Design of Web-Based Planned Referral Information System from Public Health Centers to Hospital

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Article Info	Abstract
	The aim of the study was to create a web-based planned referral system (SIJUNA) to help manage referral services from public health centers to hospitals so that there was no reason for patients not to be served because the human resources and facilities needed were not available. This study uses action research with a qualitative approach and the system development stage using the FAST method. The system is tested using black box testing. The results of this study are the establishment SIJUNA that facilitates the referral process of patients from the Public Health Center to the Hospital. With the existence of SIJUNA, the operational needs of services are good with the types of outpatient referrals, inpatient care, and emergencies can be fulfilled by increasing accessibility such as certainty of service time with competence and the closest radius of the patient's location, equalizing and increasing the effectiveness of health services, nearest health who has competencies according to patient needs.

INTRODUCTION

Referral health is one form of implementing and developing health efforts in the National Health System (*SKN* or *Sistem Kesehatan Nasional*). The health service referral system is the organization of health services that regulates the mutual assignment of tasks and responsibilities for health services both vertically and horizontally. Simply put, the referral system regulates where and from where a person with certain health problems is examined for their illness.

Effective efforts to improve comprehensive health services in accordance with Law Number 40 of 2004 concerning the National Social Security System (SJSN) in the health sector with the concept of Universal Health Coverage (UHC) by implemen-

ting a tiered referral system that is supported by the progress of the information system. Indonesia has arranged the implementation of a referral system in stages. Referral health services start at the first level, continue at the second level and finally at the third level. Implementation of a referral system cannot stand alone but exists in a system and is interconnected. If at the primary level cannot perform medical treatment, then the primary level will transfer the responsibility to the level of service above, and so on except in emergencies when patients can be referred to one of the facilities for immediate treatment (Olushola, 2004).

During this time the problems that occur in managing the referral information system data that are currently running include input data or input

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data (referral patient data that has not yet been received by the next health facility), processes (referral data management is still done manually and have not used the information system) so the activity of referring patients from the community health center to the hospital is carried out without knowing the certainty of service time with competence and the closest radius to the patient's location. These conditions result in rejection of patients referred because of a nursing room or a full inpatient, there is a buildup of patients, as well as the absence of hospital information to receive referral patients and any delay in service in the emergency room. As for the problems in communication between referrals and the destination of the referral place, especially in seeking the continuation of the health care process so that patients who tend to directly use secondary or tertiary health care facilities for minor illnesses (Gandhi et al., 2000; Reid & Wagner, 2008). While the output or output data (referral information / patient reports that have not been in the form of an information system) results in the evaluation of referral services performed by managers, specifically used to determine the effectiveness and efficiency of referral services to be constrained or hampered.

In increasing the effectiveness and equitable distribution of health services, the referral process carried out at the nearest health service facility must have competence according to the needs of the patient (Umami et al., 2017). Therefore, the use of technology and the use of appropriate transportation can support the referral services to run well and the community can be handled immediately (Murray & Pearson, 2006).

One effort in handling the referral process that is in accordance with the referral service flow that is implemented by Social Security Administrator for Health (*BPJS Kesehatan* or *Badan Penyelenggara Jaminan Sosial untuk Kesehatan*) is by developing and implementing an information system that aims to communicate and manage health referral information in the referral network between health facilities so as to facilitate communication between personnel and health facilities in handling referral requests, minimize the occurrence of rejection of referral requests by referral hospitals, increase the readiness of the hospital to receive referrals, and are expected to reduce delays in referral handling.

So far, the use of technology in improving the quality of services at first-level health facilities, one of them at the community health center requires a system that is able to accommodate the process of health care, able to accommodate the provision of reports both patient visit reports and patient referral
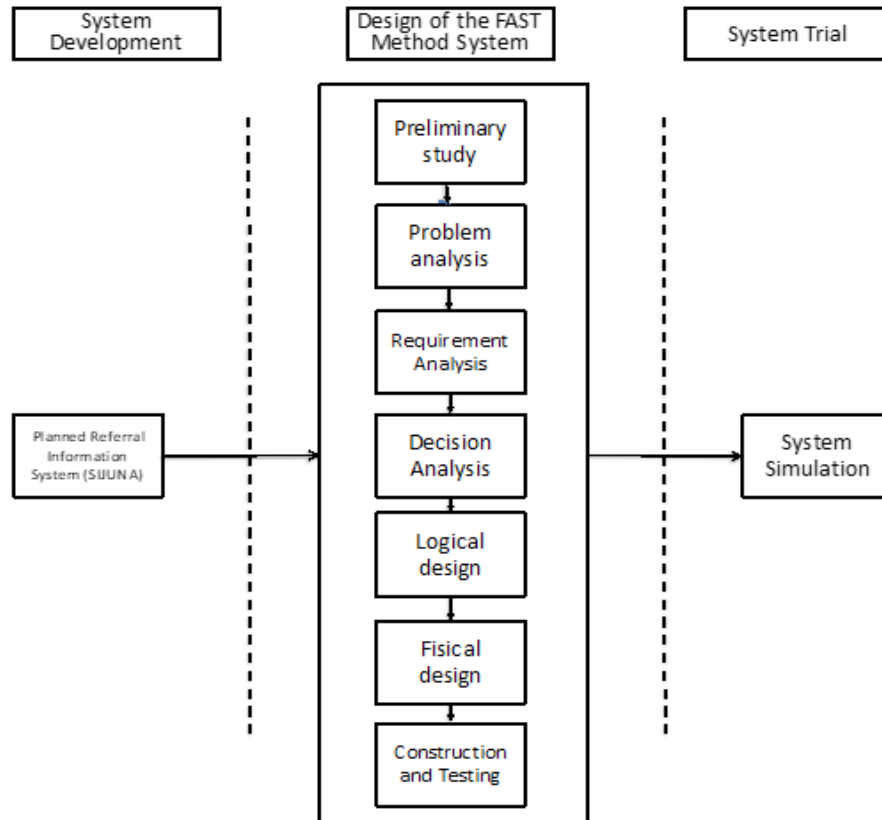

Figure 1. Framework of Concept

reports so that there is no need for manual staff to manually recap reported to related parties and the system is also expected to be able to accommodate patient records without the need for patient records separately in serving patients using BPJS and general patients (Prasetyowati & Kushartanti, 2018). The purpose of this study is to design a planned referral information system, named *SIJUNA* (*Sistem Rujukan Terencana*), to help manage referral services from community health centers to hospitals.

METHOD
Location

This research was conducted at one of the Regional General Hospitals of type C and one of the community health centers in Tanjung District, Berau Regency, East Kalimantan Province. This research has been declared feasible and obtained approval from the Ethics Committee at the Faculty of Public Health, Diponegoro University, Semarang, number 84 / EA / KEPK-FKM / 2019.

Study Design

This study uses an action research design that is a method for gaining knowledge and using interventions to produce change (Joanda, et al., 2015). The time approach in this study uses a cross sectio-

nal approach. The method used in the design of the Planned Referral Information System (*Sistem Rujukan Terencana = SIJUNA*) is the FAST method. The stages in the FAST method consist of the first stage, namely a preliminary study, the next stage of problem analysis, needs analysis, logic design, decision analysis, physical design and integration, manufacturing and testing, installation and delivery and the last is the System Operations and Maintenance (Lonnie & Whitten, 2007).

In this study only uses seven stages that have been adapted to the needs of the study because this study did not reach the stage of installation and delivery. System testing uses the blackbox testing method. Then the system that has been built will do a system simulation to see whether the system built can run according to its function and in accordance with the goals and expectations of the user of the system.

Research Materials

This research has several research materials that will be used including (1) Referral Patient Data at community health center (2) Data of medical devices, blood, beds, Doctors, Polyclinics and Operational schedules at one of the regional public hospitals in Tanjung Redeb District; (3) The object

Figure 2. Entity Relationship Diagram of *SIJUNA*

of research is the planned reference information system *SIJUNA*; (4) Research subjects are 40 respondents who will simulate the system both from the community health center and hospital in the District of Tanjung Redeb.

Data Collection Technique

The data collection technique was carried out by observation and in-depth interviews to analyze the problem and collect data about the referral service from the community health center to the hospital.

System Design

This research conducts system design based on database design. According to (Swara et al., 2016) the database is an important component that functions to support information systems. The next step is the data normalization stage, context diagram creation, data flow diagram (DFD), entity relationship diagram (ERD). Then do a system simulation. DFD is used to describe and describe the flow of origin of data used, where the purpose of information coming out of the system, where the data is stored, what processes can produce that information, interactions between stored data, and the processes imposed on the data have a clear name and has meaning (Afyenni, 2014). While Entity Relationship

Diagrams (ERD) are initial database modeling that will be developed based on set theory in the field of mathematics for relational database modeling (Sukamto & Shalahudin, 2014).

Results Analysis Techniques

Analysis of the results in this study is based on the results of the simulation system that is built on the web-based Planned Referral Information System *SIJUNA* using the FAST method. So that, the simulation results will be used to get conclusions (Jogiyanto, 2008).

RESULTS AND DISCUSSION
 System Design Analysis Results

The Design of a Planned Referral Information System *SIJUNA* is carried out with the stages of problem analysis and needs analysis done through the process of observation and interviews. This process provides the information and data needed about the current system, the weaknesses of the current system and the system that needs to be developed to solve problems in the field. Based on the flow of patient referral activities carried out from the health center to the hospital, it is necessary to take systematic steps to design a computerized planned referral information system in support of a smooth referral system.
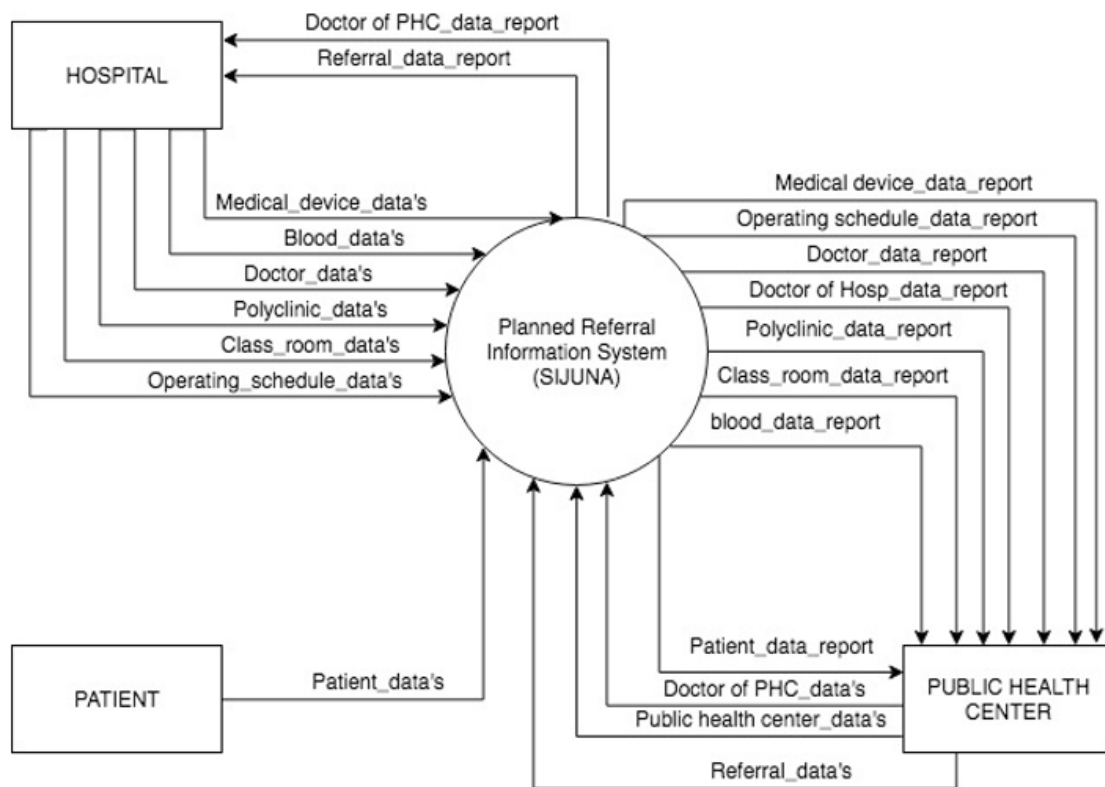

Figure 3. Context Diagram of *SIJUNA*

The design of the system is built based on the results of system analysis that has been done. At this stage the software design for the Planned Reference Information System *SIJUNA* is continued with the design for the output or output format of the system, the design of menus and the design of the program structure that contains the program process flow starting from the input to the system output.

This system uses the PHP programming language and javascript which is a server-site language that is specifically designed for web-based applications. While the database uses MySQL. This system was developed web-based and this system can run in HTML (Lonnie & Whitten, 2007). MySQL is used for data storage and data management and supports applications that rely on access to MySQL data which is then connected to localhost in windows so that the browser can connect to the internet (Lavarino & Yustanti, 2016). To be able to simplify the system design process, it is necessary to establish relationships between entities and attributes used, the system flow along with the processes used in the system, an Entity Relationship Diagram (ERD), context diagrams and Data Flow Diagrams (DFD) can be designed et al., 2015). The Entity Relationship Diagram (ERD) in the SIJUNA system is shown in Figure 2.

Based on Figure 2, it can be seen that the relation display in *SIJUNA*. Relations between the entities above, are described together with attributes that can show the function characteristics that exist in each entity. After creating an ERD, it can then proceed with making context diagrams that can explain data and information that enters and exits the system. The following context diagram in *SIJUNA*

can be seen in Figure 3.

Figure 3 explains the related flow of inputs and outputs from the planned referral information system *SIJUNA*. System users including puskesmas administrators and hospital administrators use *SIJUNA* to conduct the referral process. Administrators of public health centers enter patient data and referral hospitals. Furthermore, hospital administrators receive referral data from community health centers, and can enter data on the availability of medical devices, blood, doctor data, available polyclinics, beds, and operating schedule data. According to (Priyadi & Irawan, 2014) a picture of the relationship of data on the system and the processes that occur in the system can be seen in the Data Flow Diagram (DFD) in the form of symbols in describing how the data flows through interconnected processes.

Interface Design Results

The interface design can be seen from the graphical display of the information system that makes it easy for users to understand and be programmed to be easily read by the computer operating system. Furthermore, users can enter the process of entering data and view output data according to user needs (Larry, 2000).

The interface design in the Planned Referral System *SIJUNA* includes three levels of use including the administrator level, the community health center level and the hospital level, each level having its own level of access authority. The interface design at *SIJUNA* consists of referral service features from the public health center to the hospital. This system has notifications or alerts to refer to or referenced.
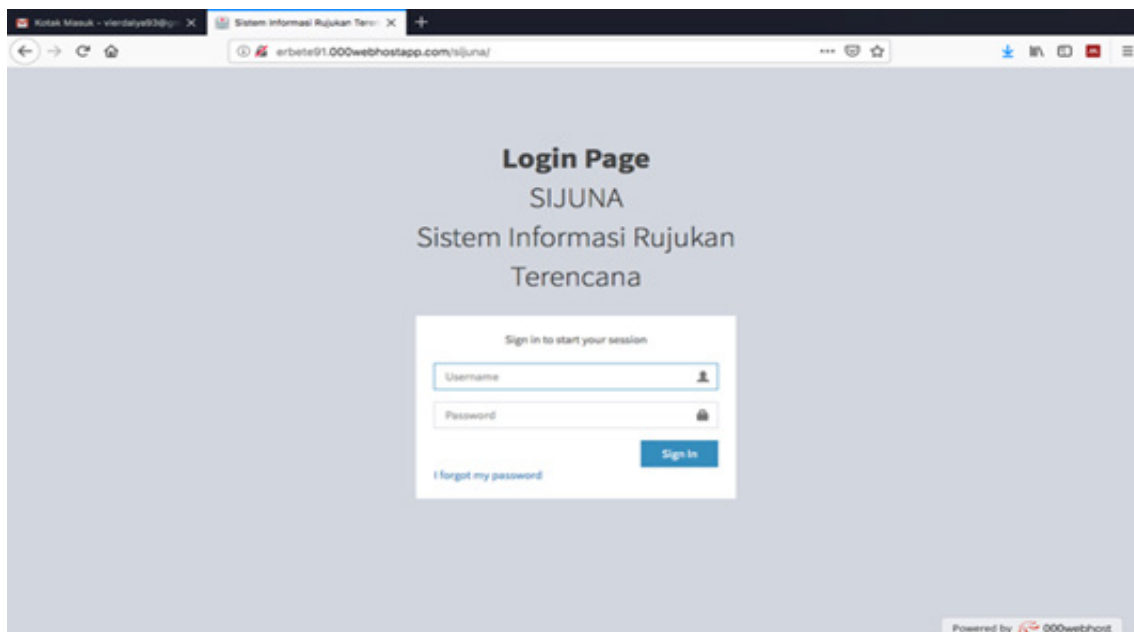

Figure 4. Pages of Login SIJUNA

Figure 5. Referral Patient Input Menu

This system also has information related to the availability of medical equipment, blood, doctor data, available polyclinics, beds, and operating schedule data from the hospital that will be used as a place of reference. Some *SIJUNA* interface designs can be seen in Figure 4 through Figure 6.

Testing and System Simulation

SIJUNA was tested with the black box testing method. This testing technique focuses on the functional requirements of the system being built (Rizan et al., 2018). Black box testing in this study was used to validate the function of the information system (Cholifah et al., 2018). Based on the results of the overall system testing features have a good function and in accordance with the objectives of the system user.

SIJUNA simulations are carried out by running the *SIJUNA* system to describe the system process of a real system that generally cannot be examined at the proper time (Thomas, 2004). *SIJUNA* simulation is able to increase the effectiveness and efficiency of the referral health service process with the speed of receiving referral or referral notifications performed by the *puskesmas* (*Pusat Kesehatan Masyarakat* or Public Health Center) simulation section to the hospital simulation section is 3 seconds which is seen from the average time of sending referral messages. Communication between community health centers and hospitals using *SIJUNA* can work well. *SIJUNA* also has an alert system when there is a notification either referring or being referred. *SIJUNA* can also change the referral place if the referral status is rejected by the previous referral place to another, but the emergency status of the system does not have the option of refusing a referral so automatically patients with emergencies must be accepted by the referral place.

Discussion

The results of this study are the formation of a planned referral information system *SIJUNA* with a variety of referral facility data menu choices, referral forms and referral reports. *SIJUNA* uses the PHP programming language and javascript and its database management uses MySQL. According to (Rompis, 2018) the PHP programming language and javascript are very well used in web programming with various conveniences offered. PHP programming language and javascript also strongly supports databases that use MySQL because it is stable and strong enough as a medium for data storage. The system that has been built is then tested by the blackbox method. According to (Khan, 2011) blackbox testing focuses on the functional specification of information domains in software that is by conducting a tester by participating domain input or input from SIJUNA by providing deeper testing coverage. Based on the results of the blackbox test, all the features of *SIJUNA* are functional and can run well and in accordance with the goals of the system user.

SIJUNA functions as an effective and efficient tool for managing patient referral processes from *puskesmas* to hospitals. The process of referral health services is made easier with the speed of time to receive notifications or referrals or referrals conducted by the *puskesmas* simulation section to the hospital

Figure 6. Display of Referral Reports

simulation section is 3 seconds which is seen from the average time of sending referral messages. *SIJUNA* can also change the referral place if the referral status is rejected by the previous referral place to another referral health facility, but the emergency status of the system does not have the option of refusal of referral so automatically patients with emergency must be accepted by the referral place. So that the creation of *SIJUNA*, communication between community health centers and hospitals can run well. *SIJUNA* is able to accommodate services in the form of outpatient referrals, hospitalizations, and emergencies, namely by increasing accessibility such as certainty of service time with competence and the nearest radius from the patient's location, leveling and increasing the effectiveness of health services, referral process is carried out at the nearest health care facility that has competence according to patient's needs.

Using computerized *SIJUNA* is able to provide time efficiency compared to manual referrals, SIJUNA is able to do data processing quickly, precisely and accurately, data stored in *SIJUNA* can be changed, deleted, stored, and can be used as reporting material that is needed. These results are able to represent the real conditions in the field and the needs desired by the user. Based on previous research conducted by (Permatasari, 2014) concerning the design of a health service information system for community health centers and (Sari, 2015) concerning the administration information system for outpatients and web-based inpatients at the community health center in Tanjung Raja that with the existence of an information system The web-based is able to

manage the data of outpatients, inpatients, poly, and referral letters, able to make it easier to make reports and decision holders can receive reports easily.

Furthermore, the results of this study are also supported by research conducted by (Siti, 2016) regarding the design of information systems for outpatient referral services. The outpatient provided is faster and has complete data so that it can support administrative arrangements especially in the outpatient referral service information system. As well as research conducted by (Yufrizal et al., 2017) regarding the first level health service information system (community health center) it is known that with the development of the system is able to overcome the problem of time and distance variables that previously could not be estimated, then the queue variable and the waiting time for services can be minimized. Thus it can be concluded that the design of a referral system is needed and has benefits in supporting the referral process to be more effective and efficient.

SIJUNA has the interface shown in Figure 4 to Figure 6. With a system of authority consisting of administrators, community health center level and hospital level. At each level it has a different level of authority so that this system guarantees the security of data available on this system so that it is not misused. With this system there are no more patients who are not served in relation to human resources and the required facilities are not available and there is no more complicated management of referrals.

The advantages displayed at *SIJUNA* include ease of understanding and operation, this system is able to facilitate the community health center in

controlling and making decisions regarding where the patient will be referred, this system is able to produce patient visit reports and referral reports and this system is able to display data availability of tools medical, blood, doctor data, available polyclinics, beds, and operating schedule data. This system can be used with multiple users, then the system is built based on the web so that it can be accessed through the internet network anytime and anywhere.

CONCLUSION

The Planned Referral Information System *SIJUNA* that was built had a referral service feature from the community health center to the hospital. This system has notifications or alerts to refer to or referenced. This system also has information related to data availability of medical devices, blood, doctor data, available polyclinics, beds, and operating schedule data from the referenced hospital.

SIJUNA was built with programming languages such as PHP and javascript while its database management used MySQL. *SIJUNA* is able to meet the operational needs of services both with the type of outpatient, inpatient, and emergency referrals, namely by increasing accessibility such as certainty of service time with competence and the closest radius of the patient's location, leveling and increasing the effectiveness of health services, the referral process is carried out at the service facility closest health that has competencies according to the needs of patients. This system is capable of producing patient visit reports and referral reports. This system has been tested using blackbox testing with the results that all features have a good function and in accordance with the goals of the system user.

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