HIS Implementation in Small Hospital

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ABSTRAK
Latar belakang: *RS Budi Rahayu Magelang telah mengimplementasikan SIMRS bekerjasama dengan laboratorium SIMKES FKKMK Universitas Gadjah Mada sejak April 2021. Selama empat bulan awal implementasi, RS Budi Rahayu mengalami berbagai tantangan. Untuk memahami dan mengatasi tantangan tersebut, perlu merancang strategi implementasi SIMRS guna menghasilkan rekomendasi yang tepat.*
Metode: *Penelitian ini berbentuk deskriptif kualitatif dengan desain action research, meliputi empat tahap penelitian yaitu Diagnosing, Planning, Action dan Evaluation. Pada tahap Diagnosing, dilakukan diskusi dengan RS. Dalam tahap Planning, peneliti merencanakan strategi untuk menghasilkan rekomendasi yang sesuai guna keberhasilan implementasi SIMRS. Pada tahap Action, peneliti melakukan reviu dan pendampingan implementasi SIMRS. Peneliti menyelenggarakan UAT dalam tahap evaluasi, menggunakan kuesioner yang dibagikan kepada responden. Penelitian dilakukan pada bulan September – Desember 2021. Subyek penelitian dipilih secara purposive dari unit layanan yang terlibat, dengan total 20 responden pengguna SIMRS.*
Hasil: *Langkah strategis untuk kelancaran implementasi adalah keterlibatan aktif dan kerjasama dari tim pengembang dan tim RS yang dimonitoring oleh Dinas Kesehatan. Kegiatan monitoring yang dilakukan oleh dinas kesehatan memastikan timeline yang telah ditetapkan berjalan sesuai target dan RS mendapatkan manfaat yang optimal dari penerapan SIMRS. Penerimaan sistem dinilai penting untuk pengembangan SIMRS lebih lanjut. Skor penerimaan SIMRS di RS Budi Rahayu adalah 70% berdasarkan skenario 85% yang berhasil dijalankan. Berdasarkan kinerja sistem, pemeliharaan berkelanjutan dan komunikasi antar tim implementasi, SIMRS dapat diterima dengan peningkatan dan penyesuaian berkelanjutan.*

Kesimpulan: *Keterlibatan aktif serta kolaborasi dari tim pengembang dan RS, peningkatkan kinerja dan kehandalan sistem sangat penting dalam keberhasilan implementasi SIMRS.*

Kata kunci: *SIMRS, Implementasi, UAT*

ABSTRACT
Background: *Budi Rahayu Hospital at Magelang City has implemented HIS in partnership with the SIMKES FKKMK laboratory of Gadjah Mada University since April 2021. During the initial four months of implementation, Budi Rahayu Hospital experienced various challenges. For understanding and overcome the challenges, it is necessary to construct a strategy of HIS implementation, and then offer a proper recommendation based on study.*
Methods: *This study is a descriptive qualitative with action research design that describe four stages of action research i.e Diagnosing, Planning, Action, and Evaluation. On the Diagnosing stage, Author arrange an interview and discussion with Hospital Team. Next, Author plan a strategy to generate suitable recommendations for the successful implementation of HIS. In the Action stage, author conduct an implementation review and assistance. Author also manage an UAT as an evaluation stage distributed to respondents using a questionnaire. The study is performed by observing of HIS implementation from September – December 2021. The subject of this study is chosen purposively from departments involved, with total 20 end-user respondents on multiple service units to capture data in a real environment when HIS is used for healthcare services to patients.*
Results: *Strategic actions for smooth implementation is active involvements and collaboration from developer team and hospital team monitored by regional health services. the hospital team and developer team formed an online communication group as a place to discuss the problems encountered. There are monitoring activities*

that involved by regional health services, so the timeline that has been set runs according to the target and the hospital gets optimal benefits of HIS implementation. System acceptance is important for the further development of HIS. The score of HIS acceptance at Budi Rahayu Hospital is 70% based on 85% scenario that execute successfully. Based on system performance, continues maintenance and communication among implementation team, HIS can be accepted with condition of continuous improvement and adjustment.
Conclusions: *Active involvements and collaboration from developer team and hospital team, performance improvement and availability of the system is very crucial for user acceptance, satisfaction and overall success of HIS implementation.*

Keywords: *HIS, Implementation, UAT*

PRELIMINARY

Every hospital is required to implement a Hospital Information System (HIS) as mandated by Minister of Health Regulation No. 82 of 2013, but finding a system that fits the needs is a big challenge itself. HIS is an information and communication technology system that processes and integrates the entire flow of hospital services, including registration, billing, outpatient, inpatient, laboratory, radiology, pharmacy and all another supporting services[1]. HIS is very important to manage health problems because it providing data integrity and accuracy, and it can also be a solution to improve cost efficiency, increase access and quality of service in hospitals[2]. HIS implementation is believed to improve the overall quality of care and contribute to patient safety[3,4].

HIS design should be in line with the core business of the Hospital. Careful planning and critical evaluation of progress are important to the successful implementation of major health information technology[5]. Systems that developed by minding and meeting user demands which is called 'user centered design', can be implemented optimally and shows a good level of acceptance and usability[6]. System acceptance is important for the further development of any new technology, including HIS. There are many methods of measuring system acceptance, one of which is common used is User Acceptance Test (UAT). User acceptance has been understood as the contribution of users in system development[7].

Budi Rahayu Hospital at Magelang City, is a brand-new class D public hospital owned by local government that occupies a building formerly known as maternity clinics. This Hospital has implemented HIS in partnership with the SIMKES FKKMK laboratory of Gadjah Mada University since April 2021. During the initial four months of implementation, Budi Rahayu Hospital experienced various challenges, such as adjusting the services process flow, obstacles in data input, and also challenge for reporting related to data accuracy and data captures. For understanding and overcome the challenges, it is necessary to construct a strategy of HIS implementation, and then offer a proper recommendation based on study. This study's outcome can be used as a reference for implementing HIS in a small hospital scope.

METHODS

This study is a descriptive qualitative with action research design. Action research design is a research approach that is carried out collaboratively and in a participatory way by everyone involved in a research process and has the aim not only to understand a phenomenon but also to improve practice and provide solutions as needed[10,11]. This study was carried out at Budi Rahayu Hospital, a brand-new class D public hospital owned by local government. As a new small hospital which was inaugurated in 2019, Budi Rahayu provide outpatient and inpatient services with total 50 beds. The plan to develop the Budi Rahayu Hospital is constrained by the COVID-19 pandemic, which currently operates with deficient resources considering budgeting and planning mechanisms depending on the Regional Health Services.

This study describes four stages of action research i.e Diagnosing, Planning, Action, and Evaluation. On the Diagnosing stage, Author arrange an interview and discussion with Hospital Director, IT Department and Medical Record Unit of Budi Rahayu Hospital to identify needs that motivate HIS implementation. Next, Author plan a strategy to generate suitable recommendations for the successful implementation of HIS. In the Action phase, author conduct an implementation review and assistance. The review is performed by observing of HIS implementation from September – December 2021. Author observe on obstacles encountered during implementation of HIS, and help follow up on solving it, collaborating with the IT department of Budi Rahayu Hospital and SIMKES FKKMK laboratory of Gadjah Mada University. Obstacles that found during implementation are reported through Google Form and regularly reviewed for its follow-up accomplishment.

Aside from implementation review and assistance, author also manage an UAT that held in December at Budi Rahayu Hospital for evaluation phase. UAT is defined as testing the system by the user or client to determine whether it can be accepted or not. UAT consists of a process of verifying that a solution works for the user, the main purpose of this testing is to validate system against the business requirements, so the test is carried out by the end-users who are familiar with the business requirements[8,9]. Hambling (2013) define that UAT may carried out to several steps, that on this research context explained as:

1. UAT Initiation

    From all of available menus in HIS, we selected ten main menus that are considered routinely used in hospital, i.e 'Nomor Antrian', 'Registrasi Pasien Baru', 'Admisi', 'Pemeriksaan Rawat Jalan', 'Pemeriksaan Rawat Inap', 'Radiologi', 'Laboratorium', 'Farmasi', 'Biling', and 'Rekam

Medis (Coding)'. The subject of this study is chosen purposively from departments involved, with total 20 end-user respondents.

2. UAT Design

    UAT is distributed to respondents using a google form questionnaire. Author prepared one questionnaire for each menu and it was given only to authorized respondents who used the menu. The questionnaires contain stages of scenario in the system. This type of testing is called black-box testing. Blackbox testing is a test that examines the functionality of an application without peering into its internal structures or workings. This test is aware of what the software is supposed to do but is not aware of how it does it. For instance, the test verify every scenario that a particular input returns a certain invariable output[12,13]. Scenario stages of each menus was taken from electronic user guide of HIS on page http://docs.simkes.id/user-guide/smart-rs.

3. UAT Execution

    UAT execute at Budi Rahayu Hospital on multiple service units to capture data in a real environment when HIS is used for healthcare services to patients.

4. UAT Closure

    Author confirmed the UAT data to respondents, processed and analyzed data, then presented it to the hospital management.

RESULT

The results in this study will be presented in four stages of action research as follows:

1. Diagnosing

Findings from discussion with Hospital Director, IT Department and Medical Record Unit of Budi Rahayu Hospital is, HIS implementation were urgently needed to accommodate the need for cooperative relationships with national health insurance provider. Implementing HIS also can support routine reporting that required by

the Ministry of Health. Data can be analyzed automatically using HIS, it saves time and effort compared to manual reporting.

Hospital management explain that they need HIS that can be customized, to be compatible with the hospital characteristics. HIS that would be implemented must meet the appropriateness requirements of the regional health services. With the many features offered by HIS, hospitals should map implementation priorities according to the most vital needs for patient care and also considering feasibility of features to be implemented.

2. Planning

With several outlines from the diagnosing stages, we plan to arrange priority features that will be implemented with scheduled timeline. Starting from queue feature that which would be immediately utilized to support vaccines services, to bridging with national health insurance's reimbursement system (v-claim). We also plot strategy for smoothness implementation, that is need active involvements and collaboration from both parties. Active contribution from the developer team would be manifested in assistance during implementation. Hospital team that consist of hospital management and representatives from all patient service units including doctors and nurses, also actively coordinates by holding regular meetings monitored by regional health services.

3. Action

During the implementation assistance of HIS, author encountered several obstacles that can be categorized as problems from HIS aspect and problems from hospital management. Problems from hospital management including lack in data input related with data accuracy that can be affect to the quality of reports. In addition, the implementation of HIS is constrained by medical record form that still haven't meet the

requirements, which medical record forms are important supporting means for data capture. To overcome this problem, author offer a recommendation of medical record forms design as needed. The form is designed based on the results of interviews with the Head of the Medical Records Department and hospital accreditation standards reference. Forms that recommended is:

a. Patient Data form
b. Patient Rights and Obligations form
c. General Consent for Treatment form
d. Initial Medical Assessment of Newborn form
e. Initial Medical Assessment for Inpatient form
f. Initial Medical Assessment for Outpatient form
g. Pediatric Fall Assessment form
h. Adult Fall Assessment for Inpatient form
i. Adult Fall Assessment for Outpatient form
j. Nursing Assessment of Newborn form
k. Nursing Assessment of Pediatric form
l. Obstetrical Needs Assessment form

On the early months of implementation, Author register to total 83 problems from HIS aspect. The problems obtained from the Google Form reports, then can be summarized to several topics as:

a. Bug and error on one or multiple scenarios of HIS.
b. Additional features request to adjust the service process flow in the hospital.
c. Printout form design adjustment as expected by users.
d. User interface customization as desired by users.

The problems are regularly reviewed for its follow-up accomplishment. By December 15th, 84% of problems is resolved leaving 16% of the list still on processing issues. Bug and error on one or multiple scenarios of HIS needs to be analyzed further by UAT to understanding the obstacles and knowing the user acceptance score of HIS.

To achieve the smooth implementation of HIS as expected, the hospital team and developer team formed an online communication group as a place to discuss the problems encountered. There are monitoring activities that involved by regional health services, so the timeline that has been set runs according to the target and the hospital gets optimal benefits of HIS implementation.

4. Evaluation

On the evaluation stages, author manage an UAT which the results can be observed on Table 1.

Table 1. UAT Result Summary

No	Menu	Σ R	Σ Sc	Test Result		User Acceptance	
				S	F	A	N A
1	No Antrian	1	3	3	0	1	0
2	Pendaftaran Pasien Baru	1	4	4	0	1	0
3	Admisi	1	4	1	3	0	1
4	Pemeriksaan Rawat Jalan	3	11	32	1	3	0
5	Pemeriksaan Rawat Inap	2	11	22	0	2	0
6	Laboratorium	4	8	23	9	1	3
7	Radiologi	1	9	7	2	1	0
8	Farmasi	4	9	28	8	4	0
9	Biling	2	7	13	1	1	1
10	Rekam Medis (coding)	1	5	4	1	0	1
	Σ	20	71	137	25	14	6
	%			85%	15%	70%	30%

R: Respondents; Sc: Scenarios; S: Success; F: Fail; A: Accepted; NA: Not Accepted

From the table, the score of acceptance is 70% based on 85% scenario that execute successfully. There are total 6 respondents that not accept the system, 1 respondent from 'Admisi', 3 respondents from 'Laboratorium', 1 respondent from 'Biling' and 1

respondent from 'Coding'. Menus that has zero fail scenarios is 'No Antrian', 'Pendaftaran Pasien Baru', and 'Pemeriksaan Rawat Inap'. There are failure scenarios in another seven menus that described on Table 2.

Table 2. Failure Scenarios

No	Menus	Failure Description
1	Admisi	User cannot fill in patient visit data according to the type of visit (the list of Emergency doctors is incomplete)
		When the user clicks the 'Simpan' button to save patient admission data, sometimes patient data does not appear in the list of admitted patients
		User has never used the 'Print General Consent' button feature because it is not provided yet
2	Pemeriksaan Rawat Jalan	User cannot search for patients who have previously registered outpatient orders in the search column (Patient is already admitted, but sometimes does not appear on the outpatient examination list)
3	Laboratorium	User cannot search for patients who have previously registered to laboratory orders in the search column, orders have been sent to the Lab but the patient list sometimes does not appear.
		User can input fields in the 'Pemeriksaan' section (especially the 'Tambah Keterangan' menu) but it does not appear in the results form
		User can click the back button and return to the lab patient list, but what is desired is to return to the patient page. If there is more than 1 type of lab examination, user must search for the same patient again when user want to input other types of lab results.
4	Radiologi	User considers that they has not been able to input the fields in the 'Informasi Pemeriksaan' section because the radiology doctor's name is not yet in the doctor's name database and the format of the expert results is not appropriate.
5	Farmasi	User failed to find a patient who had ordered a prescription in the pharmacy patient list
		Users complain that the red 'Tambah' button in the action column sometimes cannot be clicked (the page must to be refreshed first)
		User have not fully utilized the 'Update', 'Order', 'Proses', and 'Selesai' pharmacy features because of lack training.

		The Database list of doctor who order on the menu 'Lakukan Pemeriksaan' is incomplete
		User complain that sometimes 'Cetak Resep' button doesn't work (the page must to be refreshed first)
6	Biling	On the billing page for inpatients, there is information regarding bills that do not appear (already inputted) regardless the total amount is correct, its need to be revised for reimbursment need.
7	Rekam Medis (coding)	User cannot fill in the 'Coding ICD 10' data in the form of a diagnostic code (especially for A09.0 and A09.9 code) and also the ICD 9 CM is filled with a list of names for hospital examination, not ICD 9 CM description.

The UAT result is presented to hospital management. Based on system performance, continues maintenance and communication among system provider - users, HIS can be accepted with condition of continuous improvement and adjustment.

DISCUSSION

Based on the result, Implementation of HIS can be discussed on several topics, i.e Benefits of HIS Implementation, Requirements for successful implementation of HIS, Barriers to HIS implementation, and Possible errors that can occur during HIS implementation.

1. Benefits of HIS Implementation

HIS is a computer system that can manage all the information to allow health care providers to do their jobs effectively. Hospitals are becoming more reliant on the ability of HIS to assist in the diagnosis, patient management and education for better and improved services and practices[14]. Side benefits of hospital information systems include efficient and accurate administration of finance. It helps to view a broad picture of hospital growth. HIS also can used to improved monitoring of drug usage, and study of effectiveness. This leads to the reduction of adverse drug interactions while promoting more appropriate pharmaceutical utilization.

From the documentation aspect, HIS enhances information integrity, reduces transcription errors, and reduces duplication of information entries. Hospital software is easy to use and eliminates error caused by handwriting. When health care providers have access to complete and accurate information, patients receive better medical care. HIS can improve the ability to diagnose diseases and reduce medical errors, improving patient outcomes[15].

A national survey of doctors offers important evidence based on study of HIS benefit that is 94% of healthcare providers report that their HIS makes records readily available at point of care, 88% of healthcare providers report that their EHR produces clinical benefits for the practice, and 75% of healthcare providers report that their EHR allows them to deliver better patient care. From the Patient Safety point of view, Yasser (2017) conclude that HIS improves patient's safety by reducing medication errors, reducing adverse drug reactions, and improving compliance to practice guidelines. HIS is an important tool for improving healthcare quality and safety[16].

HIS is currently being used to support and improve the quality of services at Budi Rahayu Hospital. Hospital management express that these systems can enhance the ability of health care professionals to coordinate care by providing a patient's health information and visit history at the place and time that it is needed.

2. Requirements for successful implementation of HIS

The prerequisites for successful HIS implementation are Planning, Executive management support, Medical staff support, Director of Medical Information Systems, User involvement, and Resource allocation[17]. Every element of HIS implementation requires continuous and seamless maintenance.

Implementation is only the beginning of optimization. Incorporating HIS Planning into an ongoing information management program on Hospitals Business Plan does not diminish the importance of HIS but places it as an integral feature of any program initiative[18].

Executive management support has been described as the most absolute characteristic found among Hospitals implementing HIS. Research conducted by Marques states that leadership policies have a major influence on the success of RME implementation, where users say they will comply if there are provisions from leaders that require them to use RME and enter directly using a computer. Another thing that can motivate users to implement RME is if there is a reward for implementing RME. This is consistent with the assertion that financial gain can motivate a person, and that the provision of incentives can withstand the tides arising from the implementation of a new system[19].

Medical Staff Support is very important in adopting RME. While executive management should support RME to provide appropriate resources and demonstrate their importance to the organization, medical staff will be one of the main users [17]. In their spirit to promote the HIS, doctors that appointed as HIS leader have been seen as a role model. Research conducted by Smelcer states that the involvement of doctors and clinical staff can provide motivation and minimize reluctance to use new applications[20].

User involvement is another prerequisite for a successful HIS project. Users cover the full spectrum of physicians as well as administrative, financial, and other people who rely on health records in their work[17]. For the success of HIS, paramedical professionals must interact directly involving patients to educate users about how to use HIS properly. To maximize the medical value of HIS, educating nurses and other paramedical professionals on how to use HIS is necessary[21,22]. User support cannot be separated from the motivation of the users themselves. Winardi

explained that work motivation is an impulse that arises in a person to do work with all the abilities in order to achieve satisfactory work results. A person's motivation depends on the strength of his motives[23].

A final major prerequisite for a successful RME is the appropriate and ongoing accountable resource. Obviously, one of the main sources is funding. However, sources also include people, policies, and processes. Resources in the form of infrastructure are grouped into physical components and technical components, as described by Hartley in his book entitled EHR Implementation A Step by Step Guide for the Medical Practice[24].

Budi Rahayu Hospital procure HIS in cooperation with SIMKES FKKMK laboratory of Gadjah Mada University. HIS funding sources are obtained from the Magelang Regional Revenue and Expenditure Budget. HIS Implementation get support from hospital management and medical staff. User also motivated to utilize HIS with the intention of making their job easier.

3. Barriers to HIS implementation

National culture has a big impact on user's intention to accept the HIS in public healthcare. HIS may not develop optimally without government support[25]. Other obstacles in implementing RME include: (1) Physician resistance, (2) Lack of technology standards, (3) Staff workload. Amayatakul (2013) stated that the current healthcare culture is a barrier to RME. Based on her study, it is also explained that the wide differences in the adoption of HIS require major changes in behavior, workflows, and relationships between health organizations[17].

Each hospital has different characteristics and levels of complexity. This is reflected in the HIS module that is implemented. HIS customization and modification requests are commonplace and must be done so that the system can run according to the business processes desired by the hospital. The provision of

technology and the system providers support that meets the user's demands and expectations is crucial to assure HIS's implementation benefit[26].

During the initial four months of implementation, Budi Rahayu Hospital experienced various challenges, such as adjusting the services process flow and obstacles in data input that can be reduced by training and system adjustment.

4. Possible errors that can occur during HIS implementation

Possible errors that can occur during HIS implementation can be divided to the errors within and the errors without[17]. The Errors Within (intrinsic risk factors) are anticipated sources of errors, which are within the control of the information producer or user, include:

a. Design: The design process defines user requirements, system functions and system workflows
b. Data; need for standardization (data flow)
c. Deployments; test new system
d. Development; construction development phase and system design verification
e. Detection; Fault detection needs to be done

The Errors Without (Extrinsic risk factors) are unanticipated errors caused by factors outsides of the system and beyond the control of information producers or users, include:

a. Changes; there needs to be changes according to development
b. Communications; required between users (users)
c. Complexity; the large variety of components and interfaces in the RME system
d. Corruption
e. Conversions; occurs in the fusion, separation and transformation of information into other media

From the UAT result, it can be define that errors on HIS implementation is from intrinsic and extrinsic factor.

There are several benefits of UAT, that is can increase the client's confidence about the potential of the software to meet the requirements. Through the identification of defects, testing ensures that the device soft is stable and in workable condition. Client satisfaction increases, because they are more confident that the system have met the requirements. Obtain a system that conforms to functional specifications system. The purposes are testing whether the system is in accordance with what is inside system functional specifications. Provide assurance that the delivered system meets business requirements of both sponsors and users. Complements a number of approved addition[27].

Improving the performance and availability of the system is very crucial for user acceptance, satisfaction and overall success. User friendliness and new innovative methods for data entry, can improve the workload and enhance information quality. Organizational support is very crucial, through providing more training to new and old users, more dedicated and protected time during working hours for users to learn and practice on the system after implementation or upgrade and providing better user manuals and materials for training and also as reference for users when they have problems. Other important aspect is providing better and more reliable channels of communication and feedback, since lack of communication channel can decreased user chance to contribute to HIS improvement [28,29]

CONCLUSION

Hospitals are becoming more reliant on the ability of HIS to assist in the diagnosis, patient management and education for better and improved services and practices. HIS implementation was urgently needed at Budi Rahayu Hospital, a brand-new class D public

hospital, to accommodate the need for cooperative relationships with national health insurance provider. With the many features offered by HIS, hospitals should map implementation priorities with scheduled timeline compatible with the hospital characteristics.

Strategic actions for smooth implementation are active involvements and collaboration from developer team and hospital team monitored by regional health services. Active contribution from the developer team can manifested in assistance during implementation. Hospital team at Budi Rahayu consist of hospital management and representatives from all patient service units including doctors and nurses, also actively coordinates by holding regular meetings. the hospital team and developer team formed an online communication group as a place to discuss the problems encountered. There are monitoring activities that involved by regional health services, so the timeline that has been set runs according to the target and the hospital gets optimal benefits of HIS implementation.

System acceptance is important for the further development of HIS. The score of HIS acceptance at Budi Rahayu Hospital is 70% based on 85% scenario that execute successfully. Based on system performance, continues maintenance and communication among implementation team, HIS can be accepted with condition of continuous improvement and adjustment. HIS customization and modification requests are commonplace and must be done so that the system can run according to the business processes desired by the hospital. Improving the performance and availability of the system is very crucial for user acceptance, satisfaction and overall success.

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