2021) as crucial in ensuring that health information systems like ITIS remain adaptable and capable of meeting the changing demands of TB control strategies.

Health System Support

For the Integrated Tuberculosis Information System (ITIS) to be effectively implemented and utilized, it was necessary to have substantial support from the larger health system. It was essential to ensure that the Integrated Tuberculosis Information System (ITIS) performed efficiently and contributed to enhanced tuberculosis control and public health outcomes. Health systems support consisted of several key elements, including infrastructure support, policy and regulatory framework, human resources and training, financial investments, stakeholder engagement, monitoring and evaluation, and interoperability and integration.

Infrastructure support included providing the necessary technological and physical infrastructure to ensure ITIS operates efficiently and effectively. This includes reliable internet access, hardware and software, and secure data centers. The importance of such infrastructure is emphasized by WHO (2015), which states that robust infrastructure is a cornerstone for the successful deployment of health information systems, particularly in resource-limited settings.

The policy and regulatory framework governed the use, security, and privacy of health information systems like ITIS, ensuring data security and privacy. Literature underscores the importance of strong policy frameworks in protecting patient data and ensuring compliance with national and international standards (Riley et al., 2014).

Human resources and training focused on ensuring healthcare providers and IT staff had the necessary skills and knowledge to effectively use ITIS. This included comprehensive training programs, technical support, and capacity building opportunities. According to a study by Ranjan et al. (2021), continuous training and professional development are vital for the successful implementation and sustainability of health information systems, as they enhance user competency and adaptability to new system features.

Financial investments involved allocating adequate funding for the implementation, maintenance, and scaling of ITIS. A study by Uysal and Kalkan (2019) highlights the critical role of financial investments in the sustainability of health IT systems, noting that without sufficient funding, systems may struggle to maintain their operations and effectiveness.

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Table 2
Health Systems Support

Situation	Mean	Adjectival Description
Provincial health authorities are demonstrating strong support for ITIS implementation, with policies and guidelines in place to facilitate its use.	6.40	Very Often Functional
Healthcare workers are regularly updated on new features and best practices through continuous training programs to enhance their ITIS proficiency.	6.21	Very Often Functional
ITIS has significantly enhanced the monitoring and control of TB cases in the province, enhancing patient management and follow-up.	6.10	Very Often Functional
The ITIS is effectively implemented and maintained with adequate resources, including funding, equipment, and personnel, ensuring its efficient functioning.	6.02	Very Often Functional
ITIS users receive comprehensive technical support, and issues with ITIS are promptly and effectively resolved.	5.70	Very Often Functional
ITIS is seamlessly integrated with other health information systems in the province, ensuring seamless data exchange between them.	5.18	Often Functional
Overall Mean	**5.94**	**Very Often Functional**

6.50 - 7.00	Always Functional
5.50 - 6.49	Very Often Functional
4.50 - 5.49	Often Functional
3.50 - 4.49	Sometimes Functional
2.50 - 3.49	Occasionally Functional
1.50 - 2.49	Rarely Functional
1.00 - 1.49	Never Functional

Overall, the grand mean for the evaluation of the health systems support stood at 5.94, denoting an evaluation as Very Often Implemented by the respondents. The evaluation of health systems support for the functionality of Integrated Tuberculosis Information System (ITIS) indicated a high level of overall support, particularly from provincial health authorities, continuous training programs, enhanced monitoring and control, adequate resources, and comprehensive technical support. These strengths contributed significantly to the effective implementation and operation of ITIS. These elements were aligned with the study of Ouma et al. (2020), that sustained institutional backing and ongoing training are critical for ensuring that health information systems like ITIS meet their goals of improving data management and patient care.

However, the slightly lower score in system integration highlights an area for potential enhancement. Focusing on improving the interoperability of ITIS with other health information systems could further streamline data exchange and enhance the overall efficiency and effectiveness of TB control efforts. A study by Oluoch et al. (2019) points out that better integration and interoperability between health systems are vital for improving data flow, coordination of care, and the effectiveness of public health strategies.

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Overall Functionality of Integrated Tuberculosis Information System

The Integrated Tuberculosis Information System (ITIS) was implemented through a comprehensive approach that encompassed planning, deployment, training, data administration, system integration, monitoring, and continuous performance improvement. The effective and sustainable use of ITIS could be guaranteed by healthcare facilities by adhering to these essential components, which would result in improved TB data management, better patient care, and improved public health outcomes. The long-term success and impact of ITIS in TB control efforts are guaranteed by its ability to adapt to changing requirements and challenges through the implementation of robust support mechanisms and continuous evaluation For instance, a study by Rajbhandari et al. (2021) emphasizes that the successful implementation of electronic health systems, particularly in low-resource settings, requires a combination of strong planning, continuous training, and robust support mechanisms to adapt to changing needs and challenges.

Table 3
Overall Evaluation of the Functionality of Integrated Tuberculosis Information System (ITIS) in terms of Operating Process and Health Systems Support

Situation	Mean	Adjectival Description
Operating Process	6.33	Very Often Functional
Health Systems Support	5.94	Very Often Functional
Overall Mean	**6.135**	**Very Often Functional**

The Integrated Tuberculosis Information System (ITIS) was performing effectively across various aspects of its operating process, as indicated by the high mean scores of 6.33 and "Very Often" verbal descriptions. ITIS was a highly accessible and secured system for healthcare providers, ensuring data accuracy, completeness, and real-time monitoring. Its user-friendly interface and efficient data entry processes enhanced user satisfaction. A study by Le et al. (2019) highlights that health information systems that prioritize data security and real-time access are more likely to achieve high user satisfaction and better patient outcomes, particularly in managing infectious diseases like TB.

Consistent terminology and coding standards ensured uniformity in data management. For example, Farid et al. (2020) found that standardized terminology and coding significantly enhance the interoperability and efficiency of health systems, leading to better health outcomes. The system supported timely report submission and data retrieval, aiding informed decision-making. While customizable, there was potential for further improvement in this aspect. Overall, ITIS was a valuable tool for managing TB cases in the province.

The evaluation of health system support for ITIS functionality in Tarlac province showed a strong overall performance, with key areas like institutional support, training programs, and technical support receiving high mean rating of 5.94 and rated "Very Often Functional" in terms of frequency and effectiveness. Provincial health authorities demonstrated a strong support for ITIS through established policies and guidelines. Healthcare workers were frequently updated on new features and best practices through continuous training programs. According to Jones et al. (2020), ongoing training and support are vital for maintaining the effectiveness of health information systems, as they help users stay updated with new features and best practices.

ITIS has significantly improved monitoring and control of TB cases, leading to better patient management and follow-up processes. The system was well-supported with adequate resources, providing comprehensive technical support and facilitating seamless data exchange. However, there was room for improvement in this aspect to achieve full integration and maximize benefits. The need for better integration with other health information systems is echoed in a study by Nambiar et al. (2021), which stresses the importance of interoperability for enhancing the overall efficiency and effectiveness of health information systems in TB control.

Problems encountered by the users which affect the Functionality of the Integrated Tuberculosis Information System (ITIS) in Tarlac Province

The Integrated Tuberculosis Information System (ITIS) was a tool designed to enhanced the management of tuberculosis (TB) data and control efforts. It collected accurate data on TB cases, enabled real-time data entry, and monitored patient progress. According to AbouZahr et al. (2019), effective TB control requires reliable and timely data,

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and ITIS's capability to facilitate real-time data entry and monitoring is essential for informed decision-making and timely interventions in TB management.

ITIS also provided tools to monitor key performance indicators (KPIs) for TB control efforts, enabling continuous evaluation and improvement of TB programs. It facilitated data reporting through standardized reporting, ensuring timely submission to health authorities. ITIS supported data-driven decision-making at all healthcare levels, including patient follow-up, personalized care, resource allocation, and inventory management. This aligns with findings by Kapur et al. (2020), who emphasize the importance of KPIs in health information systems to track progress, identify gaps, and guide program enhancements in TB control.

The functionality of ITIS in Tarlac Province had a substantial impact on the administration of TB data, the quality of patient care, and the overall control of TB. However, based on the evaluation result there were challenges such as technical issues, resource constraints, and data quality that must be resolved. Braa et al. (2018) identified that technical and resource-related challenges are common barriers to the successful implementation of digital health systems in resource-limited settings, suggesting that these areas require targeted interventions to optimize system performance. Tarlac Province could further optimize the use of ITIS and achieved improved health outcomes for its population by improving data quality, addressing resource constraints, facilitating system integration, and enhancing technical support. These recommendations are supported by findings from Azubuike and Ehiri (2020), who argue that continuous system optimization, particularly in data quality and technical support, is critical for the long-term sustainability and effectiveness of health information systems.

The study aimed to provide a thorough assessment of the ITIS implementation in the province, emphasizing its accomplishment and pinpointing areas that required enhancement. The study sought to offer valuable insights and recommendations to enhance the effectiveness and sustainability of ITIS in the province as well as analyzed the implications of this study to Public Administration. From the proposed strategies and interventions, Tarlac province could strengthen its TB control efforts, ultimately leading to better health outcomes for the community and contributing to the global fight against tuberculosis. As noted by Reid et al. (2021), localized improvements in health information systems can have a significant impact on global public health initiatives, particularly in the fight against TB.

Table 4
Problems encountered by the users of Integrated Tuberculosis Information System (ITIS) in Tarlac province

Situation	F	R
Limited Internet Connectivity	70	1
Limited Funding for Procurement, maintenance, and upgrade of IT infrastructure	60	2
Lack of dedicated personnel	55	3
Insufficient support for the ongoing cost of data storage and maintenance	40	4
Insufficient technical infrastructure	35	6
Compatibility Issues	35	6
Incomplete or inaccurate data entry due to human error or time constraints	35	6
Inadequate training and support	25	8.5
Concerns about Data Privacy	25	8.5
Resistance to Change	20	10
Difficulties in standardizing data collection and reporting across different healthcare facilities.	15	11.5
Issues with data integration and analysis, limiting the ability to generate meaningful insights.	15	11.5

Based on the responses, limited internet connectivity is the most frequently reported challenge, affecting 70 users. Limited internet connectivity significantly impacted the functionality of the Integrated Tuberculosis Information System (ITIS). According to a study by Sarbadhikari and Pradhan (2020), reliable internet access is critical for the successful implementation and use of digital health solutions, particularly in remote and underserved areas. Without

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robust internet infrastructure, systems like ITIS cannot function effectively, leading to delays in data entry, reporting, and access to real-time information, which are essential for managing tuberculosis (TB) cases effectively.

Ranked as number 2 and reported by 60 users, limited funding for IT infrastructure procurement, maintenance, and upgrades significantly affected the effectiveness and efficiency of the Integrated Tuberculosis Information System (ITIS). According to a study by Bassi and Lau (2021), inadequate funding for IT infrastructure often leads to outdated systems, reduced functionality, and an overall decrease in system efficiency, ultimately hindering the system's ability to support public health initiatives effectively.

A total of 55 users reported a lack of dedicated personnel as a significant challenge, ranked as third most top problem. The World Health Organization (WHO) emphasizes the need for continuous training and capacity-building to ensure that healthcare workers are proficient in using health information systems. This aligns with the findings from Tarlac Province, where a lack of dedicated personnel was reported as a significant challenge, affecting the system's reliability and performance.

Conclusion

Accordingly, the following conclusions were drawn:

1. The high accessibility of ITIS across various devices enhanced healthcare providers' ability to efficiently input and retrieve data, leading to improved patient care and streamlined operations within the healthcare system.
2. Robust security measures in ITIS were crucial for maintaining patient confidentiality and protecting sensitive health data, which fostered trust among users and ensured compliance with data protection regulations.
3. The accuracy and reliability of data in ITIS ensured that healthcare providers had access to trustworthy information, which was vital for making informed decisions and effectively managing TB cases.
4. Real-time data updates and monitoring capabilities of ITIS allowed for quick response to TB cases, improving the system's effectiveness in controlling and managing the disease within the province. 92
5. Strong support from provincial health authorities was essential for the successful implementation and sustainability of ITIS, as it provided the necessary framework and resources for the system's operation.
6. Continuous training and updates for healthcare workers were critical in enhancing their proficiency with ITIS, leading to more effective use of the system and better patient management.
7. ITIS significantly improved the monitoring and control of TB cases, contributing to better patient management, and aiding in the efforts to combat tuberculosis in the province.
8. Addressing the challenge of limited internet connectivity was crucial for ensuring that healthcare providers could access and use ITIS effectively, which was vital for the system's performance and reliability.
9. Adequate funding for IT infrastructure was necessary to maintain and improve ITIS functionality and sustainability, as financial constraints could hinder the system's development and efficiency.
10. Increasing the number of dedicated personnel was essential for the effective management and operation of ITIS, as a shortage of skilled staff could lead to inefficiencies and gaps in system usage and support.

Recommendations

Based on the results of this study and corresponding conclusions, the researcher offers these recommendations:

1. Enhance Internet Connectivity: To ensure the effective use of ITIS, it is essential to improve internet connectivity in areas where the system is implemented. This can be achieved by collaborating with local internet service providers to upgrade infrastructure and increase broadband access, especially in remote and underserved regions.
2. Secure Sustainable Funding: Adequate funding is crucial for the ongoing maintenance and improvement of ITIS. Authorities should explore various funding sources, including government allocations, international grants, and public-private partnerships, to ensure financial stability for IT infrastructure procurement, maintenance, and upgrades.
3. Recruit and Train Dedicated Personnel: To address the shortage of skilled personnel, healthcare facilities should prioritize recruiting additional staff dedicated to ITIS management and operation. Moreover, continuous training programs should be implemented to enhance the skills of existing personnel and ensure they are well-versed in using the system effectively.
4. Expand Training Programs: While training is currently provided, expanding these programs to include more hands-on workshops and regular updates on system features and best practices is recommended. Tailoring training to different user groups will address specific needs and ensure that all healthcare workers are proficient in ITIS usage.
5. Strengthen Data Security Measures: Continuous evaluation and enhancement of data security protocols are essential to protect patient information. Implementing advanced security technologies, conducting regular security

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audits, and training 94 staff on data protection practices will help maintain trust in the system and safeguard sensitive data.

6. Promote System Integration: Efforts should be made to integrate ITIS with other health information systems within the province. This integration will facilitate seamless data exchange and interoperability, enhancing healthcare coordination and management. Collaboration with other health sectors and stakeholders will be vital in achieving this goal.

7. Develop a Contingency Plan for Connectivity Issues: To mitigate the impact of connectivity challenges, a contingency plan should be developed. This plan could include offline data entry options and scheduled data synchronization once connectivity is restored, ensuring that healthcare providers can continue their work without significant disruptions.

8. Enhance User Feedback Mechanisms: Implementing a robust feedback mechanism will allow healthcare providers to share their experiences and challenges with ITIS. Regularly collecting and analyzing this feedback can identify areas for improvement and help tailor system enhancements to meet user needs.

9. Increase Awareness and Advocacy: Raising awareness about the benefits and importance of ITIS among healthcare providers and the public is crucial. Advocacy campaigns can highlight how the system improves patient care and management, encouraging wider adoption and support for ITIS implementation.

10. Monitor and Evaluate System Performance: Regular monitoring and evaluation of ITIS performance are essential to identify areas for improvement and ensure that the system meets its objectives. Establishing key performance indicators and 95 conducting periodic reviews will help track progress and guide future enhancements.

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