

Community-Based Surveillance Information System for Pulmonary Tuberculosis (Pulmonary TB)

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Abstract— Pulmonary Tuberculosis is still a public health problem in Indonesia. Community participation is needed to control pulmonary tuberculosis through community-based surveillance. Community-based surveillance is based on fast and accurate information expected to come from the community, including case incidence (case finding), description of risk factors. Community-based surveillance has not been optimal in managing pulmonary TB data in the city of Semarang, especially in the search for pulmonary TB suspects. The unavailability of data on pulmonary TB cases that were found and referred to by the community or community organizations illustrates the lack of contribution from the community in finding and referring pulmonary TB cases. In connection with this, a community-based pulmonary TB surveillance information system is needed to help control pulmonary TB tracking. This study aims to develop a community-based pulmonary TB surveillance information system that produces complete, accurate, easily accessible, and timely information. This research is action research using a qualitative approach to help analyze problems and user needs. The development of information systems uses the System Development Life Cycle (SDLC) development methodology that includes the stages of planning, system analysis, system design, and system implementation. System testing using Black Box Testing and evaluation of information system acceptance using the Technology Acceptance Model (TAM) method, involving 34 respondents consisting of cadres and managers of the Public health center for Pulmonary TB program, and the Public Health Office. Black Box Testing shows the system's actions and responses were done well following the system's objectives. The results showed that most respondents gave a high assessment of the existence of benefits (31.48), ease of use (32.13), willingness to use (31.52), and interest in using (31.92). Recommend to the Public Health Office and Public health center the use and implementation of a community-based pulmonary TB surveillance information system in surveillance activities for pulmonary TB in Semarang City.

Keywords— Information Systems, Community-based Pulmonary TB Surveillance, SDLC.

I. INTRODUCTION

Pulmonary Tuberculosis (Pulmonary TB) is an infectious disease caused by infection of Mycobacterium Tuberculosis. (Ministry of Health, 2016) Globally, new cases of pulmonary TB are 6.4 million, equivalent to 64% of pulmonary TB incidents (10.0 million). Tuberculosis remains the top 10 cause of death in the world, and global pulmonary TB death is estimated at 1.3 million patients. (WHO, 2018) The prevalence of tuberculosis in Indonesia in 2018 was 250 per 100,000 population, with 566,623 cases found. Pulmonary TB cases in males are higher than females, namely 1.3 times compared to females (Kemenkes

RI, 2019)The government pays serious attention to the situation of pulmonary tuberculosis in Indonesia. Community participation is needed to control pulmonary tuberculosis through community-based surveillance. Surveillance is the process of collecting, processing, analyzing, and interpreting data systematically and continuously and disseminating information to units that need to be able to take action. Community-based surveillance is a strategic step as a concrete manifestation of community concern in overcoming pulmonary tuberculosis. Community-based surveillance is based on fast and accurate information expected to come from the community,

including case incidence (case finding) and description of risk factors.

One indicator of the success of pulmonary TB control is the participation of the community or community organizations in finding and referring pulmonary TB cases. (Ministry of Health, 2016) The discovery of pulmonary TB suspects and cases is the first step in the management of TB patients. At this time in the city of Semarang, there is no data on pulmonary TB cases that were found and referred to by the community or community organizations. The discovery of pulmonary TB suspects in Semarang City was carried out by health workers passively by observing close contacts of pulmonary TB cases treated at health facilities. However, this is still not optimal and illustrates the lack of community contribution in finding and referring pulmonary TB cases in their area. So that community-based pulmonary TB surveillance is needed to increase community participation in the detection of TB suspects in the area.

Health cadres are part of the community, who have received training on health and work voluntarily in assisting the pulmonary TB control program. (Directorate General of Disease Control and Environmental Health, 2009) For residents who are suspected of having pulmonary tuberculosis, these cadres are expected to find out quickly, then the suspects are reported to the Public health center officer for examination. To support community-based pulmonary TB surveillance data management, it is necessary to develop an information system that can correctly be used to facilitate data input, processing, and analysis of pulmonary TB data as well as presenting reports in the form of tables and graphics. With this information system, it will speed up data reporting, thereby accelerating decision-makers to determine appropriate interventions for pulmonary TB suspects.

The purpose of this research is to develop a community-based pulmonary TB surveillance information system in Semarang City, which produces complete, accurate, easily accessible, and timely information.

II. METHOD

The research was conducted at the Semarang City Health Office with the object of research was the pulmonary TB surveillance information system. This research was action research with qualitative and quantitative approaches. A qualitative approach is carried out to help the process of analyzed user problems and needs. (Sugiyono PD, 2016) A qualitative approach is carried out by in-depth interviews with officials or officers who handle pulmonary TB prevention and control

activities (Head of Section P2 Direct Communicable Diseases, Manager of the Pulmonary TB program, Health Office, as well as the manager of the Pulmonary TB Public health center program), observation and documentation.

The system development method used the System Development Life Cycle (SDLC) development methodology. The SDLC method was chosen because SDLC is a way of developing information systems that can be used when an information system is first developed. (SusantoAzhar, 2004) The stages in SDLC consist of planning systems (System Design), system analysis, and system implementation. (Roberta M. Roth, Barbara Haley Wixom, 2015)

In this study, system function testing was carried out using Blackbox Testing and evaluation of system acceptance by users using the Technology Acceptance Model (TAM), which aims to determine the user's perception of perceived usefulness, perceived ease of use (perceived ease of use), attitude toward using, interest to use (behavioral intention use) (Fred D. Davis, 1989)

III. RESULT AND DISCUSSION

3.1 System Analysis

Based on the results of interviews with informants involved in the management of pulmonary TB data in Semarang City, it is known that currently, community / community-based surveillance has not been optimal in managing pulmonary TB data, especially in the search for pulmonary TB suspects. The unavailability of data on pulmonary TB cases that were found and referred to by the community or community organizations illustrates the lack of contribution from the community in finding and referring pulmonary TB cases. Health workers at health facilities carried out the discovery of suspected pulmonary tuberculosis in Semarang City. Because the detection of TB suspects and cases through health facilities is still not optimal, it is necessary to develop community / community-based pulmonary TB surveillance, which aims to increase community participation in the detection of pulmonary TB suspects in the area.

In implementing pulmonary TB surveillance, data management is carried out both manually and electronically. Based on observations, it is known that the city of Semarang has developed a surveillance system for pulmonary tuberculosis, namely Semarang, to combat tuberculosis (SEMARBETUL). SEMARBETUL is an online pulmonary TB surveillance information system based on health service facilities (Public health centers, Hospitals, Clinics). In SEMARBETUL, it has not

accommodated community-based pulmonary TB surveillance, especially the detection of pulmonary TB suspects. Thus, it is necessary to develop an information system that can produce information about community-based pulmonary TB surveillance, especially in the effort to detect pulmonary TB suspects. The development of this information system is a management design for various data stored in files so that one another can be linked to form information. The purpose of system development is to support community-based pulmonary TB surveillance in Semarang City so that it can produce information that is easily accessible, complete, fast, clear, and timely.

3.2 Community-Based Pulmonary TB Surveillance Information System Design

Based on the results of problem identification and system requirements, the system design is as follows:

3.2.1 Context Diagram Creation

A context diagram is a diagram that describes the incoming and outgoing data flow systems and the flow of data into and out of the entity.

The context diagram of the Community-Based Pulmonary TB Surveillance Information System can be seen in Figure 1

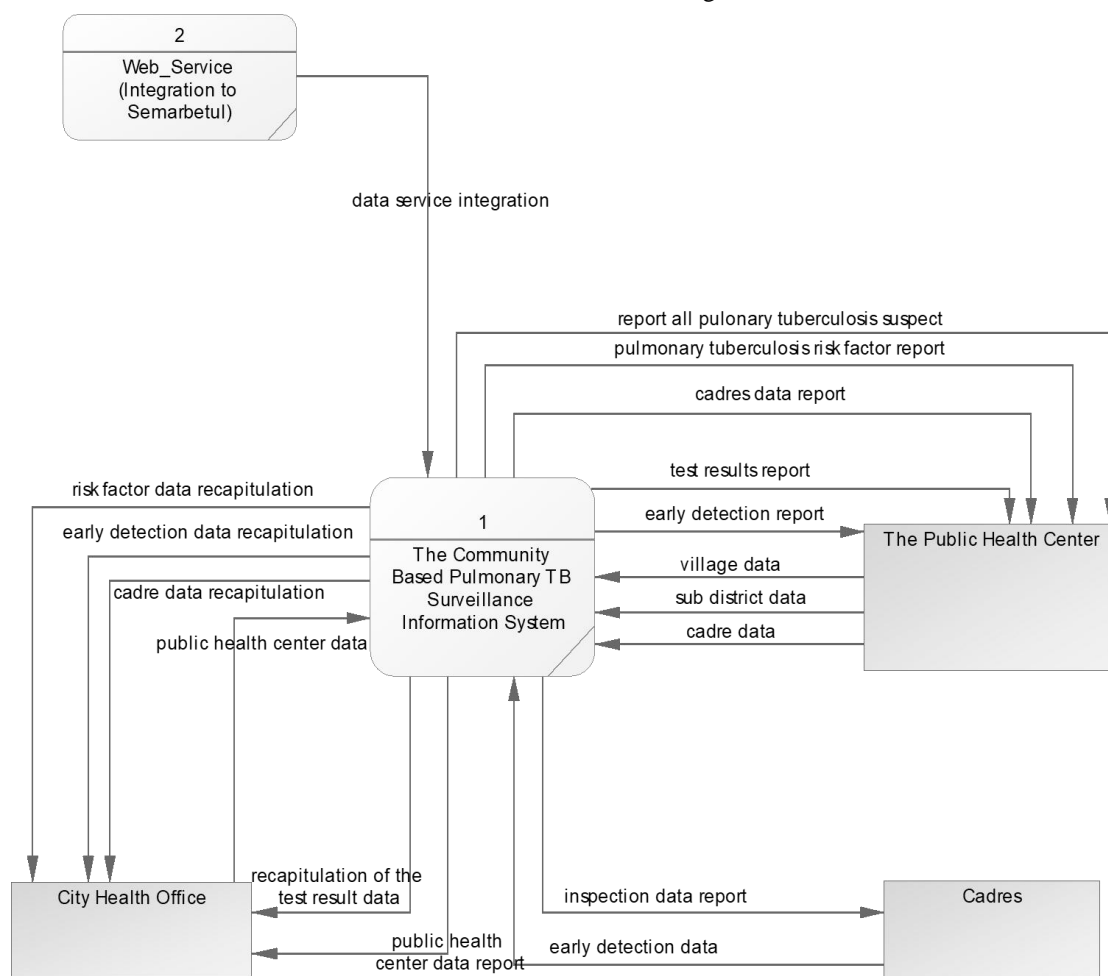


Fig.1: Context Diagram of Community-Based Pulmonary TB Surveillance Information System

The community-based pulmonary TB surveillance information system model in Figure 1 was designed after the researcher conducted interviews and discussions with system users. The entities contained in the community-based pulmonary TB surveillance information system can be explained as follows:

City Health Office, after logging in, information can be accessed in the form of cadre data recapitulation, recapitulation

Data on early detection of suspected pulmonary tuberculosis, the recapitulation of factor data risk of suspected pulmonary tuberculosis, and recapitulation of outcome data examination of suspected pulmonary tuberculosis.

The public health center, after logging-in, can access information on cadre data reports, data on early detection of pulmonary tuberculosis suspects, risk factor data reports for suspected pulmonary tuberculosis, and reports on the results of examining pulmonary tuberculosis suspects.

Cadres, after logging in, just enter data on early detection of suspected pulmonary tuberculosis. Cadre entities can also access examination data reports.

3.2.2 Making Data Flow Diagrams (DFD)

Data Flow Diagrams (DFD) describe the system as a network between functions that relate to one another

by loading and storing data. DFD is a depiction of a context diagram in a more detailed form to define the processes contained in the system to be built. (Hariana, 2019) Therefore, in making all names of entities, processes, and data flows must be following the context diagram. DFD community-based pulmonary TB surveillance information system is shown in the following figure

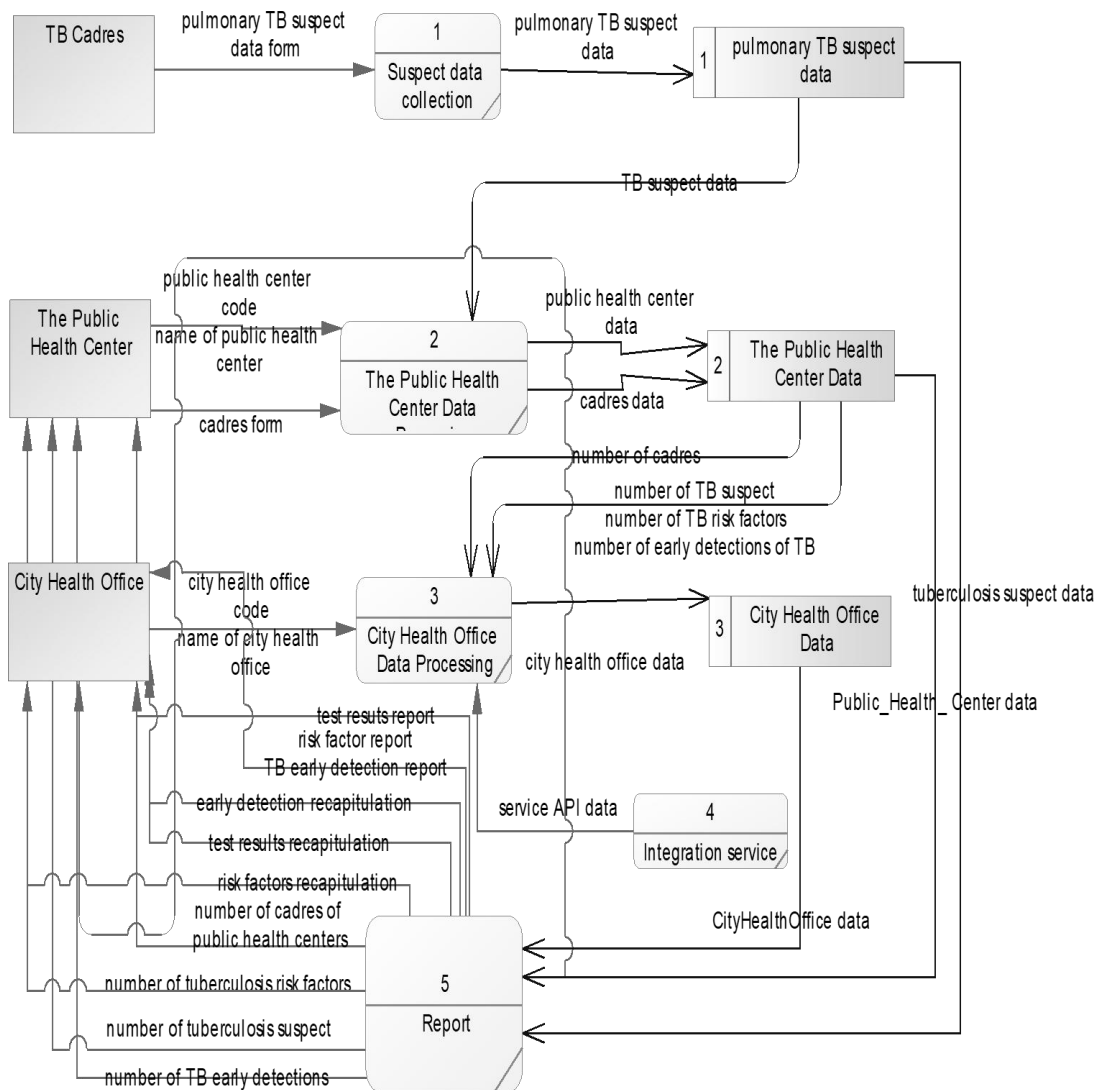


Fig.2: Data Flow Diagram of Community-Based Pulmonary TB Surveillance Information System

Figure 2 shows the Community-Based Pulmonary TB Surveillance Information System divided into 3 components, namely:

Input

In the input process, cadres enter data into the Community-Based Pulmonary TB Surveillance

Information System in the form of pulmonary TB suspect data.

Process

The process is an activity of processing input data so that the results will be output in the form of a report on the suspected pulmonary tuberculosis

Output

The output is the result of an information system process. Output comes in the form of early detection reports, examination results reports, risk factor reports, the

recapitulation of early detection, the recapitulation of examination results, and recapitulation of risk factors.

3.2.3 Database Design

Database design aims to make the database compact and efficient in the use of storage space, fast in accessing and easy to manipulate data, and free from redundancies. Based on DFD and behavior analysis involved in the system, the database design for Community-Based Pulmonary TB Surveillance Information System is shown in the following figure:

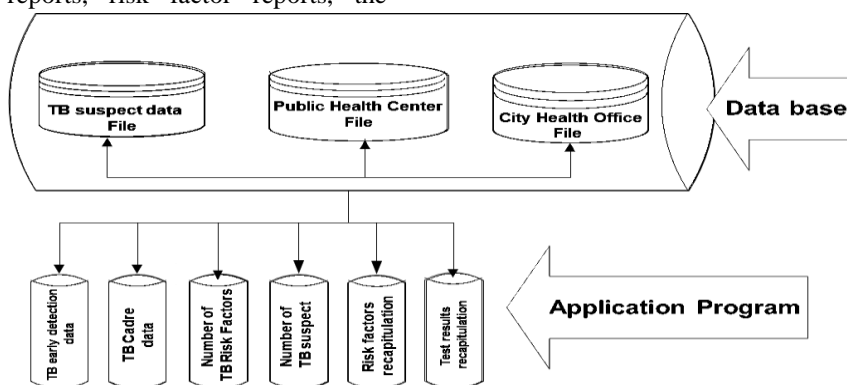


Fig.3: Database Design of Community-Based Pulmonary TB Surveillance Information System

In the database design, according to DFD, there are 3 files, namely TB suspect data files, Public health centerfiles, and City DKK files. With the information system application program, it will process input data and produce early detection data, cadre data, data on the number of pulmonary tuberculosis suspects, data on the number of suspects based on risk factors, recap suspects based on risk factors, and a recap of examination results.

The database entities involved in the Community-Based Pulmonary TB Surveillance Information System are shown in table 1

Table 1. Association of Community-Based Pulmonary TB Surveillance Information System Entities

No	Entity	Description
1	dkk_City	It contains data about names et al., addresses et al.
2	Public health center	Contains data about id_ Public health center, name of Public health center, address of Public health center
3	Cadre	Contains data about id_ cadre, cadre name, cadre's NIK, cadre address, cadre telephone, cadre

4	Suspect_tb	education, cadre job Contains data on the suspect id, suspect identity (name, gender, age, city, district, village, address, domicile, place of birth, date of birth, education, occupation, telephone), symptoms of suspected pulmonary tuberculosis, other diseases in the suspect, suspected risk factors
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3.2.4 Making Entity Relationship Diagram (ERD)

Entity Relationship Diagram (ERD) serves to explain the relationship between entities in the database based on fundamental data objects that have relationships between relationships. ERD community-based pulmonary TB surveillance information system according to the following diagram;

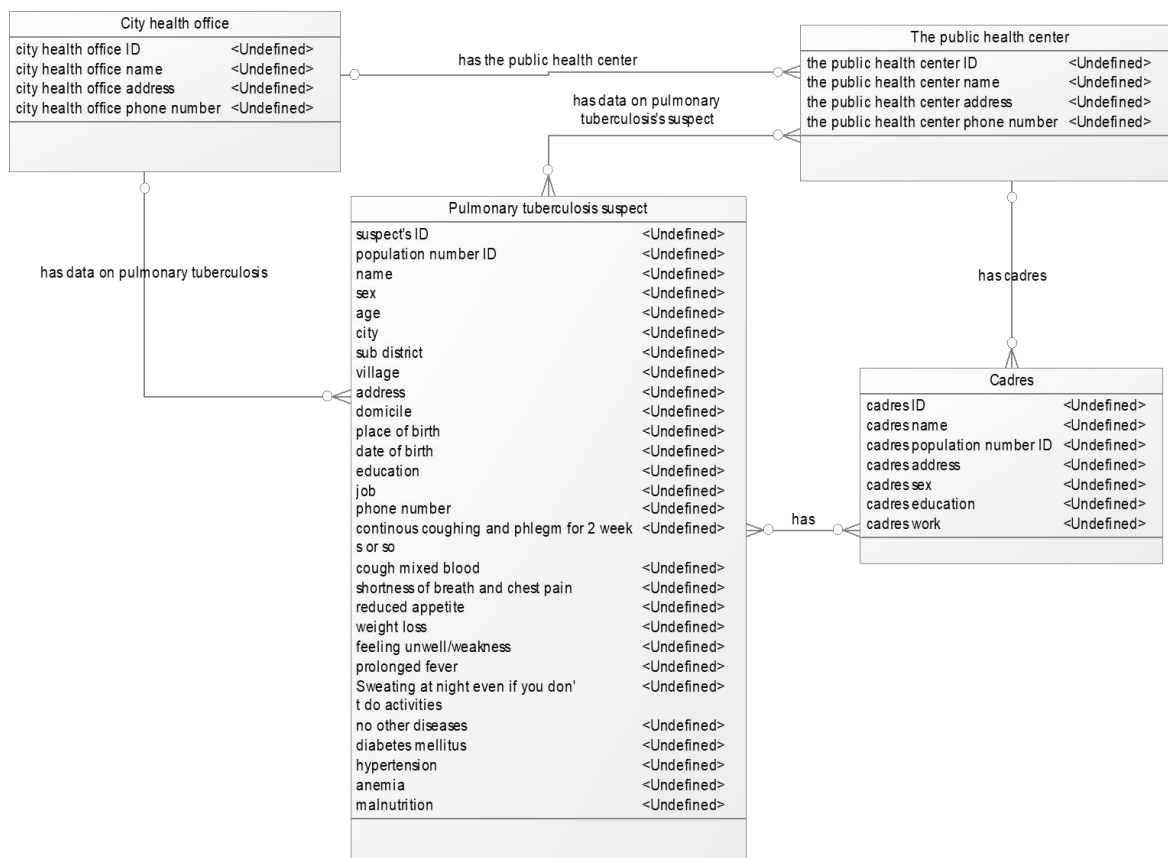


Fig.4: Entity Relationship Diagram Community-Based Pulmonary TB Surveillance Information System

3.3 System Implementation and Testing

The implementation stage is the real stage of making an application system in the form of a programming language. Programming uses the PHP application version > 7 and the Laravell front end framework, which is used on the server-side. In contrast, the interface uses HTML, CSS with the bootstrap framework, javascript, while the library uses jquery, and the database uses MySQL. Development of a community-based, web-based pulmonary TB surveillance information system that can be accessed via a personal computer (PC), laptop, or mobile system.

The following are the results of the development of a community-based pulmonary TB surveillance information system.

1) Login page

On the login page, there is a username and password for each user who is useful for data security and limiting the access rights of community-based pulmonary TB surveillance information system users. The following shows the login page of the Community-Based Pulmonary TB Surveillance Information System.

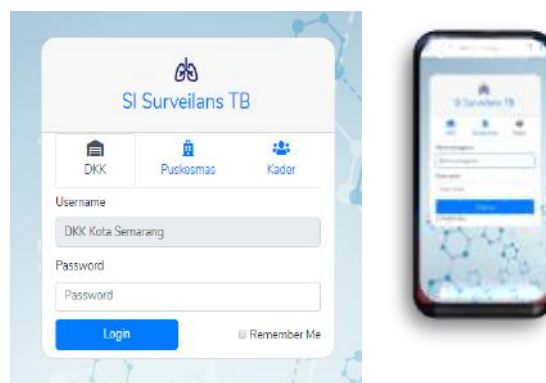


Fig.5: Login page of Community-Based Pulmonary TB Surveillance Information System

2) Display the report menu for users of the Semarang City Health Office

The Semarang City Health Office will receive a report and data recapitulation of suspected pulmonary tuberculosis of the Public health center in Semarang City. The display of the report menu for users of the Semarang City Health Office is shown in Figure 6

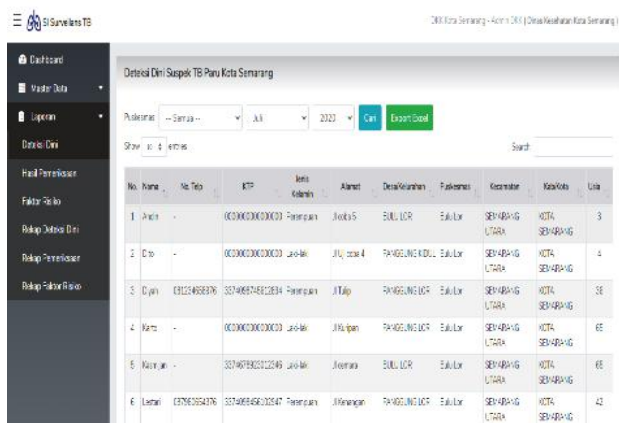


Fig.6: Display of the report menu at the Community-Based Pulmonary TB Surveillance Information System Health Office

Figure 6 shows the report menu at the Semarang City Health Office, which consists of early detection reports, examination results reports, suspicion reports based on risk factors, the recapitulation of early detection, recapitulation of examinations, and recapitulation of risk factors. This report menu can be downloaded according to the time requirements and needs of the Public health center in excel.

3) Display report menu for Public health center users

The Public health center will receive a report on suspected pulmonary tuberculosis that has been inputted by the cadres. The following displays the report menu for Public health center users

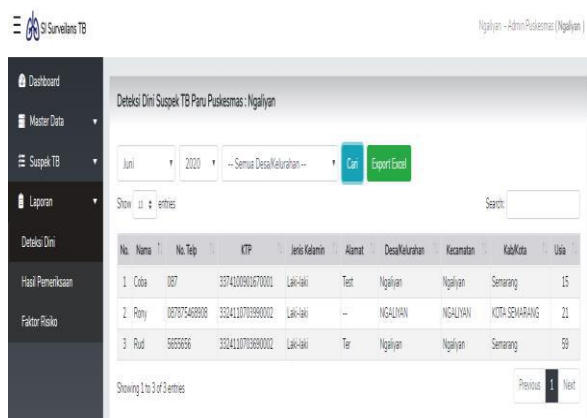


Fig.7: Display of the report menu for community-based Public health center users of the Pulmonary TB Surveillance Information System

Figure 7 shows the report menu display at the Public health center, which consists of early detection reports, examination results reports, suspicion reports based on risk factors. This report menu can

be downloaded according to the time requirements and needs of the Kelurahan in the Public health center working area in excel form.

4) Data Input Menu Suspect Pulmonary TB

Suspect data input menu, which consists of suspect identity, symptom, and suspect risk factors observed by cadres. To make it easier for users to input data on suspected pulmonary tuberculosis, this community-based pulmonary TB surveillance information system can be accessed by a mobile system, and most of the forms are filled in free forms. The menu display for the suspected pulmonary tuberculosis data input is shown in Figure 7

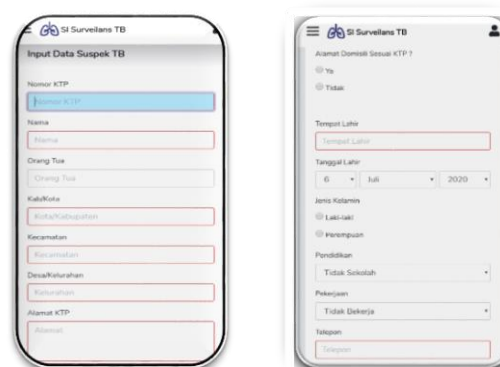


Fig.8: Menu display of community-based pulmonary TB surveillance information system data input

3.4 Blackbox Testing Functional Testing

Blackbox testing is used to see the suitability of the system being tested with the stated objectives. In this study, the focus of testing was on the functional requirements of the system. The results of black-box testing on community-based pulmonary TB surveillance information systems for DHO users, Public health center, and Cadres show that user actions and system responses have gone well and are following the system user objectives.

3.5 Evaluation of Information System Acceptance

Evaluation of information system acceptance using the Technology Acceptance Model (TAM) method to assess user responses to information systems on perceptions of information system usefulness, perceived ease of use, attitudes to use, and interest in using. The number of respondents was 34 people consisting of (managers of the pulmonary tuberculosis program of the Semarang City Health Office, managers of the Public health center pulmonary TB program, and cadres). Assessment using a Likert scale score and data analyzed

using quantitative descriptive. The results of the assessment are as follows:

1) Result of Assessment of Information System Usability Aspects

Perceptions of usefulness can be interpreted as user belief that using this technology will improve performance at work (Layungsari, Wuri, &Ruldeviyani, 2015)

The results of the assessment of user responses on the usefulness of the information system obtained an average index of 31.48, which is in the "high" category. This means that the user feels the Community-Based Pulmonary TB Surveillance Information System is beneficial. Respondents' responses to the beneficial aspects of using community-based pulmonary TB surveillance information systems are that this information system can simplify and accelerate the recording and reporting of pulmonary TB suspects, and the use of community-based pulmonary TB surveillance information systems can improve skills in recording and reporting. The results of this study are following the research conducted by Martunus, where the use of information systems can increase the ability of officers in recording and reporting, thereby accelerating the completion of reports (Martunus, Agushyana, &Nugraheni, 2019).However, research conducted by SeilaRiska in 2018 found that the perception of the benefits of SIMRS users did not affect the intention to use SIMRS, which was because users felt that SIMRS had not been able to make data search more manageable, not all reporting features were not available in SIMRS, and reports that could not input in SIMRS can only be recapitulated manually. (Riska, Daerina, Mursityo, &Rokhmawati, 2018)

2) Result of Ease Aspect Assessment

Ease of use will lead to the perception that the information system provides benefits in helping users' tasks. Ease of use is one of the factors that has been tested in the research of Davis et al. in 1989, which states that the ease of use factor is proven to explain a person's reasons for accepting and using the developed information system (Fred D. Davis, 1989).The results of the assessment of user responses on the aspect of ease of use indicate that most respondents give a high assessment of the ease of use of information systems. The average answer score for the convenience variable is 32.13 in the high category. According to respondents, the ease of use of this information system is because the process of entering data is easy and fast,

easy to access, easy to understand, and easy to use. Research conducted by Martunus also states that one of the indicators of perceived ease in using information systems is that the information system is easily accessible anywhere. (Martunus et al., 2019) Sevtiyani's research stated that perceptions of ease of use of RSUD SIM affect perceptions of the benefits of RSUD SIM in helping tasks and work. (Sevtiyani, Sediyono, &Nugraheni, nd)

3) Result of Assessment of Attitude Aspects of Using

Attitude to use information systems is a person's attitude towards the use of information systems in the form of rejection or acceptance of information systems. A person's attitude consists of cognitive (point of view), affective and other components related to behavior (Saputra&Misfariyan, 2013)

The results of the assessment on the attitude aspect of using information systems show that the respondents gave a high assessment of the attitude to using information systems, with an average answer score of 31.52 (high category). More than half of the respondents stated that they strongly agreed and liked the idea of using a community-based pulmonary TB surveillance information system. This is because respondents feel by using this information system, the process of entering data is easy and fast, easy to access, easy to understand, and easy to use. This research is different from the research by AyuLaraswaty, which states that more than half of the respondents do not agree that recording and reporting using the 5NG information system is better because respondents feel the burden is increasing and there are problems that the information system is often difficult to access, so it requires relatively time. (Gaol, Atik, & Djoko, 2017)

4) Result of Interest Aspect Assessment of Using

Interest in using is a person's tendency to continue to behave using information technology (Saputra&Misfariyan, 2013). In this case, there is someone's interest or desire to use the software. Also, it will provide recommendations to persuade others to take advantage of this technology. This desire to use arises because of the belief in an increase in performance, as well as ease of use.

The results of the assessment on the aspect of interest in using information systems, namely, most of the respondents gave a high assessment of the interest in using Community-Based Pulmonary TB Surveillance Information System. The average score of respondents' answers was 31.92 and in high criteria. The interest in using the Community-Based

Pulmonary TB Surveillance Information System is based on the respondent's plan to use the Community-Based Pulmonary TB Surveillance Information System for recording and reporting the discovery of pulmonary TB suspects in the community (index 32.6), receiving a community-based pulmonary TB surveillance information system if implemented (index 32.2) and willing to ask questions if there are difficulties in using the community-based pulmonary TB surveillance information system (index 32). Erika Devi's research states that the variables of use and convenience each have a positive influence on the interest in using the TB e-Scoring application. (Udayanti, Fajar, & Nugroho, 2018)

IV. CONCLUSION

The development of a community-based pulmonary TB surveillance information system aims to facilitate and accelerate the recording and reporting of suspected pulmonary TB findings by the community (cadres), as well as providing complete information on community-based pulmonary TB surveillance. We are developing a community-based pulmonary TB surveillance information system with web-based following the SDLC system development methodology stages, accessible via personal computers (PCs), laptops, or mobile systems. The community-based pulmonary TB surveillance information system has been tested using the Blackbox Testing system. The results showed that user actions and system responses have been running well and have been accepted by system users based on perceptions of benefits, perceived ease of use, attitudes in use, interest in using, with the average index in the high category.

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