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Requirements Analysis of Tuberculosis Screening Information System Using PIECES Framework

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ABSTRACT

Tuberculosis (TB) remains a global health threat, especially in low and middle income countries, including Indonesia. In Indonesia, there is a surge in TB cases due to the lack of detection and treatment of TB that does not reach the target. To achieve TB elimination by 2030 in accordance with the global target, Indonesia must reach the target of finding cases at least 90% of estimated cases. TB case finding through the screening activities is the first step of TB control to reduce morbidity and mortality. This study aims to analyze the requirements of the TB screening information system. The analysis was conducted based on the PIECES Framework as a method of analysis as a basis for obtaining more specific issues. The results of the analysis resulted in the need for an information system that can be accessed by the Health Office, Health Center, and the community with several requirements including providing a menu of counseling schedules and consultation messages, adding data on educational materials, producing an information dashboard, a system equipped with a database for storage and a password for security, and producing accurate and real time information for the requirements of prevention and intervention efforts

INTRODUCTION

Tuberculosis (TB) remains a global health threat, especially in low and middle income countries. According to the World Health Organization (WHO), TB is one of the top 10 diseases causing death in the world, with an estimated 10 million people infected with TB and 1.5 million of them dying from the disease each year. The health burden of TB is particularly high in Africa and Southeast Asia, where resources for prevention, diagnosis, and treatment are limited (WHO 2023b).

Indonesia has a big problem in dealing with TB disease that develops in the community. Based on data from the Ministry of Health of the Republic of Indonesia in 2023, there has been an increasing trend in TB cases compared to previous years. In 2020, 824,000 TB cases were recorded and then rose to 969,000 cases the following year. Meanwhile, in 2023 TB cases reached around 1,060,000 cases (WHO 2023a). This is the highest number so far.

The increase in cases can occur due to the lack of detection and treatment of TB that does not reach the target. To achieve TB elimination by 2030 in accordance with global targets, Indonesia must reach the target of finding cases at least 90% of the estimated cases. Then of the treated patients must be able to recover or complete treatment (success rate) at least 90% (Kemenkes 2020). TB disease can affect various age groups, including those of productive age. Thus, its potential negative impact on the quality of human resources is a serious concern, especially in areas with high rates of TB cases (Novita et al. 2020). The impact of TB is not only limited to the individual level, but also involves a broad impact on the welfare of society as a whole (Ulfa and Mardiana 2021). Thus, community support and cooperation is needed in TB prevention so that cases do not grow.

Based on the TB 06 form, a person who shows symptoms of coughing for more than 2 weeks accompanied by body heat is called a TB suspect. TB suspects who receive services according to standards with the establishment of a diagnosis of TB will go through bacteriological and clinical examinations, perform other supporting examinations or be referred

to advanced referral health care facilities and undergo treatment according to TB standards.

TB case finding through TB screening activities is the first step of TB control activities. This activity can reduce morbidity and mortality from TB (Marhamah et al. 2022). The TB case finding rate is related to the TB suspect screening rate. The higher the TB suspect screening rate, the greater the expected number of positive TB cases found. However, obstacles that can arise during this activity include lack of motivation for the community to participate, limited access (transportation and time) for the community to go to the screening site, lack of socialization and invitations are too sudden, and the role of cadres/community is not optimal in mobilizing screening targets (Kemenkes 2023)

Efforts can be made through community outreach to raise awareness about TB disease, understanding of its symptoms, and the importance of seeking medical care if symptoms arise. These outreach programs also help dispel myths and reduce the stigma associated with TB disease (Datiko, Jerene, and Suarez 2020) which can encourage people to seek diagnosis and treatment, thereby helping to accelerate the elimination and eradication of this contagious TB disease (WHO 2023b). However, Indriyani's research shows that the existence of counseling through promotional media does not guarantee that counseling activities will run well, lack of human resources and lack of optimal cooperation can hinder the TB elimination program (Indriyani, Yanthi, and Sando 2021).

World Tuberculosis Day, which is celebrated annually on March 24, aims to increase public awareness and play a role in efforts to overcome TB disease. In line with this goal, the development of an information technology based TB screening information system is an interesting idea to be realized in preventing TB transmission (WHO 2023b). Screening and early detection programs, especially for high-risk populations, are essential for achieving good and effective treatment and achieving good public health.

The obstacles and barriers in TB screening activities that have emerged so far are a strong reason

for the development of a TB screening information system. This system can be utilized by the community at large and can be accessed anywhere and anytime. In addition, the community can conduct early detection of TB to determine their health status. The existence of this system can be an alternative in maintaining the confidentiality of one's health status so as not to create a negative stigma that usually develops in the community, because only system users and health workers are able to access the data.

In addition, public awareness of the importance of screening for TB and its associated symptoms is often low. Most people may not seek medical care until TB symptoms become severe, leading to delays in diagnosis and appropriate treatment (Kemenkes 2023). This screening information system is equipped with TB-related information that can be accessed and read through the developed system.

The initial step of developing this system is to analyze system requirements. The analysis used is the PIECES Framework. This study aims to analyze the requirements of TB screening information systems for the community.

METHODS

This research is a qualitative research, with the method of analyzing the requirements of information system development using the PIECES Framework (Performance, Information, Economy, Control, Efficiency, and Service). This framework functioned as an analysis method as a basis for obtaining more specific issues (Whitten 2007). The informants in this study were TB cadres and communities in District X in Central Java. The data collection method used in-depth interviews with each informant.

Table 1. Informant Characteristics

Informant	Gender	Age	Last Education	Position
Informant 1	Female	53	Diploma	TB Programmer of Health Center
Informant 2	Female	37	Diploma	TB Programmer of Health Center
Informant 3	Female	56	Senior High School	Cadre
Informant 4	Female	44	Senior High School	Cadre
Informant 5	Female	39	Diploma	Someone as Community
Informant 6	Female	31	Bachelor Degree	Someone as Community
Informant 7	Male	26	Senior High School	Someone as Community

RESULTS AND DISCUSSION

The informants recruited in this study totaled 7 people. The characteristics of the informants can be seen based on table 1. In the process of analyzing the requirements of the TB screening information system, there are 6 major themes, are performance analysis, information analysis, economy analysis, control analysis, efficiency analysis, and service analysis.

1. Performance Analysis

This analysis has an important role in assessing whether existing processes or procedures can be improved. Performance analysis in identifying the requirements of an information system consists of the sub-themes

of users, amount of work, and TB screening time. TB screening activities are carried out by health workers and cadres in each village. Then the results of TB screening are reported to the Health Center and Health Office in the region to be used as a reference in decision making.

Each informant involved in this activity is a user of the information system to be developed. According to the cadres and TB programmers at the Health Center, the results of the screening activities also need to be informed to the relevant district health office to assist in follow-up prevention and intervention efforts. So that the agency can access the information system as one of the users. This is supported by

the informant's explanation in the interview results as follows:

"...Information or reports on screening results need to be informed to the Health Center and Health Office so that suspected TB cases are followed up immediately..." (Informant 1)

"...Information should be reported to the Health Office so that it is easy to record and track cases through SITB (Tuberculosis Information System)..." (Informant 2)

"...It seems that the Health Office requirements to know the screening report so that the handling is faster..." (Informant 5)

The TB screening process in the community takes a lot of time because cadres or health workers need to ask questions to the community one by one. So that the queue of people is quite piled up. The limitation of health workers and cadres in conducting screening in an area also makes each of them have more work responsibilities. In addition, TB screening cannot be done all the time, unless there is a positive case of TB and officers need to conduct contact investigations to find other TB suspects. This is related to the limited number of screening officers and the fact that they also have other responsibilities at work. This fact is reinforced by the informant's statement as follows:

"...Sometimes we are few in number but the people in a village who need to be screened are hundreds in a day..." (Informant 2)

"...The queue is long, maybe because there are few people to screen" (Informant 7)

"...This activity is carried out in conjunction with Integrated Healthcare Center (Posyandu) activities for toddlers and the elderly, but if someone is positive we go to their house and screen their family..." (Informant 1)

The results of the requirements analysis on the performance aspect, the information system developed can be accessed by the Health Office and the Health Center to see a recap of TB

screening data and take appropriate follow-up steps. The developed system saves time and effort because it can be accessed anywhere and anytime and people can access it through their smartphones.

2. Information Analysis

This process is able to assess whether existing procedures can still be improved so that the quality of the information produced becomes better and has use value. Information analysis for the purpose of identifying information system requirements consists of data input and information output sub-themes. Previous TB screening activities were still carried out manually using paper. The results of the questions and answers to the community were filled in on the form provided. The purpose of the filling is to produce information on TB status, whether it includes TB suspects or not. The form contains personal data, location data, risk factors, and TB symptoms based on the main symptoms and additional symptoms. Filling out the form is assisted by health workers and cadres. This is in accordance with information provided by informants as follows:

"...We conduct health checks and ask about complaints, then record them on paper. The data entered is in accordance with the existing screening form..." (Informant 3)

"...I was asked by the officer about my identity, address, and complaints..." (Informant 6)

The system to be developed has a data input feature according to user requirements that will produce output in the form of an up to date TB screening results report. Screening data will be displayed on the dashboard menu in the form of information on the number of people who have been screened and the number of people who are suspected of TB and who are not as a reference in making decisions on TB treatment.

3. Economy Analysis

This activity is able to assess whether the current procedures can still be increased in benefits (use value) or reduced in the cost of implementation. Economy analysis for the purpose of identifying information system requirements consists of the sub-themes of facilities and financing. The manual recording of TB screening requires a budget for the provision of paper forms and ledgers for recording results. These requirements are included in the district budget plan for health program procurement. This situation was described by the informant as follows:

"...There are expenses in procuring paper forms and notebooks..." (Informant 2)

"...All necessities have been provided by the Health Center..." (Informant 4)

The development of an electronic-based TB screening system has made TB screening activities faster and more cost-effective. However, in its utilization, this system requires a computer or smartphone and internet data to access it. So that adequate Wi-fi facilities and each smartphone are needed.

4. Control Analysis

This activity is carried out to assess whether the current procedures can still be improved so that the quality of control becomes better, and its ability to detect errors or fraud becomes even better. Control analysis for the purpose of identifying information system requirements consists of storage and security sub-themes. TB screening result files have not been stored properly, they are scattered and even lost. If lost, it is possible that the TB data can be found by other people. This is supported by the informant's explanation in the interview results as follows:

"...Because the file is on paper and not recapitulated electronically, the data is lost over time..." (Informant 1)

The information system will be designed with the ability to store and secure data through a database management system. In addition, in order to maintain the security of the system, access will be restricted according to users equipped with passwords.

5. Efficiency Analysis

This analysis process assesses whether the current procedures can still be improved, so as to achieve increased operating efficiency, and must be superior to the manual system. The analysis was carried out with the aim of identifying information system requirements consisting of sub-themes, namely performance efficiency. During screening activities, health workers and cadres need a long time in the process of collecting data, recording data, and analyzing data to produce information. The informant explained it in the interview as follows:

"...Screening data collection is obtained through questions and answers to the community. After the screening activities are completed, we recap and analyze the data to produce a TB screening report..." (Informant 3)

"...I see that they are still working even though the screening activities have been completed..." (Informant 7)

The TB screening information system is very helpful in the process of recording and reporting. The data inputted can be recorded properly and processed automatically by the system, so there is no need to analyze for a long time. This system can help facilitate user performance and provide information in the form of reports that are up to date and real time and can be downloaded immediately after the data is inputted.

6. Service Analysis

This analysis process will assess whether the current procedures can still be improved to achieve improved service quality. It is necessary to design a service quality that is very user friendly for users so that users get good service quality. Service analysis for the purpose of identifying information system requirements consists of sub-themes of expectations and comfort and convenience. Users expect the system to be designed simply then the system is easy to operate, the language is easy to understand, and there is information about TB in it. In addition, it is expected that the system can be utilized by various users according to their requirements. This was stated by the informant as follows:

“...Hopefully the system is not complicated to use...” (Informant 3)

“...The questions are short and there are no terms that are difficult to understand...” (Informant 5)

“...If possible, there should be TB information so that we can read it...” (Informant 6)

“...Hopefully the system suits our requirements, for the Health Center and Health Office to see the recap of screening data, while for the community it can be used for early detection of TB disease...” (Informant 2)

CONCLUSION

The developed system is designed to be able to provide solutions to various problems that exist in various aspects. The development phase of the TB screening information system begins with analyzing system requirements. The problem solving framework and the preparation of system requirements are carried out using the PIECES Framework. The requirements analysis in the development of this information system is designed according to user requirements so that the TB screening information system can process and process data according to user requirements, produce accurate and real time information, save cost requirements, guaranteed data storage and security,

facilitate and assist user performance, and be comfortable and easy to operate by users. The TB screening information system is expected to be used anytime and anywhere and produce evidence-based information that is used for reference in decision making as an effort to overcome TB in the community.

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