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# PATIENT CLINICAL DATA INTEGRATION IN INTEGRATED ELECTRONIC MEDICAL RECORD SYSTEM FOR HEALTH CARE FACILITIES IN INDONESIA

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**Abstract**

Complete patient service requires continuous support of clinical history. This can be realized by integrating electronic medical record data. The limitation is the wide variety of software, formats, and data dictionaries used in healthcare facilities. This was a descriptive analysis study with cross sectional approach to find open source electronic medical record integration model for clinical data exchange between health care facilities. Respondents were doctors, nurses, pharmacists, laboratory staffs, and person in charge of hospital information system as informant for content analysis. From the study, we managed a web-based service portal to implement clinical data integration that can be accessed by clinician registered within the Ministry of Health. The patient's clinical history is stored in the hospital database and requires unique OpenIDRM code on the Health Service Server to integrate it. OpenIDRM contains all of the patient's medical record number, as one patient may have several different medical record numbers in several hospitals. In conclusion, clinician can access the patient's clinical history by opening a web portal system through a unique OpenIDRM code.

## Introductions

According to Law No. 40 of 2004 about National Social Insurance System (SJSN) and Law No. 24 of 2011 about Social Insurance Administration Organization (BPJS), nowadays the government has implemented BPJS since January 1st, 2014. BPJS coverage of service continually increase its member until it achieves universal health coverage in 2019 (Kementerian Kesehatan RI, 2015).

One of its accomplishment strategy is health financing, that is the access and control toward Health Care Facility (HCF). The key factor of decision making are human and supporting resources, such as qualified data of medical record (Kementerian Kesehatan RI, 2015). The government has already developed online National Health Information System (SIKNAS) which will connect resources in every HCF . Basic components needed to be perfected are health data validity and completeness of medical record. Based on WHO, electronic medical record contains all individual health information which provide clinical history of patient to health care provider for outpatient, inpatient, and emergency situation. Quality medical record is needed to achieve a whole and complete patient care. Clinical data can be managed with computer system, according to literatures (Bates, 2003; Hersh, 2016). We can use tabular, warning information, and mapping to present the information with ease

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to the person in charge of the health program, i.e. Toddler Nutrition Geographic Information System for Family Health Nutrition Officer of Health Office (Setyowati, 2015).

The biggest problem nowadays is varying use of software, format, and data dictionary in every HCF for data recording. As we know, medical record is a data source to determine health profile and decide health financing in HCF. It contains document and record of patient identity, examination, treatment, and other services given to the patient. Therefore, standardizing data capturing, definition, information presentation, and reporting is key in the success of SIKNAS.

The aim of the study is to identify the need of medical record user in HCP, the type and source of clinical medical record in HCP, and to design a prototype of electronic medical record system model which can provide evidence-based information and is exchange-able to each HCP.

**Methods**

We used qualitative descriptive methods and cross sectional design, and focuses on the recording and management governance of medical record at type A and B hospital that already used Hospital Information System (SIMRS) in Semarang, the survey of integrated clinical data need, the challenge or problems of using SIMRS for clinical data integration.

We asked doctor and nurse as medical record data user about data need and clinical information, pharmacist about treatment data needs, and laboratory staff about data needs of supporting service as supporting clinical data. We also interview reporting staff of Central Java Health Office to explore the information policies and the needs of integrated medical record system for various hospitals under their supervision. We observed medical record document and reporting form that have been collected from medical record management system in the hospital. Next, we analyzed and developed the system from collected data. We started by describing systemic and content needs analysis; defining scenario from the user – doctors, nurses, pharmacists, and laboratory staffs – to find open source based of integrated electronic medical record system model for exchanging medical record data in each HCF. This integration is intended to ease analysis and decision making (Bates, 2006).

Electronic medical record (EMR) system has the potential to increase quality of health service, smooth the workflow, and increase efficiency in health care system (Weiskopf, 2013); Williams, 2017). Medical record data exchange is also beneficial for completing patient care service, because of continuous reading and recording data, even in different HCF. Patient safety factor is also fulfilled because of early detection function, such as duplicate drug and allergic reaction (West, 2015).

**Results and Discussions**

All sample hospitals have already used Hospital Information System (SIMRS) as a supporting service for internal and external reports. The limitations of using SIMRS in hospital and expected need of integrated clinical data are slow connection, server error, light-out problem, limited use for information and patient billing only, not optimal clinical data entry, non-entry of supporting examination data, unfamiliarity of the medical worker with technology; limitation of inter-health worker communication includes entry data discipline, absence of laboratory and radiology result, incomplete and manually-managed anamnesis, manual receipt, laboratory and radiology result being not inputted yet, medication being not input despite already delivered to patient, many file to open for identification; limitation of showing pathology history include an examination result or patient history that was not inputted to the system and low desire to input the data; user expectation of clinical data management, consists of simple and easy operation to display disease history, treatment, and supporting examination, complete patient data and that it can be used as clinical decision analysis, and continued patient service data quickly and accurately from health workers; whereas user expectation of showing pathology history is decrease in paper use and less writing, patient history need not be written in medical record, and system security via user accessibility that had already been done.

Interview results with Hospital Information System staff about possibility of system integration and interoperability between

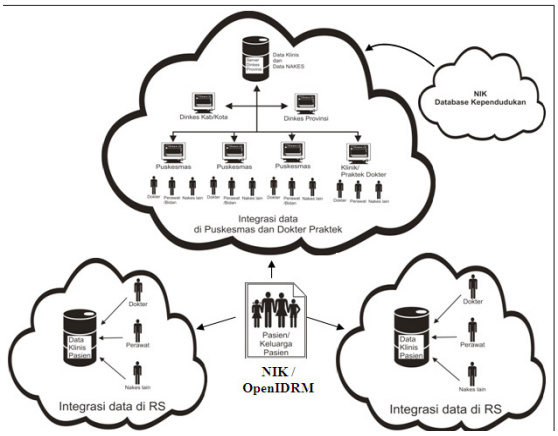



Figure 1. Electronic Medical Record Plan Model between Hospitals

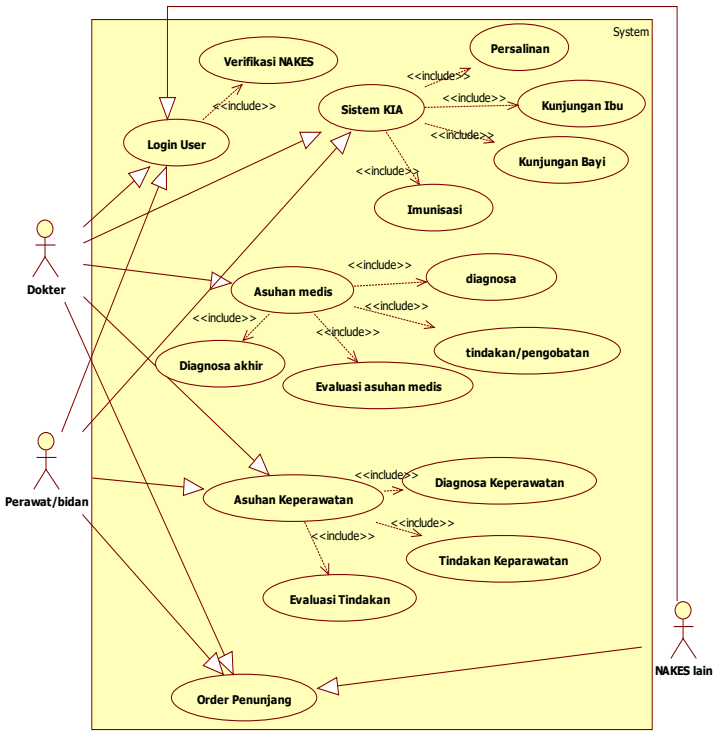
hospitals was shown below:

> "*It is possible and we are ready to perform integration of interoperable HCF system, because until now we already used information technology and SIMRS. The requirements are standardization of data, processes including clear rights and obligations limitation, and web service and its security. We are ready to realize this integration and interoperability system. We also ready to coordinate and discuss these plan.*"

This contradicted the current situation in Ministry of Health as stakeholders, as there was no specific rule about electronic medical data or standard data in medical record exchange. Nevertheless, there is recently a regulation of Indonesian National Standard (SNI) about e-health, which adopted from ISO, and Indonesian Health Metadata as standardization arrangement.

We could make functional needs analysis of system user from doctor which include the use of system for patient diagnosis, communicate or consult with other health workers for his/her patient, show patient pathology result and treatment, record drug demand for pharmacy and supporting examination order to laboratory staff, and show the laboratory exam result from requested order. The functional needs of the nurse are: the system could record initial assessment or patient base condition like vital sign, nursing plan, and also implementing and helping evaluate nursing plan from the handled patient. Laboratory staff functionally needed that the system could show the order/demand of supporting examination from the doctor. Whereas functional needs of pharmacist are that the system could show list of drug order/receipt from patient, help for requesting drug provision, and help to monitor drug stock and expired drug.

Analysis-based system plan as illustrated in Figure 1. Our plan started from hospital database server, as shown at Figure 1, where every hospital keeps their inpatient, outpatient, and emergency patient clinical data in their local database. Each hospitals must provide OpenIDRM (Open Identity Medical Record) number as a unique key for doctor or nurse in other HCF to access the database. These numbers are registered in Health Office server and are also integrated with Single Identity Number (NIK) of Civil Registry Office, Ministry of Home Affairs. The database was used to save patient clinical service data in every Community Health Center (Puskesmas), Clinic, or Private Practice Doctor. The data were saved according to the service and must enclosed OpenIDRM as a unique key for each patient. These medical record data integration was managed with web-based portal service, which can be accessed by all health workers registered within Ministry of Health, Republic of Indonesia. Both of health worker user and patient OpenIDRM database saved in Health Office server. The OpenIDRM




Gambar 2. Medical Record Integration Model Diagram of Use Case

database contains all medical record number for each patient, where one patient can have several different numbers in different hospitals. There is no similar medical record number for each patient in "X" hospital compared to in "Y" or "Z" hospital. However, there is only one specific unique number of OpenIDRM for each patient.

Description of process in those systems was shown in Figure 2. The role of user system task is: Doctors are only allowed to access his/her patient, insert, update, and delete data for 1x24 hours after service, but he/she cannot print the medical record because of security and confidentiality. Nurse/midwife can only accessed his/her patient in their nursing room, or midwife can only accessed their patients, insert, update, and delete data for 1x24 hours after service, but he/she cannot print the medical record because of security and confidentiality aspect. Other health workers (Nutritionist, Physiotherapist, Hemodialysis staff, operation room staff, ICU staff) can only accessed consulted patient to their room, or midwife can only accessed their patients, insert, update, and delete data for 1x24 hours after service, but he/she cannot print the medical record because of security and confidentiality aspect. Medical record staff can access all patients' medical record data and printed it anytime if needed, but they cannot insert, update, and delete data, except for social data if there is a request to change social data.

Relationship between each storage table that be used in electronic OpenRM system is shown in Figure 3, with the detailed explanations of storage function are shown in Table 1.

This OpenRM prototype was developed using PHP program with MySQL database and is accessible with browser. The system was controlled by user login which is completed with authentication and authorization using user management via registration page as seen in Figure 4.

Doctor or physician could display patient health history, such as patient disease history (Figure 6), treatment history (Figure 7), and visitation history (Figure 8). Each patients can have many medical record number for every visited hospitals, however there is only one integrated medical record key with OpenIDRM

Below is chart of storage links as shown in Figure 3.

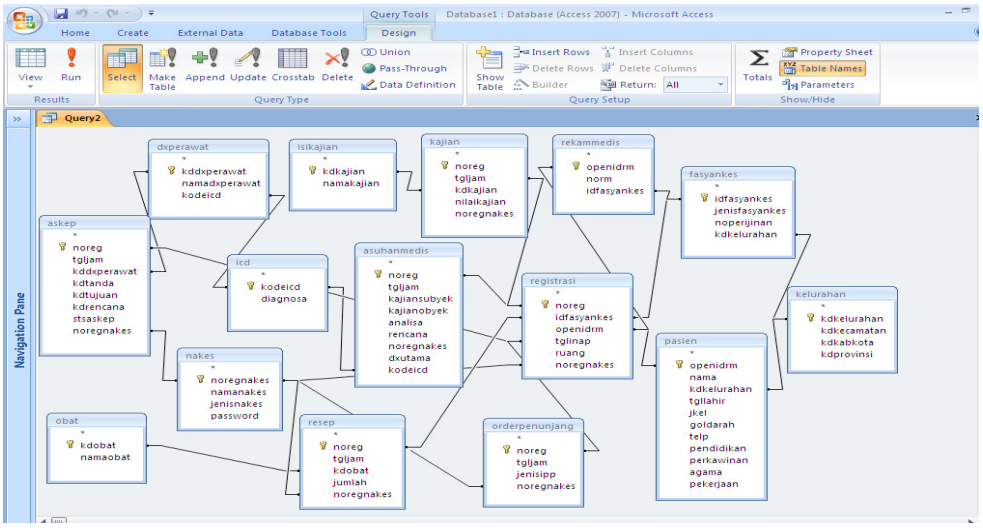



Figure 3. Chart of Each Storage Table Link

Table 1. Storage Function Table

| No | Table Name | Function |
|---|---|---|
| | Patient | Record patient identity data |
| | Village | Record area data according to Minister of Home Affairs decree |
| | Health Care Facility | Record HCF data (hospital, Community Health Service/ Puskesmas, private practice doctor, etc.) |
| | International Statistical Classification of Diseases (ICD) | Record disease code data |
| | Drug | Record drug name list |
| | Health workers | Record health workers data (doctor, nurse, midwife, others) |
| | Registration | Record patient registration data |
| | Medical record | Record list of patient medical record number that has been owned by patient from various HCF |
| | Assessment | Record patient initial condition assessment data |
| | Content of assessment | Record detailed assessment data |
| | Nursing assessment | Record patient nursing assessment data from the nurses who handled him/her |
| | Nursing diagnosis | Record nursing diagnosis list |
| | Medical assessment | Record patient medical assessment data from the doctor who handled him/her |
| | Drug receipt | Record drug demand list |
| | Supporting exam order | Record supporting examnination demand data |

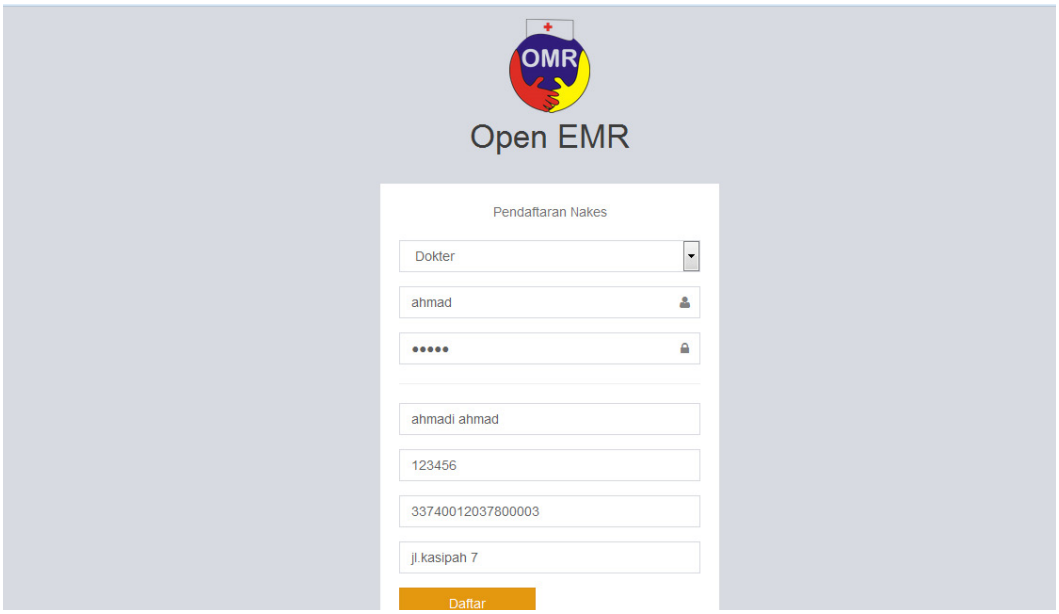



Figure 4. Screenshot of Health Worker User Registration Page

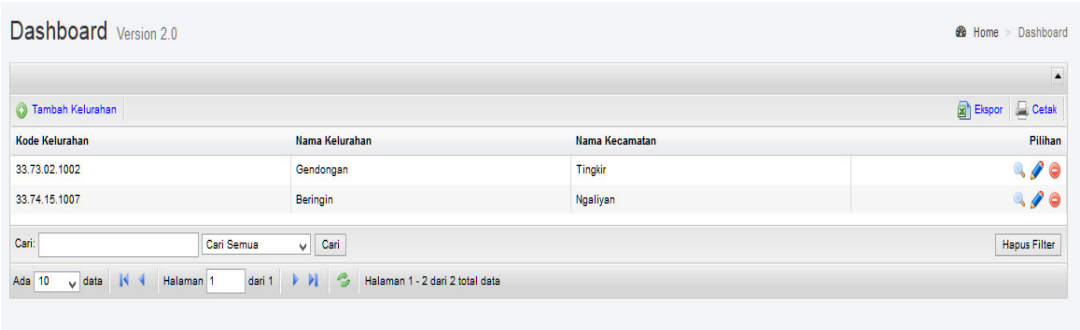



Figure 5. Screenshot of Hospital List Data

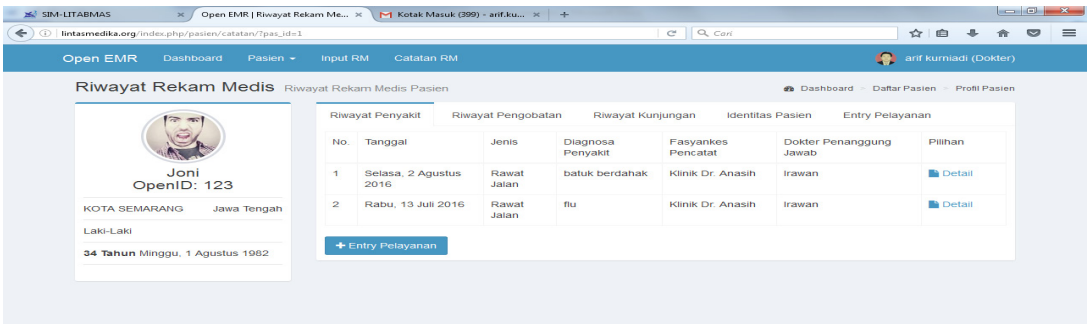



Figure 6. Screenshot of Patient History List

or OpenID number.

Details of clinical history of previous disease can be shown in Figure 6, so the clinician can be informed about previous history for treatment decision making.

In Figure 8, patient visitation history – every HCF which he/she ever visited and every doctor who ever managed him/her – are shown to display details of previous history service from the clinician who have handled the patient.

**Conclusions**

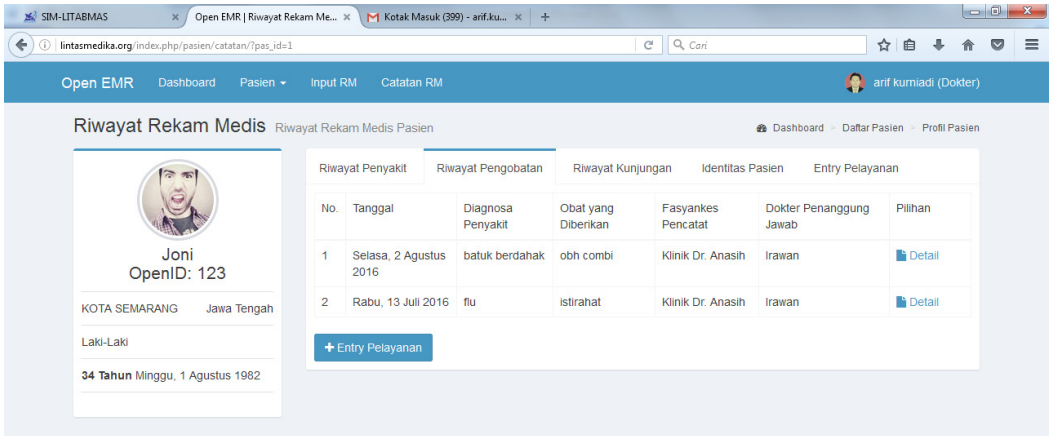



Figure 7. Screenshot of Patient Treatment History

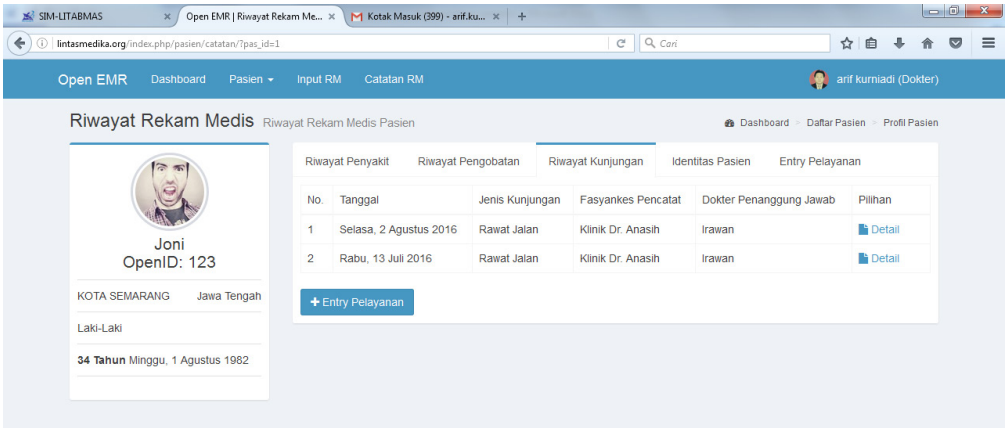



Figure 8. Screenshot of Patient Visitation History

Infrastructure condition and user readiness, including doctor and nurse, are sufficient to carry out integration of medical record data, especially clinical patient data which can be exchanged to each HCF, despite varying quality of infrastructure variation in each HCF. Integrated medical record user system design, particularly clinical data of doctor from his/her handled patients, nurse for the patient who was admitted in their nursing room, and other user such as nutritionist, physiotherapist, hemodialysis staff, operation room staff, ICU staff for every admitted patient in their unit, can insert, update, and delete the data for 1x24 hours after service, but he/she cannot printed the record because of security and confidentiality aspect. All access and data change required the use of user ID and is systematically recorded, so who and what change is done to the system can be tracked, especially medical clinical data of doctor and nursing assessment of nurse.

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