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No.	Judul Karya Ilmiah	TahunPelaksanaanPenelitian
1	Sistem Informasi Program Pelaporan ISPA di Kota Surabaya (C113)	2019
2	Pengembangan Basis Data Imunisasi Dasar Lengkap dan Booster Batita (Studi Kasus di Puskesmas Blega Kabupaten Bangkalan) (C125)	2016
3	Development of Recording and Reporting of Nosocomial Infection Surveillance System in Surabaya Premier Hospital (C127)	2018

Adapun penelitian tersebut layak dilakukan dan menghasilkan output yang sangat baik, meskipun belum ada *Uji Ethical Clearance* karena merupakan penelitian menggunakan metode pengembangan sistem informasi yang bersifat deskriptif.

Demikian surat keterangan ini kami buat untuk dapat dipergunakan sebagai persyaratan pengusulan Jabatan Fungsional Guru Besar.

Surabaya, 24 April 2023
Dekan

Dr. Santi Martini, dr. M.Kes
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Development of Recording and Reporting of Nosocomial Infection Surveillance System in Surabaya Premier Hospital

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ABSTRACT

Nosocomial infection is infection that occurs in patients who are hospitalized. One of infection control programs is the surveillance activity. Refer to the Instructions Practical Hospital nosocomial infections Surveillance by the Health Ministry (2011), computer usage in surveillance activities will increase the efficiency of data collection and analysis. The aim of this study was to develop recording and reporting nosocomial infection surveillance system. This study type was action research with System Development Life Cycle (SDLC) method where in the stages of SDLC were planning, analysis, design, implementation and usage. The instruments used in this study were by creating DFD, ERD, data dictionary then continued with the development of applications using PHP and MySQL. Data collection was committed through interviews and observations. The results of this research was web-based applications tested using the method of Technology Acceptance Model (TAM).

Keywords: Nosocomial infection surveillance, Recording and reporting, System development

INTRODUCTION

Nosocomial infection is an infection that patients get during hospitalization (Darmadi, 2008), this infection still becomes the high cause of worldwide morbidity and mortality rate due to 1.4 million patients die every day (Septiari, 2012). In United States, the incidence of nosocomial infection less than 5% of 40 million patients are hospitalized every year, the mortality rate reaches 1% and the cost of handling reaches 4.5 billion dollars per year (Guadalope, 2017).

In Indonesia, in 2010 conducted a study on 10 teaching hospitals and result that nosocomial infections were quite high at 6-16% with an average was 9.8%. Nosocomial infections also cause length of stay of patient which increases to 14 days longer and if calculated, the expenditure of stay cost becomes higher (Kusnanto, 1997).

Nosocomial infection control program with surveillance activities can reduce the incidence of infection. In United States, surveillance can reduce the incidence of primary blood flow infections rate up to 50 to 70%, urinary tract infection is 5 to 14%, wound infections operation for 2 to 17% (Perdalin, 2016). In Indonesia, surveillance activities are also able to decrease the incidence of nosocomial infection rate up to 32%, (MOH, 2001).

Surveillance is the collection, analysis and interpretation of health data systematically and continuously which is required planning, implementing and evaluating of public health efforts evaluation, required by parties in need (CDC, 2001). Lelonowati (2015) mentioned the achievement rate of recording and reporting activities of nosocomial infection at Dr. Iskak Tulung Agung Hospital was only reached 15.38% (very low if compared with the national standard which is more than 80%). This was caused by IPCN officers that did not perform the task of supervision every day due to double tasks of functional duties. While Permanna (2004) in his study found the problems that affect the implementation of PPI activities was the officer of surveillance having obstacles in carrying out their duties because of the dual tasks.

Information technology in implementation of surveillance is needed based on Hospital Infection Surveillance Practice Guide (Health Dept, 2011) which states that surveillance is a time-consuming activity especially almost half of IPCN work time so it takes a full time activity. In this case the computer will be very helpful, especially to improve the efficiency in analyzing. The amount of data to be collected and the complexity in analyzing data is an absolute reason to use computer services. Moreover the surveillance system is not only

deals with current issues but also anticipates future challenges. According to Gunther (2001), he mentioned that there are 10 reasons of the importance in using electronic health technology namely efficiency, avoid duplication of diagnosis or intervention, as base evidence, empower consumers and patients, support new relationships between patients and health professionals, as education, communication, ethics and justice. Gunther also adds that electronic healthcare technology is very easy to use, interesting and pleasing to its users. The use of computer technology with supporting applications can save time, cost and ease in obtaining information to improve patients services and other related environments (Tominanto, 2013).

Nosocomial infection prevention and control program in Surabaya Premier Hospital has been running since this hospital was established. The main activity conducted is by carrying out surveillance. This activity is effective enough to reduce the incidence of infection. Data on infection incidence collected in 2015 and 2016 indicates a nosocomial infection rate is less than 1.5% which is a national standard. Based on preliminary study of recording and reporting system of nosocomial infection surveillance, some problems encountered by the prevention and control committee of Surabaya Premier Hospital in the implementation of this surveillance activity are surveillance officers (or IPCLN) were not on working for 24 hours, double task of nurse of patient care, repetition recording patient data every day, recording committed in 3 forms that had almost the same variable and the availability of system information resources that had not been used optimally. The existing information technology was still used only for administration (billing of patient), inventory and patient data collection therefore it needs to be developed for surveillance activities in order that surveillance activities can be more effective and efficient in middle of resources limitation problem.

Based on the problems above, the prevention and control of Nosocomial infection committee of Surabaya Premier Hospital requires a surveillance information system that will be used as a basis for the development of recording and reporting system of nosocomial infection-based surveillance technology to facilitate data input, processing and data analysis result of surveillance activities nosocomial infection in Surabaya Premier Hospital.

The general objective of this research was to develop a system of recording and reporting of computer-based nosocomial infection surveillance by describing ongoing surveillance systems, identifying existing barriers, identifying and analyzing system requirements, developing system designs, and committing a testing and evaluating of design model of recording systems and surveillance reporting developed.

METHODS

The type of this research was action research formed development of existing system by using System Development Life Cycle (SDLC) method with planning, analysis, design, implementation and usage stage. Assessment of success testing was done by using Technology Acceptance Model (TAM) with its criteria were ease and expediency of new system. Data collection was committed by in-depth interview and observation. Processing and analysis were done by categorizing existing problems to be analyzed using content analysis systematically and qualitatively then the result was described.

RESULTS

The Overviews of Ongoing Nosocomial Infection Surveillance Recording and Reporting System in Surabaya Premier Hospital

Recording and reporting of surveillance was done in the inpatient ward by an officer of Infection Prevention and Control Link Nurse (IPCLN) on part-time duty. There were 8 IPCLN officers working in 8 inpatient wards and 1 Infection Prevention and Control Nurse (IPCN) Supervisor which is responsible on infection control program in hospital.

Daily surveillance recording was done manually using 2 different forms and monthly reports using 1 form. Surveillance data collection was conducted actively and passively. There were infection prevention and control manual book and a complete standard procedure. Data processing and analysis was done by IPCN manually using Micorosft Excel. Completeness of reporting and timeliness of submission of reports reached 80%. The results of nosocomial infection surveillance information each month were reported to hospital and corporate leaders in narrative and table form, while dissemination of results is done every 3 months in the meeting of prevention committee and control of hospital infections.

Identification of disruptions of Ongoing System

The disruptions found in the nosocomial infection surveillance and reporting system are outlined in Table 1.

Table 1. List of Disruptions at ongoing system

	System Components		Problems
1	*Input*		
	A	Data	Repetition of patient data recording in every day and recording was committed manually
	B	Human Resources	Double tasks, There were no full time IPCLNs yet, IPCLN replacement officers were not optimal yet, 1 person (8%) of IPCLN officers have not been skilled
	C	Material	The use of information system in hospital was not already optimal and surveillance form is divided into 3 kinds.
	C	Method	Implementation of surveillance activities had not been computer-based and Recording and reporting of surveillance was done manually
2	Process		
	A	Data Collection	Recording and reporting was done manually, the data was formed in a hard copy file consists of multiple sheets of many forms of correction
	B	Data Compilation	The data was a collection of hard copy files for 1 month, compilation was done manually/excel
	C	Analysis and Process	Working manually with excel, potential errors occurred
	D	Interpretation	There was already none of data interpretation
3	*Output*		
	A	Generated Information	Information in Graphic form
	B	Dissemination	Dissemination of information to the community widely had not been consistent, feedback had no mechanism

Identification and Need Analysis

Identification data and information needs of recording and reporting system of nosocomial infection surveys was obtained from interviews with informants and field observations. The results of data and information needs identification were analyzed according to the input, process and output components that were in information form required by the recording and reporting system of nosocomial infection surveillance in Surabaya Premier Hospital.

Table 2. Recording and Reporting System of Nosocomial Infection Surveillance Data Needs in Surabaya Premier Hospital

No	Information	Data Needs	Source of Data
1	Frequency of Patient Operation	The number of patients operated data	Medical record of patient operated Operation reports
2	Clean operation frequency, clean contamination and dirty contamination.	The number of operation data according to classification of operation proceeding.	Medical record of patient operated according to operation proceeding Operation reports
3	ILO Frequency	The number of ILO incidences data found	Medical record of patient Infection incidence reports
4	ILO Prevalence	The number of ILO incidence data in a month Total action of operation data in a month	Infection incidence reports Monthly surveillance recapitulation reports
5	The number of days of using urine catheter	Date of urine catheter setting up Date of urine catheter release data	Medical record of patient Integration patient reports
6	ISK frequency	The number of ISK incidences data found	Medical record of patient Report of Infection incidence
7	ISK Prevalence	The number of ISK incidence data in a month The number of total days using urine catheter	Report of infection incidence Report of monthly surveillance recapitulation
8	The number of overall days of patient using iv purifier	Date of iv purifier setting up data Date of iv purifier release data	Patient medical record Report of patient integration
9	ILI Frequency	The number of ILI incidences data found	Patient medical record Report of infection incidence
10	ILI Prevalence	The number of ILI incidence data in a month The number of overall days patient using iv purifier	Report of infection incidence Report of monthly surveillance recapitulation
11	The number of overall days of patients' recline	Data of bed rest patients	Patient medical record Report of patient integration

No	Information	Data Needs	Source of Data
12	HAP Frequency	The number of patient of HAP infection found data	Patient medical record Report of infection incidence
13	HAP Prevalence	The number of patient of HAP infection found data in month Data of total days of bed rest patients	Report of infection incidence Report of monthly surveillance recapitulation
14	The number of overall days of patient using ventilator	Data of ventilator installation date Data of ventilator releasing	Patient medical record Report of patient integration
15	VAP Frequency	Data of the number of patient of VAP incidence	Patient medical record Report of infection incidence
16	VAP Prevalence	Data of the number of VAP infection incidence in a month Data of total days of ventilator usage	Report of infection incidence Report of monthly surveillance recapitulation
17	The number of overall days of patient using CVC	Data of CVC installation date Data of CVC release date	Patient medical record Report of patient integration
18	IADP Frequency	Data of IADP incidence found	Patient medical record Report of infection incidence
19	IADP Prevalence	Data of total IADP incidence in a month Data of total days of ventilator usage	Report of infection incidence Report of monthly surveillance recapitulation

Development of Recording and Reporting System of Nosocomial Infection Surveillance
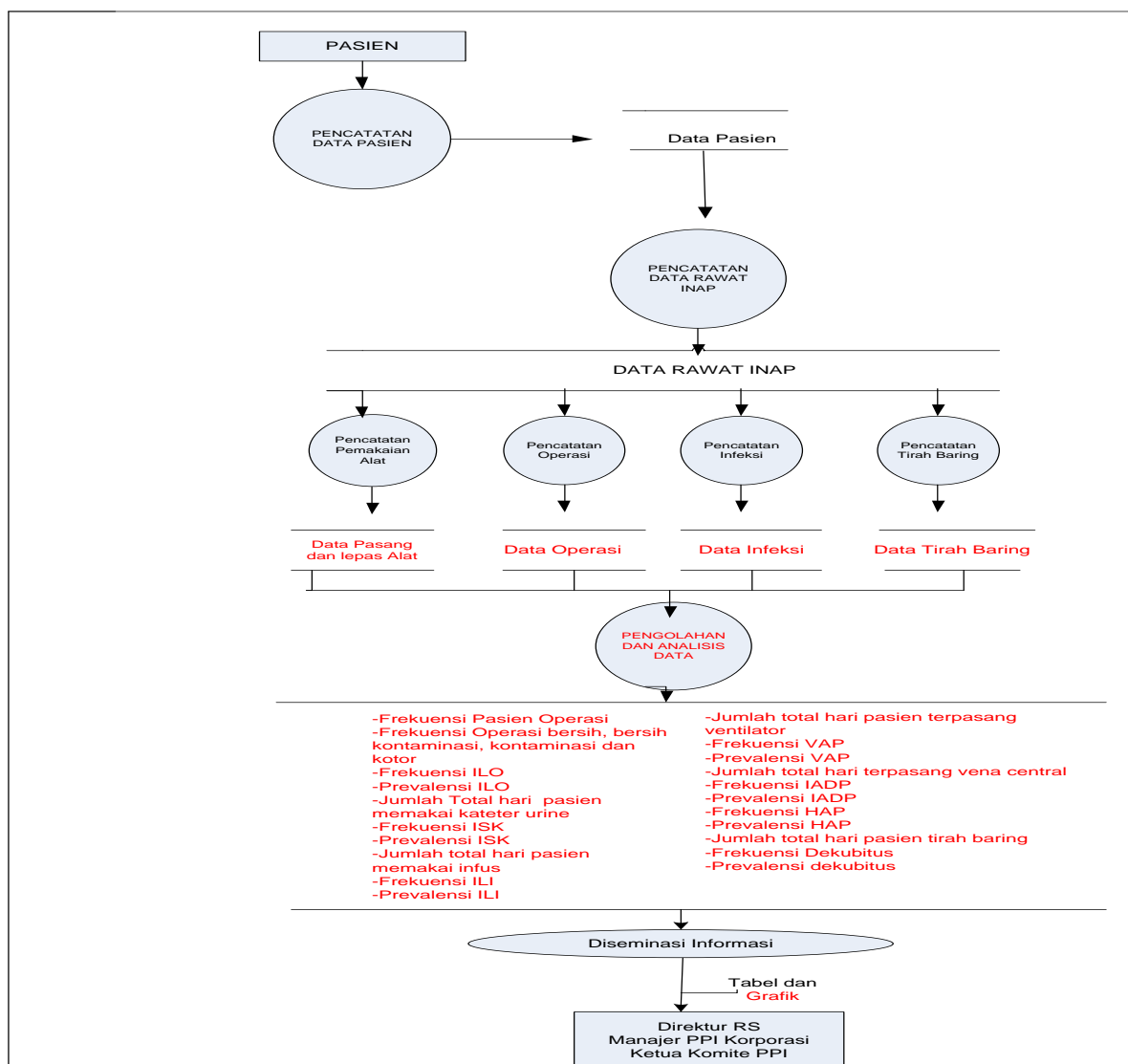

Figure 1. Data flow diagram of recording and reporting surveillance system developed

Development of recording and reporting system of nosocomial infection surveillance is the design of management of various data so that one with others can be connected to form information. The method used in this design was System Development Life Cycle (SDLC) model with four stages namely planning, analysis, design begun with making Data Flow Diagram (DFD), Entity Relationship Diagram (ERD), data dictionary and interface design, and stage of application and use (Gordon, 1995). Data Flow Diagram describes the process of the system developed. The main process in this activity is recording of patient data, data collection, data analysis, data processing, data interpretation and reporting dissemination.
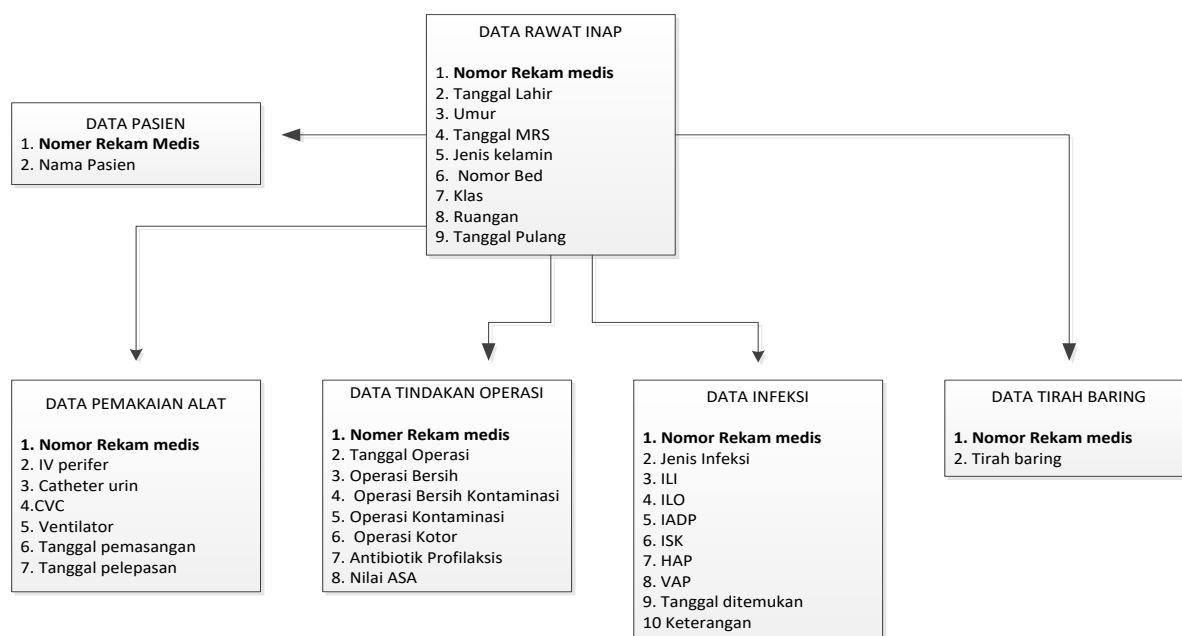

Figure 2. ERD developments of recording and reporting system of nosocomial infection surveillance

The next process is to create a relationship / ERD model such a conceptual data model that views the world as a whole and relationship. In this stage will be committed a normalization of data in order that no redundancy data found.

Table 3. Data Dictionary Surveillance systems and surveillance reporting developed

No	Field Name	Types	Width	Annotations
1.	Medical Record Number	Text	10	patient_number
2	Patient Name	Text	50	patient _name
3	Date of Birth	Date	-	patient _birth
4	Age	Numeric	3	in_age
5	Sex	Option		patient_sex
6	MRS Date	Date	-	in_hospitaldate
7	Bed Number	Text	50	in_bednumber
8	Class	Option	50	in_class
9	Room	Text	50	in_room
10	Date return	Date	-	in_homedate
11	Date of setting up tools	Date	-	install_installdate
12	Date of releasing tools	Date	-	install_releasedate
13	Tools type	Option	3	tool_id
14	Date of infection found	Date	-	infected_founddate
15	Infection type	Option	5	infection_id
16	Infection annotation	Text	100	infection_note
17	Date of operation	Date	-	operation_date
18	Type of operation	Option	10	operation_type
19	Antibiotic Prophylaxis	Text	50	operation_prphylaxis
20	ASA	Text	10	operation_asa
21	Bed rest	Date	-	bedrest_date

The data dictionary above is a collection of elements or symbols used to assist in describing or identifying each *filed* in the database. The last process is to create interface design using XAMPP application as a server that consists of several programs such as Apache HTTP server, MySQL database and programming language using PHP.

Figure 3. Home Page Application of Recording and Reporting of Nosocomial Infection Surveillance at Surabaya Premier Hospital

The interface design is began with a user name and keyword display to distinguish administrator privileges in access that are divided into 2 accounts namely IPCLN and IPCN as shown in Figure 3 above. After entering user name and keyword, main menu will appear as shown in Figure 4 below.
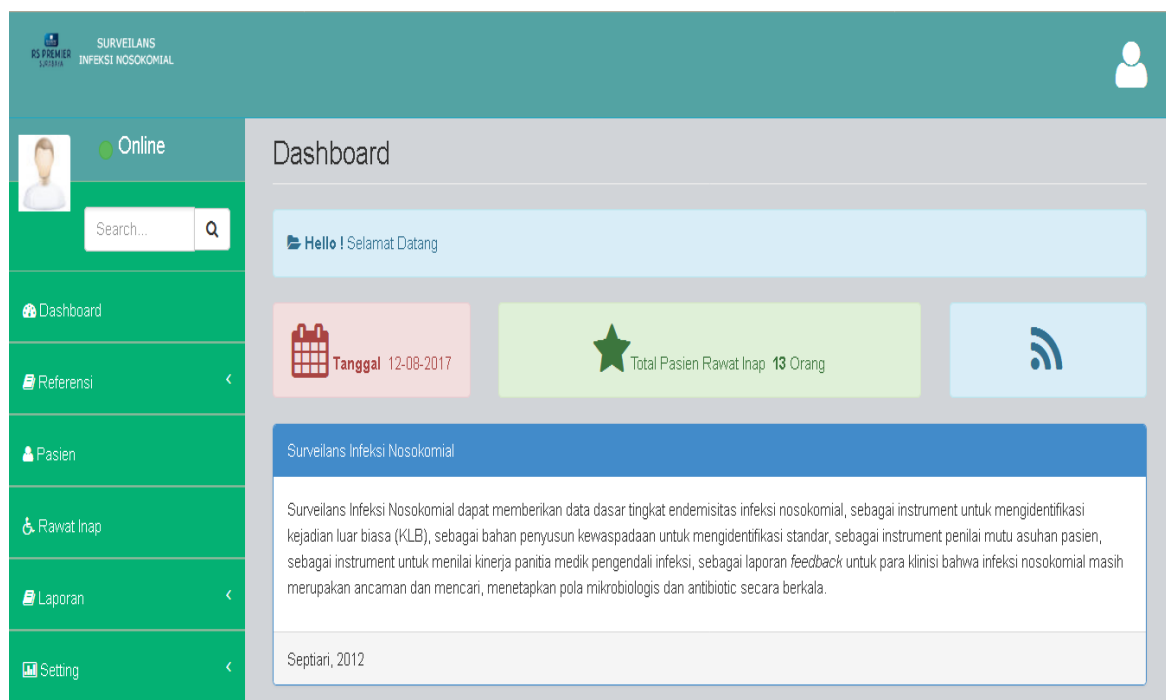

Figure 4. Display Main Menu.

Figure 4 above is displaying the main menu of the recording and reporting system of nosocomial infection surveillance. The main menu display consists of six options, namely dashboard, references, patients, hospitalization, reports and settings. The way to fill the form is begun by selecting the patient data menu consisting of two choices of new patients and old patients, as shown in Figure 5.
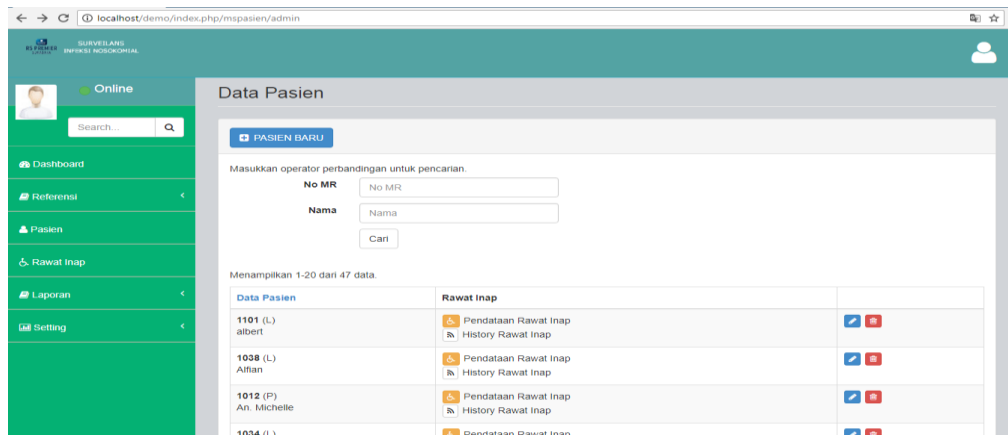
Figure 5. Display of Patient Data Entry Form

Figure 5 is the page to perform the entry of the patient's old data (readmission) by entering data "medical record number" or "patient name" then select "search" then patient data will appear. For data collection of new patients who have never been hospitalized, user should choose "" then input the patient's data based on form as shown in Figure 6.
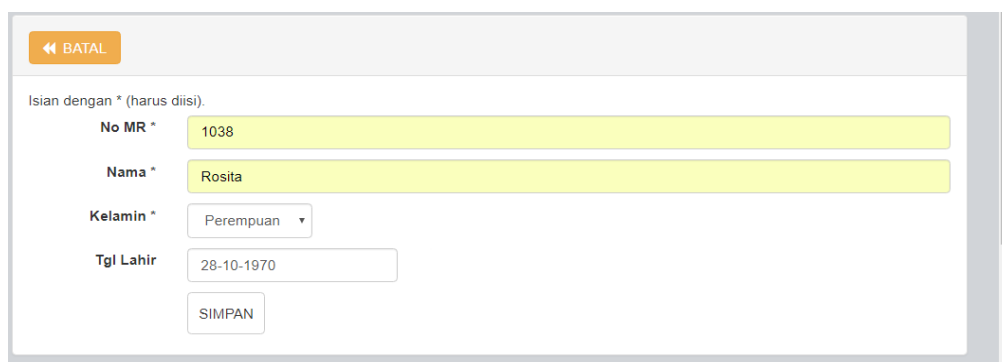

Figure 6. Display Patient Data Input

Figure 6 is a new patient data display that has been inputted, which consists of patient medical record number, patient name, gender, and hospital admission date. After filling patient data then select "inpatient" menu to fill patient data.
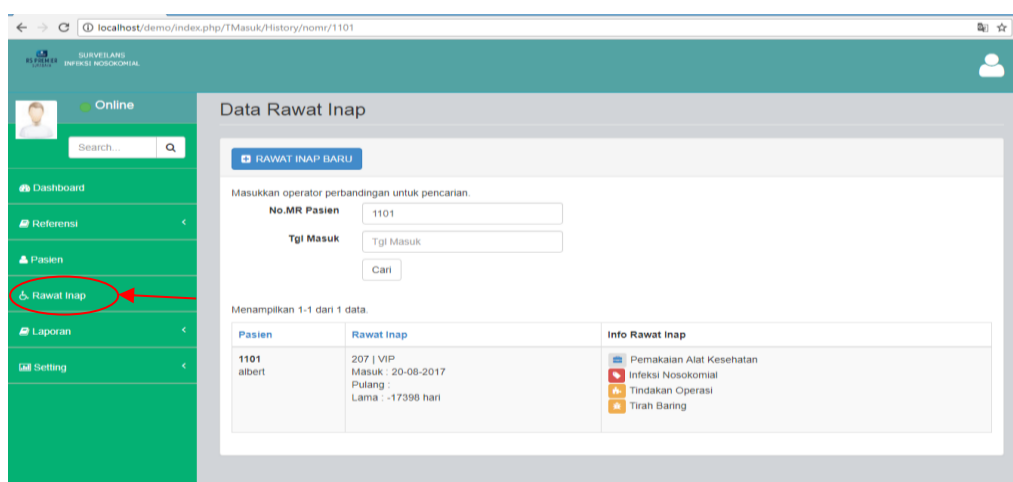

Figure 7. Displays of Inpatient Data

Figure 7 is the result of the display of inpatient data form consisting of "medical device usage data", "nosocomial infection data", "operational action data", and "bed rest data". In the data menu, the use of medical devices consists of the date of installation. The type of equipment used includes iv purifier, urine catheter, CVC and ventilator. Next select the tool which is used and fill the installation date of the tool as shown in Figure 8.
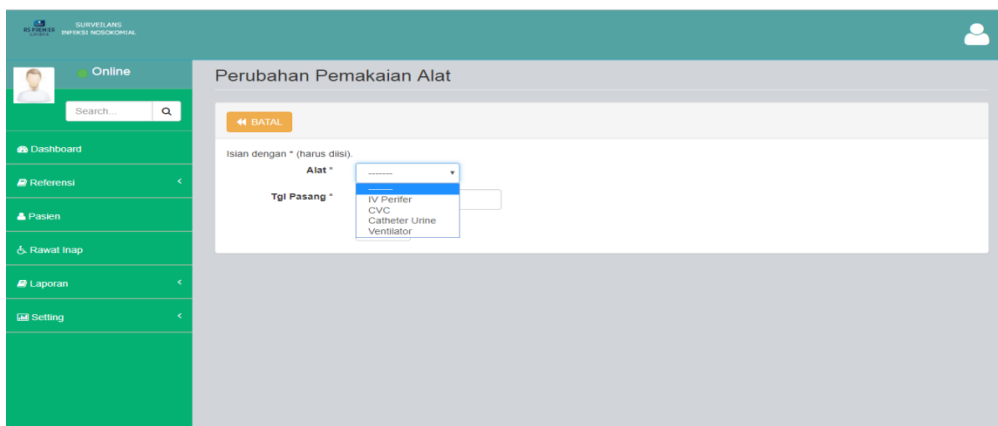
Figure 8. Display Menu Data Use of Medical Devices

On the menu "nosocomial infection data", it will be filled if found any signs of infection. The way to fill this form by choosing the type of infection found, date of infection found, and information filled with signs of infection found or supporting laboratory results, as shown in Figure 9.

Figure 9. Display Menu Data of Nosocomial Infection

On the "operation action data" menu, it will be filled in patients who performed operation. Required forms should be filled include the date of operation, the type of operation action, the type of antibiotic prophylaxis given, and the ASA value as shown in Figure 10 below.

Figure 10. Display Menu Data of Action Operation

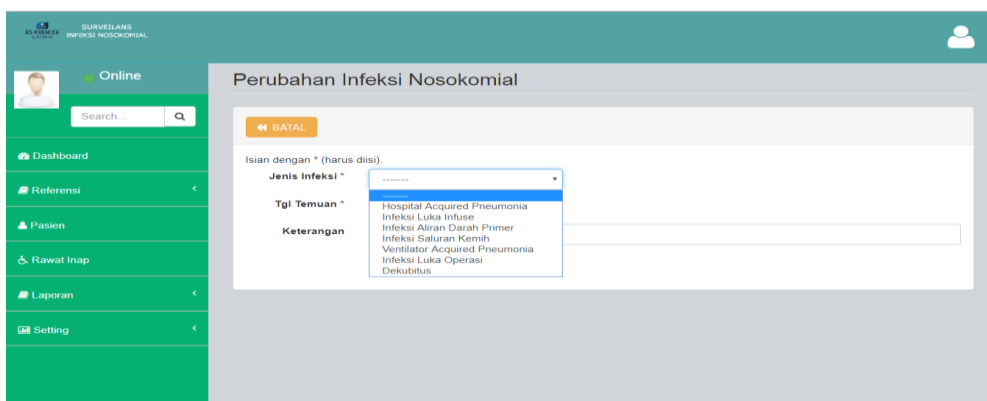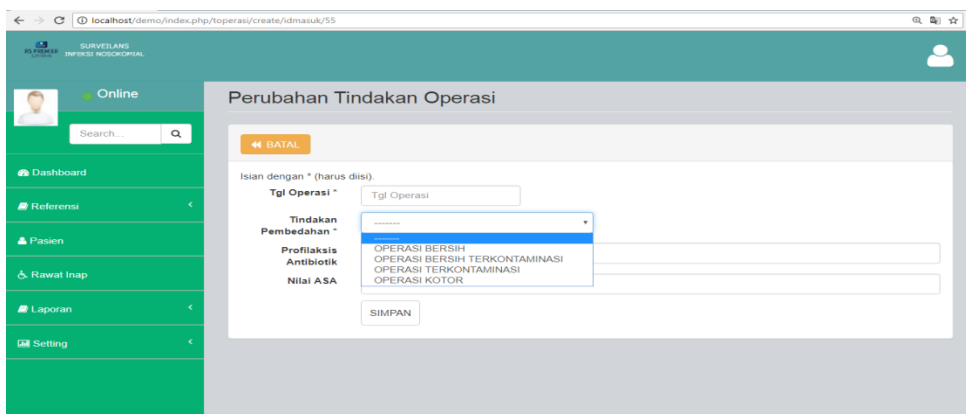On the "bed rest data" menu, it will be filled if patients experience bed rest. The way to fill this form is by selecting [+ PASIEN BARU] every day during the patient's bed rest, as shown in Figure 11.
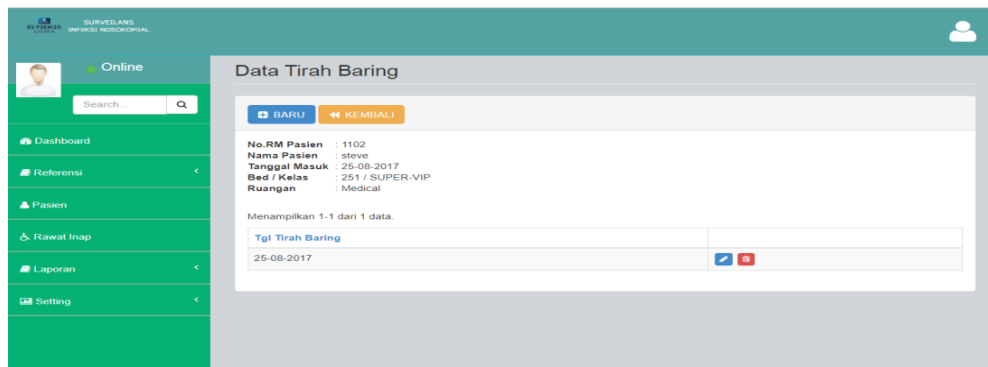

Figure 11. Display Menu Data of Bed Rest

The last stage of the recording process was looking at the results or outputs of the entry data to generate information therefore the development of the nosocomial infection recording and reporting system will be successful. The output of this system development can be seen in the "report" menu. There are 3 report options, namely: 1) Daily report containing records of surveillance of all patients in the room per day or per date, this report can be printed if needed, as shown in Figure 12.

Rumah Sakit Premier Surabaya
Jl. Nginden Intan Barat Blok B
Surabaya 60118

Daily Nosocomial Infection Monitoring

Ruangan : Medical
Tanggal : 23-08-2017

No.	Data Pasien No Bed | Kls | Tgl MRS | Sex MR | Nama	Terpasang Alat Kesehatan								Klasifikasi Operasi				Tirah Baring	Keterangan
		IV Perifer		CVC		Catheter Urine		Ventilator		B	BK	K	Kotor		
		Tgl	Inf	Tgl	Inf	Tgl	Inf	Tgl	Inf						
1	207 | VIP | 08-08-2017 | P 1002 | Ny. Farida	11/08 14/08													
2	201 | SUPER-VIP | 01-08-2017 | P 1006 | Ny. Sulisyowati	03/08 06/08				07/08 21/08									
3	101 | SUPER-VIP | 14-08-2017 | P 1012 | An. Michelle	23/08 25/08	14/08												
4	208-A | I | 05-08-2017 | P 1019 | Ny. Maria	20/08 01/01		05/08 20/08											
5	208-B | I | 05-08-2017 | P 1020 | Nn. Bella	05/08 08/08						05/08 31/08							
6	232 | VIP | 06-08-2017 | L 1022 | Tn. Yusuf														
7	212-A | I | 07-08-2017 | P 1023 | Ny. Ratna	07/08 10/08													
8	239-A | III | 07-08-2017 | P 1024 | Ny. Rubiah	07/08 10/08													
9	240-B | III | 07-08-2017 | L 1025 | Tn. Dahlan	13/08 17/08				08/08 18/08									
10	202 | VIP | 08-08-2017 | P 1026 | Ny. Rahma	08/08 11/08													
11	234-B | II | 10-08-2017 | P 1030 | Ny. Lusiana	15/08 18/08													
12	234-C | II | 10-08-2017 | P 1031 | Nn. Sarita	10/08 13/08									10/08				
13	233 | ISO | 11-08-2017 | P 1032 | Janeta	14/08 17/08													
14	201 | SUPER-VIP | 11-08-2017 | L 1033 | Andreas	21/08				21/08				21/08					
15	207 | VIP | 23-08-2017 | L 1034 | Andika	25/08				06/09		21/08		31/08				23/08	
16	203 | VIP | 12-08-2017 | P 1035 | Rosita	18/08 21/08													
17	207 | VIP | 16-08-2017 | L 1038 | Alfian														
18	208-A | I | 22-08-2017 | P	23/08	23/08			22/08				23/08					

Figure 12. Views of Daily Monitoring Report

2) Monthly recapitulation report containing one month's surveillance data in the room, this data comes from daily recapitulation of daily monitoring data, as shown in Figure 13.

Figure 13. Display of Monthly Recapitulation Report

3) This incident rate report automatically generates the output that had been processed in table and graphic form showing the frequency of occurrence of nosocomial infection and the prevalence of nosocomial infection in the room for a month as shown in Figure 14.
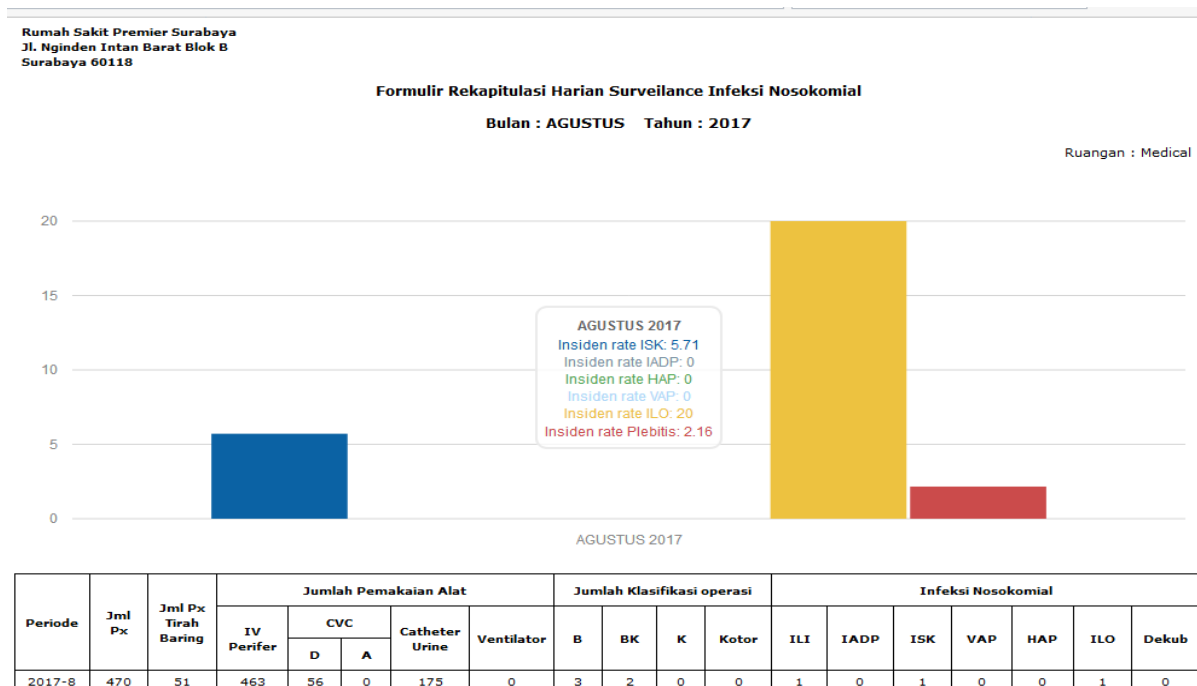

Figure 14. Display Output of Incident Report Rate

Testing Result of Recording and Reporting System of Nosocomial Infection Surveillance at Surabaya Premier Hospital

The test was conducted by 8 IPCLN of 1 person inpatient room and IPCN with data entry simulation of new patient for 3 days.

Table 4. Data Characteristics of Respondents Test

	Characteristics	Frequency	Percentage
Age	25-40	6	66.7%
	41-50	3	33.3%
Education	Nursing Bachelor Degree	4	44.4%
	Nursing Diploma Degree	5	55.6%
Working Duration	1 - 5 years	2	22.2%
	6-10 years	2	22.2%
	> 10 years	5	55.6%

After conducting the test, respondents were given an evaluation questionnaire about the new system developed. Information generated from this test was the surveillance information as in table 5.

Table 5. the Generated Information

No	Information	Form	Annotations
1	Daily Monitoring	Table	Able to be displayed and printed
2	Monthly Recapitulation	Table	Able to be displayed and printed
3	Incidence rate	Table and Graphic	Able to be displayed and printed

Obstacles encountered during new system test were the respondents had not mastered the new system, therefore respondents took time to understand how to operate the system besides they should be given an exercise regarding the system; respondents hurried when conducting test because they had to treat patients so that the time of the test should be adjusted with the schedule of the respondent's service.

Evaluation of recording and reporting system of nosocomial infection surveillance used the theory of Technology Acceptance Model or TAM which is evaluate the ease and usefulness of application using. The results of questionnaires showed that 66.7% stated that the application is very easy to use, 22.2% stated easy, and 11.1% stated quite easy. While regarding usefulness, 77.8% of respondents said the application is very useful in running surveillance activities and 22, 2% stated useful.

DISCUSSION

The hospital has infection prevention and control committees whose members consist of doctors, nurses and other members. There was 1 IPCN officer with 168 bed capacity, surveillance program with monitoring and visit patient every day, there was evaluation activity was done every 3 month as meeting, availability of computer facility, internet and intranet, therefore the system which run now had not fulfilled standard regarding on resources supply of IPCN wherein the hospital should have 2 IPCN officers. Aside the hospital had not used the information technology for conducting surveillance activities

The obstacles that exist in the current recording and reporting system were limitation of IPCLN personnel who did not work full time so that they were concurrently assigned, the recording of surveillance reports was committed manually and repetition of recording the same data on the same patient every day, and the facilities had not been utilized maximally that exists, in this case is information system. According to Health Ministry Regulation of Indonesia Number 27 of 2017 related Guidelines for Infection Prevention and Control in Health Services Facilities outline that every 100 beds must have 1 IPCN officer, based on the guideline the Premier Hospital, it needs 1 more IPCN personnel and requires full time IPCLN personnel to perform the task maximally.

The needs for data and information systems for recording and reporting of nosocomial infection surveillance was identified through deep interviews and observations from IPCN, IPCLN, Supervisor of management system information and electronic record project manager being built in hospital. Needs identification are based on input, process and output components. There are 22 data types and 19 information from surveillance recording and reporting system required including patient data, inpatient data, medical device usage data, nosocomial infection data, operational action data and bed rest data; and required information

including operating frequency, ILO incidence frequency, ILO prevalence, IADP, VAP, ISK, total number of bed rest, HAP frequency and HAP prevalence.

The surveillance activities were carried out manually which meant had not used computer technology. According to the Hospital Infection Surveillance Guidebook 2011 issued by the Health Department stated that surveillance activities require computer technology to improve the efficiency in analysis process therefore it is an absolute reason to use computer services. In Premier hospital, surveillance activities carried out had not met the standard because the existing information system was used for administration and patient database.

The development of recording and reporting system of nosocomial infection surveillance uses system Development Life Cycle method (Gordon, 1995). This method consists of planning, analysis, design, implementation and usage. In its design, this system begins by creating a DFD to explain the flowchart of the data then followed by creating an ERD to describe the interconnection between tables and fields on a database system (Agus 2014), to avoid duplicate data recording. The next stage is to create a data dictionary that describes the elements or symbols used in system design.

The test and evaluation of this system used the theory of Technology Acceptance Model (TAM) (Davis, 1989) that assesses ease and usefulness. The results of the evaluation showed that 66.7% respondents said this application is very easy to use and 11.1% stated easy to use. Regarding the evaluation of the usefulness of this application, 77.8% respondents said this application is very useful in supporting surveillance activities and 22.2% respondents said useful. Based on the practical guide book of hospital infection surveillance, the use of information technology is very efficient and appropriates with the aims of development this surveillance system.

CONCLUSION

Based on the results of research development of this surveillance system, it can be concluded as follows.
1. Ongoing surveillance system in Premier Hospital is recording and reporting surveillance system using three forms done by IPCLN manually, recording is committed every day by repeating the same data in same patient and report in the narration and table form
2. The obstacles of ongoing systems include IPCLN officers having double tasks, manually recording and repeating the same data every day and the information system have not accommodated the surveillance activities.
3. Data and information needs of surveillance system include the frequency of nosocomial infection incidence, prevalence of nosocomial infection incidence, total days of application usage, operation frequency and type of operation proceeding.
4. Development of recording and reporting system of nosocomial infection surveillance use System Development Life Cycle (SDLC) theory.
5. Testing and evaluation of system development showed that this developed application is very easy and useful to help IPCN and IPCLN works.

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