

Design of Inpatient Electronic Medical Records to Improve Patient Health Services

Tominanto¹, Eko Purwanto² and Novita Yuliani¹

¹Faculty of Health Sciences, Universitas Duta Bangsa Surakarta, Surakarta, Indonesia

²Faculty of Computer Science, Universitas Duta Bangsa Surakarta, Surakarta, Indonesia

Keywords: Electronic Medical Record, Inpatient, Patient, Health, Waterfall

Abstract: Medical record is a file that contains records and documents about patient identity, examination, treatment, actions and other services that have been provided to patients in health care facilities. Most hospitals in Indonesia have implemented a computer-based Hospital Management Information System, however for the majority of patients' medical record services are still manual. This manual medical record has the disadvantages of requiring a large storage area, a long-time services, and a lot of human resources to access the data. Moreover, documents are easily damaged and data security is not guaranteed. This can result in less optimal patient health services. This research aims fasten the management of inpatient medical data recording, so it can run quickly, precisely and efficiently. This system development method uses waterfall. This information system is based on WEB using the PHP programming language supported by the MySQL database. The results of this designed system show that the system is able to store and present inpatient treatment history information faster and more accurate. This designed system will be able to improve the inpatient medical record service to be more optimal. This designed system can be one of the solutions to the problems of inpatient medical record services that have been done manually.

1 INTRODUCTION

Generally, every hospital in Indonesia will improve its services to patients as well as possible. Therefore, support from various related health service factors are needed. One of them is the implementation of applicable standards for medical record. Medical records are files that contain records and documents about patient identity, history, examination, treatment, actions, and other services to patients at patient care facilities (Permenkes, 2008). Medical record is confidential, secure, and contains information that can be accounted for. Medical Record is also a compilation of facts about a patient's health condition and illness which includes documented data about the present and past illness, also treatment that has been and will be carried out by medic in writing (Puspitasari et al., 2013).

Electronic Medical Record (EMR) is a medical record technology that uses information technology devices to collect, store, process and access data stored in patient medical records with a database management system that collects various sources of medical data (Handiwidjojo, 2015). The use of EMR can

provide information on the history of examinations, treatment and development of patient health quickly and accurately to improve higher quality advanced health services. In addition to improving administrative services, the use of electronic medical records can facilitate retrieval of patient health service information that has been provided (Schnipper et al., 2008).

Most hospitals in Indonesia have implemented a computer-based Hospital Management Information System. However most of the patient's medical record services are still done manually. This manual medical record has the disadvantage of requiring a large storage area, a long-time service, a lot of human resources to access, more over the documents are easily damaged and data security that is not guaranteed. This can result in less optimal patient's health services (Tominanto et al., 2018).

Research on the development of information systems or applications of electronic medical records has been widely carried out including (Chuan, 2014), (Pan et al., 2014), (Kho et al., 2012), (Purnama, 2020), (Khasanah and Rosyidah, 2011). These studies develop various electronic medical record models to solve the problem of managing medical records by us-

ing various methods, software and specific databases. However, most of them produce conclusions that electronic medical records can improve patient health services. This study focuses on the development of an electronic medical record model for inpatient medical record services, namely the design of inpatient electronic medical records using the waterfall software development method (Sasmito, 2017), PHP programming language and MySQL database.

2 METHODS

The method of developing electronic medical record software using waterfall has 5 stages : communication, planning, modeling, construction, and deployment as in Figure 1 :

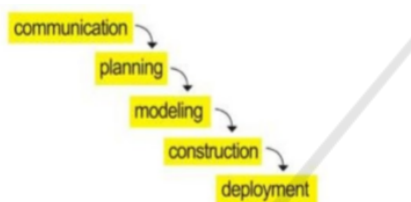


Figure 1: Waterfall method

The stages of the waterfall system development in Figure 1 are as follows :

1. Communication is a comparison of the current system with the information system proposed using the PIECES aspect
2. Planning is the retrieval of information related to the needs of system users
3. Modeling is the representation of system requirements into a design as a standard for designing an application
4. Construction is a waterfall system design implementation into an application through coding and testing processes
5. Deployment is the implementation of applications that have been created by testing the system that has been run.

The stages of developing the waterfall system in Figure 1 are carried out sequentially from the communication, planning, modeling, construction, and deployment. However, when a stage finds a problem, it can be repeated back to the previous stage or to an earlier stage, then proceed to the next stage in sequence until the inpatient electronic medical record software is successful in the system testing phase.

3 RESULTS AND DISCUSSION

3.1 Designed System

The results of this study began with the design of an inpatient electronic medical record architecture as shown in figure 2 :

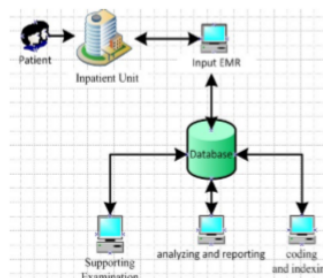


Figure 2: Inpatient electronic medical record architecture

In the system architecture, the figure 2 shows that the patient who conducts the examination or treatment in the inpatient unit will get an electronic medical record information service from the inpatient EMR. Inpatient EMR accesses data from databases that have been connected with various health services including registration, supporting examinations, medical measures, supporting examinations and medicines.

The flowchart overview of the process of inpatient electronic medical records such as Figure 3 below:



Figure 3: Inpatient electronic medical record flowchart

The of inpatient electronic medical record flowchart in Figure 3 flows as follows:

1. When patients come for treatment is determined as a new visit or an existing patient
2. If a new visit then inputted registration as a new patient, whereas if an existing patient then the data is sought in the registration system and then registered as existing patient
3. The next stage is the doctor’s examination process and nurses in the inpatient room, at this stage the

- doctor or nurse can read or access the patient’s medical record before giving medical treatment
4. Doctors, nurses and other medic can provide medical treatment, supporting examinations and medicines during the patient being treated and record the entire medical treatmentand services at the Inpatient EMR.
 5. All medical record data during treatment will be stored in a database and can be used for further treatment services and for the purposes of hospital management reports.

The next design is the Use Case Diagram of an inpatient electronic medical record as as shown in figure 4 :



Figure 4: Use Case diagram of an inpatient electronic medical record

Use Case Diagram of an inpatient electronic medical record in figure 4 shows that in this inpatient electronic medical record system there are at least 6 actors namely: Patients, Medical Record Officers, Nurses, Doctors, Laboratory Assistants, and Pharmacists. The first stage begins with patients who register to be served by medical records officers. The second stage the patient gets an examination and medical action from doctors and nurses, in this process there will be carried out supporting tests of laboratory tests conducted by the laboratory assistantif needed. The third stage is the process of prescribing medicines by the doctor and continued with the service of taking medicines by the Pharmacist. The processes in the Use Case Diagram are developed electronically and are interconnected in a database of inpatient electronic medical records.

3.2 System Implementation

The inpatient electronic medical records design is implemented with the PHP programming language and MySQL database. The results of the implementation are as follows:

1. Inpatient data input form

The inpatient data input form is used to input new inpatients. Display form is like the following figure 5:



Figure 5: Input form for inpatients

Data entered on this form is patient’s identity. Patient identity that has been entered is stored in an inpatient electronic medical record database. Besides input data, there is also a data update menu on this form.

2. Inpatient registration data input form

The registration data input form is used to enter new and existing patients who will register for hospitalization. Display the form as shown in figure 6 :



Figure 6: Inpatient registration form

In this form, inpatient registration data is consistof patient identity data, responsible data, method of payment, guarantee number, treatment room, and the doctor.

3. Initial Medical Assesment input form

The initial medical assessment form is used to input the patient’s initial examination data when hospitalized. This initial examination data is needed to take further treatment. Display this form as shown in figure 7:



Figure 7: Initial medical assessment form

4. Input Form of Integrated Patient Development Records for Doctors and Nurses

Integrated Patient Development Record Form is a

form used by doctors and nurses in inputting the examination and treatment of patients while being treated at the Hospital. Display the form shown in figure 8 below:

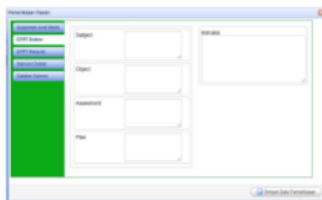


Figure 8: Integrated Patient Development Record Forms for Doctors and Nurses

5. Input form doctor’s instructions

This doctor’s instruction form completes the examination and treatment process carried out by the doctor. It looks like the following figure 9:

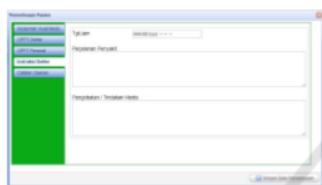


Figure 9: Doctor’s instruction form

In the doctor’s instruction form there is input for the disease course and medication or medical treatment needed.

6. Operation record form

The surgery entry form is used if there are patients with surgical medical procedures. Display form is as shown in figure 10:



Figure 10: Operation record form

7. Medicines administration form

This Medicines administration form is used by doctors to input the medicines prescription to patients. Display this form as shown in figure 11:

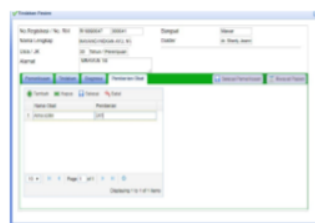


Figure 11: Medicines administration form

The prescription data entered will be forwarded by the system to the Pharmacists to prepare the medicines needed by the patient.

3.3 System Testing

The inpatient electronic medical record system testing uses the Black Box Testing method. Testing the system with this method emphasizes testing the functional program and checking input and output data (Larrea, 2017) (MZ, 2016).

Testing is done by testing data input 30 times with 10 times printing output in each process. The final results of the trial show that the inpatient electronic medical record system is running well and without an error. The inputted data is stored valid to each table and can be accessed which produces valid output.

4 CONCLUSIONS

The conclusion of this research is the design of inpatient electronic medical record software developed by the waterfall method, using the PHP programming language and MySQL database. The test results show that this software can store and present inpatient treatment history information properly and without errors. This will improve inpatient medical record services to be more optimal.

ACKNOWLEDGEMENTS

This paper is one of the research publications in the Higher Education Applied Research (PTUPT) scheme. This research was funded by the Directorate of Research and Community Service at the Ministry of Research, Technology and Higher Education in 2019.

REFERENCES

- Chuan, P. (2014). Design of electronic medical record system based on cloud computing technology.
- Handiwidjojo, W. (2015). Rekam medis elektronik. *Jurnal Eksplorasi Karya Sistem Informasi dan Sains*, 2(1).
- Khasanah, Y. U. and Rosyidah, R. (2011). Perencanaan sistem rekam medis berdasarkan input dan proses di tempat pendaftaran pasien rawat jalan puskesmas bangunan ii kabupaten bantul tahun 2011. *Kes Mas: Jurnal Fakultas Kesehatan Masyarakat Universitas Ahmad Daulan*, 5(1):24938.
- Kho, A. N., Hayes, M. G., Rasmussen-Torvik, L., Pacheco, J. A., Thompson, W. K., Armstrong, L. L., Denny, J. C., Peissig, P. L., Miller, A. W., Wei, W.-Q., et al. (2012). Use of diverse electronic medical record systems to identify genetic risk for type 2 diabetes within a genome-wide association study. *Journal of the American Medical Informatics Association*, 19(2):212–218.
- Larrea, M. L. (2017). Black-box testing technique for information visualization. sequencing constraints with low-level interactions. *Journal of Computer Science & Technology*, 17.
- MZ, M. K. (2016). Pengujian perangkat lunak metode black-box berbasis equivalence partitions pada aplikasi sistem informasi sekolah. *MIKROTIK: Jurnal Manajemen Informatika*, 6(1).
- Pan, C., Hu, J., and Shi, J. (2014). Partitioning of oracle application in structured electronic medical records. *TELKOMNIKA Indones. J. Electr. Eng*, 12(7):5693–5698.
- Permenkes, R. (2008). No 269/menkes/per/iii/2008 tentang rekam medis. *Jakarta: Menteri Kesehatan Reupublik Indonesia*.
- Purnama, B. E. (2020). Distributed data patient in medical record information system.
- Puspitasari, Y., Purnama, B. E., et al. (2013). Sistem informasi rekam medis pasien rawat jalan dan observasi pada puskesmas pringkuku kabupaten pacitan. *IJNS-Indonesian Journal on Networking and Security*, 4(3).
- Sasmito, G. W. (2017). Penerapan metode waterfall pada desain sistem informasi geografis industri kabupaten tegal. *Jurnal Informatika: Jurnal Pengembangan IT*, 2(1):6–12.
- Schnipper, J. L., Linder, J. A., Palchuk, M. B., Einbinder, J. S., Li, Q., Postilnik, A., and Middleton, B. (2008). “smart forms” in an electronic medical record: documentation-based clinical decision support to improve disease management. *Journal of the American Medical Informatics Association*, 15(4):513–523.
- Tominanto, M., Purwanto, E., and Yuliani, N. (2018). Outpatient electronic medical records. In *International Conference on Applied Science and Engineering (ICASE 2018)*. Atlantis Press.