

Full Length Research Paper

Prototyping a Nursing Management Information System across Primary and Secondary Healthcare in Depok, Indonesia

Rr. Tutik Sri Hariyati^{1*}, Mera Kartika Delimayanti² and T. Widyatuti¹

¹Faculty of Nursing, University of Indonesia, Indonesia.

²Politeknik Negri Jakarta, Indonesia.

Accepted 20 November, 2025

Communicable diseases and children's malnutrition are of significant health concerns in Indonesia. Some obstacles of overcoming these health problems are ranging from the lack of health promotion and disease prevention, inadequate early warning system, delayed case finding, and lack of collaboration between hospital and Puskesmas in the continuation of case management. These conditions may keep reoccurring due to the lack of documentation accuracy and prompt data report since the documenting and reporting processes are handled manually by the Puskesmas officer altogether with the community health cadres. This research is a preliminary study of the implementation of the management information system in the hospital and Puskesmas. The research is designed as a qualitative approach to explore current situation and incremental study. The current findings from these puskesmas and hospitals demonstrate a need of an integrated nursing management information system (NMIS). Therefore, the research has developed a prototype NMIS of the Puskesmas and hospital. Accordingly, the research needs to be continued to the try out and implementation phase in the Puskesmas and the hospital setting.

Key words: Early warning, documentation, nursing, nursing management information system.

INTRODUCTION

Malnutrition is a serious children health problem in Indonesia. It has put many children in the suffering condition and even mortality. Moreover, it is highly associated to the future of Indonesian next generation. In accordance, Indonesia has already set up goal to decrease child malnutrition cases from 8.5 to 5% by the end of 2009 (Middle Term Development Plan, 2005-2009, on MOH 2005). Another major health problem that needs to be controlled is the communicable disease. The incidence of Dengue Hemorrhagic Fever (DHF), diarrhea, and tuberculosis (TB) still remains high over the years

(Bappenas, 2005). The DHF cases, in particular, are often not well anticipated until the outbreak occurs in many areas. Beside lack of early warning system, the contingency of the communicable diseases case management in the community is also still insufficient. The post-hospitalized patients with infectious diseases are often discharged without adequate preparation for the continuation of care, also for the disease prevention and the health promotion against those communicable diseases in the community. These conditions may remain happening due to the lack of health care coordination and collaboration between the hospital and the community health services as the public health care frontiers. The discharge planning and management are frequently neglected so that many patients then have to be sent back to the hospital due to the disease recurrent (Swansburg and Swansburg, 1999). Lack of an integrated health care system may serve as one of the root of those hampering conditions. Early detection has not been optimally carried out by the Puskesmas as a result of

*Corresponding author. E-mail: rtrutik@yahoo.com, tutik@ui.ac.id.

Abbreviations: NMIS, Nursing management information system; DHF, Dengue hemorrhagic fever; TB, tuberculosis; TFC, Therapeutic Feeding Center; HIV/AIDS, human immunodeficiency virus/Acquired immune deficiency syndrome.

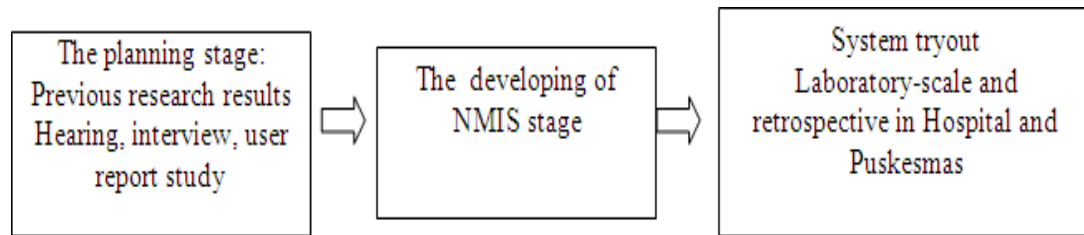


Figure 1. The research stages scheme.

the lack of documentation accuracy and prompt data report since the documenting and reporting processes are handled manually by the Puskesmas officer altogether with the community health cadres. In return, these conditions lead to delayed decision making to tackle the health problems in a timely manner. Beside many limitation in the community setting, the documentation, report and the continuity of the health care in the hospital domain require an innovative improvement. On the other hand, there is also lack of the knowledge level of the health care providers in both setting to apply a system and employ the evidence based decision to support a better health care (Engle, 2009).

Therefore, the purpose of the study was to develop a prototype of nursing information management system (NMIS). NMIS as an early detection tool of health status and communicable cases in the Puskesmas working areas. It can serve as a database to enhance health care continuation, coordination, and collaboration between the hospital and the community health care services. It also can be employed to establish an integrated nursing management information system in the hospital. Base on the problem and the purpose of the study, we have a question research: "How can NMIS help support the sustainability of health services and health care?"

MATERIALS AND METHODS

The research was designed as qualitative approach to explore current situation and incremental study. Qualitative research are interested in understanding how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences (Merriam, 2009). Qualitative research involves the studied use and collection of a variety of empirical material: case study, personal experience, introspection, life story, interview, artifacts, cultural text and productions of observational, historical, interactional and visual texts (Denzin and Lincoln, 2005). We explored the major concerns and needs of the Puskesmas officer by conducting hearing and coordination with the Puskesmas work unit and the hospital management, particularly nursing management. After exploring of the situation, we developed the NMIS. The system was developed using the prototyping incremental method. Incremental development is the development of a system in a series of partial products, generally with increasing functionality, throughout the project timescale; incremental delivery gives those increments to the users when they are completed. An increment is complete when all the associated life cycle products are finished, including testing, training, and documentation

(Graham, 1990). The incremental method in study covered the stage of planning, analysis, design, coding, the prototype trial in the laboratory, and the retrospective in the Puskesmas and hospitals. The selected samples for the system tryout were the Sukmajaya, Pancoran Mas, and Sawangan Puskesmas. The RS Bhakti Yudha, RS Bunda Margonda Depok were involved in the research as well. These location samples were selected purposively based on the Depok City Health Office's recommendation related to the infrastructure and manpower readiness level toward system implementation. The system development using the prototyping incremental method includes try out of the retrospective data that was conducted in the Puskesmas and hospital. The month data sample was taken by a convenience method in one ward in each hospital and puskesmas to try for running of program. The schematic research flowchart is demonstrated in the Figure 1.

RESULTS

The beneficence of the research depends on how optimum the user makes use of it. Hence, we explored current situation of NMIS and collaborated with the user to develop the system, application plan, and system management (Figure 2). The explored and coordination meeting results are described as follows.

Puskesmas Sukmajaya, Puskesmas Pancoran Mas and Puskesmas sawangan

The program implementation plan and coordination were conducted on October 14th-November 6th 2009. The Puskesmas Sukmajaya is one of the Puskesmas which has received ISO 2001 accreditation. The major programs of the Puskesmas are ranging from the Therapeutic Feeding Center (TFC), human immuno-deficiency virus/Acquired immune deficiency syndrome (HIV/AIDS) harm reduction, and elderly-friendly Puskesmas program. The Puskesmas Sukmajaya plays a role as a referral for malnutrition management in Depok area by the establishment of the TFC. The average number of daily patients visit was 300 patients. Accordingly, the average number of patients per month was 6000. The Puskesmas Sukmajaya was highly recommended by the Depok City Health Office since it has the supporting infrastructure. However, the health care staff will require adequate training to implement the NMIS. The Puskesmas expected the accommodation of its

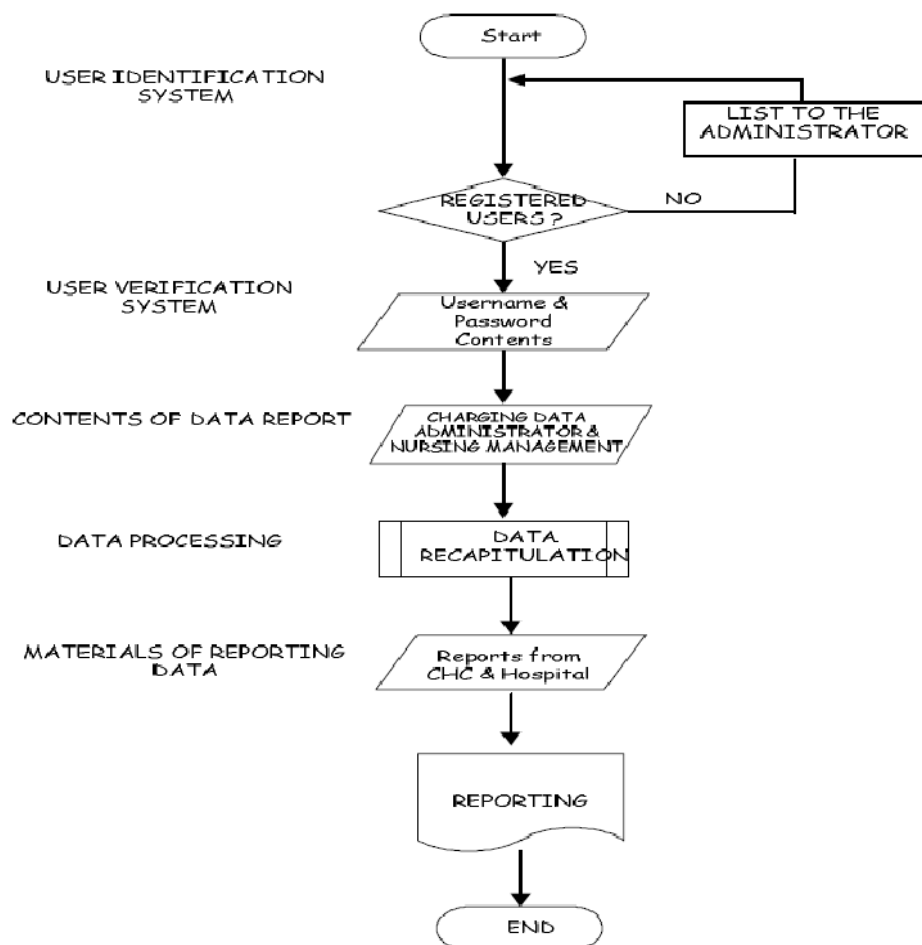


Figure 2. Flow chart diagram NMIS who we developed in this research.

program, especially its major programs by the NMIS.

The next Puskesmas was the Pancoran Mas Puskesmas. It is one Puskesmas in Depok which has just finished its building renovation. Technically, the Puskesmas was looking forward to the MIS program implementation to gain more accurate and comprehensive data documentation and report. The Puskesmas also conveyed its concern about minimizing expenditure, if the program is implemented independently in the Puskesmas through using the intranet for the MIS, not solely the internet. Otherwise, similar to the Puskesmas Sukmajaya, the average number of daily patient visit was 300, thus the average total patients per month was 6000 patients. The Sawangan Puskesmas is located near the RSUD Depok. Therefore, the Puskesmas patients that need to be referred will be sent straight away to the RSUD Depok. The Puskesmas also expressed the will-ness to involve as the tryout sample and implementation system site in order to improve and ease their periodic documentation and report. Nevertheless, they suggested that they really need supporting facilities and upgrading health care staff's capabilities to have a sustainable

implementation of the MIS. All of daily periodic documentation and information system were carried out manually in those three Puskesmas. Every polyclinic - including the general clinic, mother and child clinic has its own documentation books. The maternal-child polyclinic in particular has its own immunization, Posyandu, and medication record. Each Puskesmas unit has to make the monthly recapitulation (Monthly Report 1, 3, and 4) from the daily manual reports.

Bhakti Yudha Hospital and Bunda Depok Hospital

Bhakti Yudha Hospital was recommended by many Puskesmas to be the tryout site since it has been the referral hospital for many Puskesmas patients before the establishment of the RSUD Depok. The Bhakti Yudha hospital also accepts the health insurance coverage patients. This hospital has already had the general Hospital Information System (HIS). Nonetheless, the nursing management information system has not been settled. In the other words, the Bhakti Yudha nurses still



Figure 3. The context diagram NMIS who we developed in this research.

document and reports all of their nursing activities manually.

The Bunda Margonda Hospital was recommended by the Depok City Health Office since it also serves as a referral hospital specifically for the maternal patients. This private hospital in a strategic location in Depok has already had HIS, but not nursing MIS as well as the previously mentioned hospitals. The hospital management communicated their great willingness as a tryout and implementation site. Moreover, they intended to implement this system in all of the Bunda Hospital branches throughout Indonesia if the system can be synchronized with the existing system. They also offered the opportunity to deeper MIS development.

Base on data of explaration studies, we arranged to try out nursing information system in Sawangan, Pancoran Mas, and Sukmajaya Puskesmas and also in Bunda Depok Hospital. We didn't implement in Bhakti Yudha Hospital because the area lack the infrastructure for Nursing informatics system.

PROTOTYPE DEVELOPMENT

The information system is a collection of components within the organization associated with the process of creation and streaming of information. Information Systems has a component that processes, procedures, organizational structure, human resources, products, customers, suppliers, and partners(Indrajit, 2001). The reliability of an information system within an organization lies in the relationships that exist between components so that can be generated and inserted into the information that is useful, accurate, reliable, detail, fast, relevant to an organization (Kadir, 2003). NMIS is part of nursing informatics, which is one part of a management information system Nursing informatics is a combination of computer science, information science, computer scien and information science to manage and communicate data, information, and knowledgr in nursing practice. Nursing informatics facilitates the integration of data, information and knowledge to support patient, nurses and other providers in their decision-making in all roles and settings (Graves and Corcoran,1989; Hannah and Ball,

2006). The systematic steps on the system (NMIS) development are described in the following paragraphs.

DATABASE DESIGN

The compiled and identified data was categorized into the data tables. It is categorized according to the normalization rule- the logic technique to design a software database. It enables us to create a fine relation structure without any redundancy (Sumathi and Esakkirajan, 2007).

Software application design

A structured analysis method was applied to design the web-based software. This method consisted of the arrangement of the system flow chart, context diagram, level-1 data flow diagram, E-R diagram, program structure, data dictionary, and the process specification (PSPEC) (Sander, 1995). The Graphical User Interface (GUI) and the menu application were properly designed to be user friendly.

Context diagram

The context diagram or the level-0 data flowchart diagram is known as the fundammentation system model (Greenspan and Bulger 2001). The diagram is the starting point of the software application design. The data flowchart diagram depicts the global picture of the system as modeled as the process of outer entity-system interaction. The context diagram for the healthcare management information system in the hospital and Puskesmas is illustrated in the Figure 3.

Data flow diagram

The data flow diagram is functioned as the system development aid tool comprises of several levels diagram depends on the system's complexity or depth. The level-1 data flow diagram (N = 1) is developed from the context diagram. The PSPEC or Process Specification further describes about the process going on the data flow diagram and the involving dictionary (Figure 4).

E- Diagram R (Entity relationship)

The ER diagram (ERD) is a conceptual model depicting the relationship between the data storage and based of the actual world perception that consists of the object group (entities) and the relationship between entities (Pressman, 1997). The ERD is

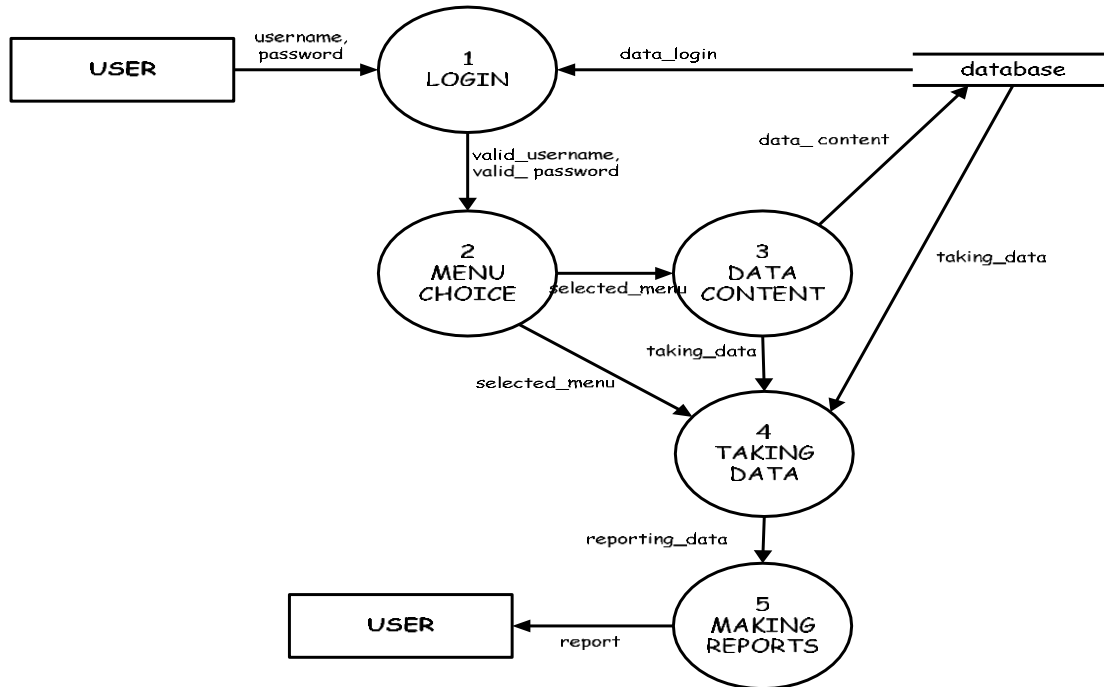


Figure 4. The data flow diagram (N = 1) who we developed in this research.

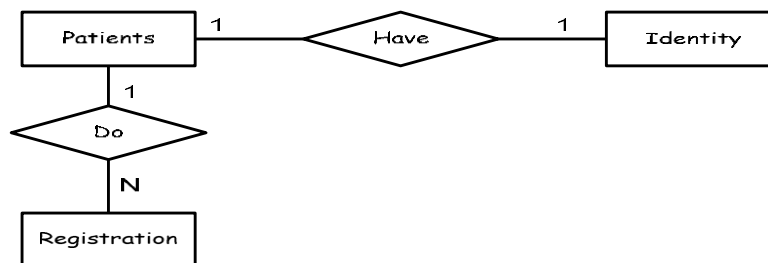


Figure 5. The ER diagram for the patients' documentation in the hospital and Puskesmas who we developed in this research.

employed to build the data structure and the data relation modeling. Through ERD, the model in turn can be examined without the need to account the ongoing process. The system function can be created on the ERD as pointed on Figure 5.

Program structure

The program structure is made for illustrating the whole process incorporated on the system and the process interrelationship. It is often considered as the control hierarchy. The program structure rewrites all of the process on the existing data flow diagram. The structure program of the web-based Puskesmas and hospital management information system is shown in Figures 6-8.

The system coding stage

The system coding is the realization of the software development

format. It is consisted of the coding and scripting that is made on the each side of the multi tier application. The client side presentation was created on the HTML script, CSS, and JavaScript supported by the Macromedia Dreamweaver. It is then connected to the back-end storage/database system side. Eventually, the software is ready to be tried on using the single desktop or the network.

TRY OUT NURSING MANAGEMENT INFORMATION SYSTEM

Try out had implemented at Sukmajaya, Pancoran Mas and Sawangan Puskesmas and also Bunda Depok Hospital. Try out base on web <http://simkep.fik.ui.ac.id> (Figures 9-10). The test had been carried out in one ward in each hospital and puskesmas and had been carried out

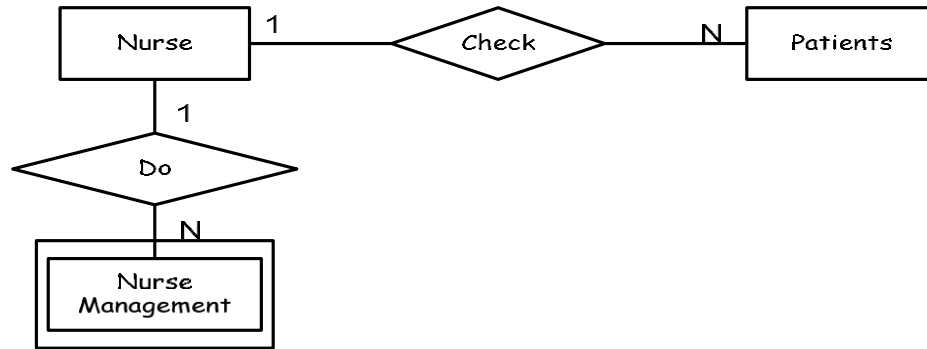


Figure 6. The ER diagram for the diagnoses and therapy in the Hospital and Puskesmas who we developed in this research.

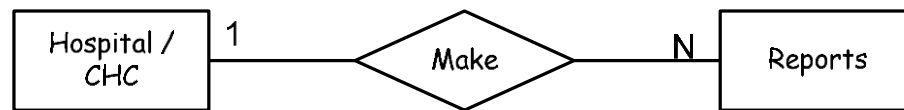


Figure 7. The ER diagram for report arrangement who we developed in this research.

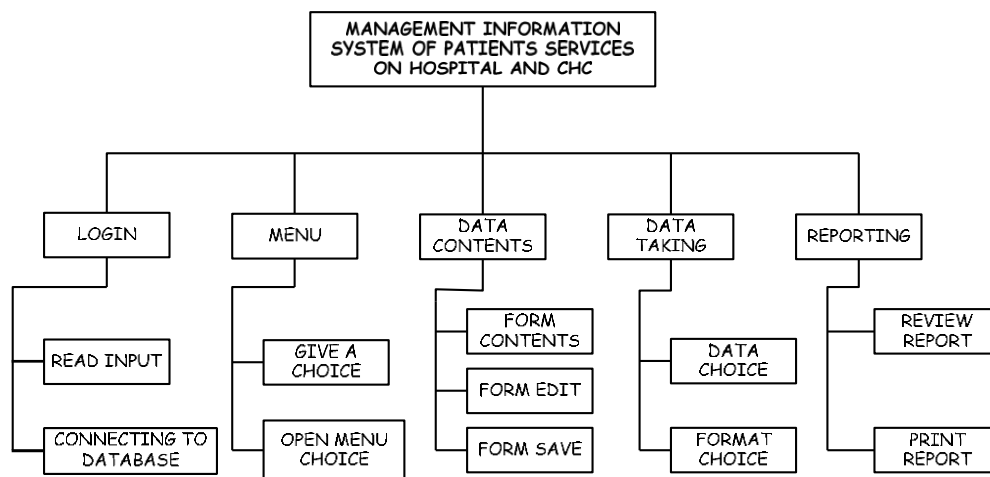


Figure 8. The program structure of the system who we developed in this research.

out for a month. The test result of the prototype of information system in puskesmas showed that the system could be used as the detection tool for the nutrition problem and tropical disease, besides that, this system could be used to record the patient's medical history in puskesmas that needed to be referred to in the hospital. The test result of the prototype of information system in hospital could be used to document the nursing care, starting from assessment, nursing diagnose, planning, implementation and evaluation.

The patient's continuity of care could be guaranteed through this nursing process. The difficulty during the test

process were observed, in several nurses who were not familiar with the use of the system yet, and another barrier came from the infrastructure which the computer provided had not supported the documentation process yet.

DISCUSSION

The integration of the health care service is not supposed to be hampered only by the work health care setting. The health care providers in the Puskesmas as the front liner

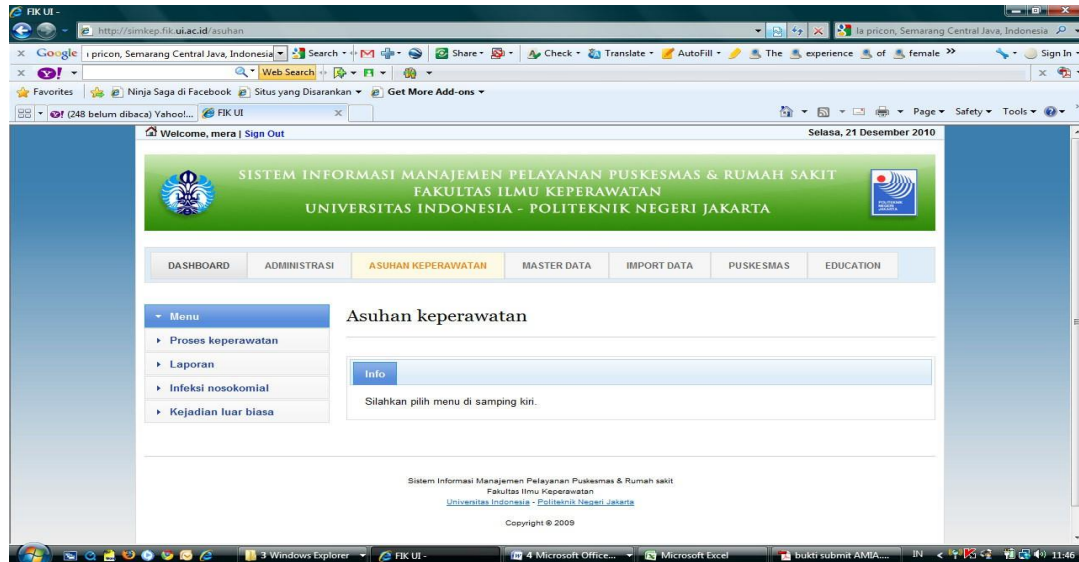


Figure 9. web. <http://simkep.fik.ui.ac.id> for nursing management system informatics in hospital who we developed in this research.

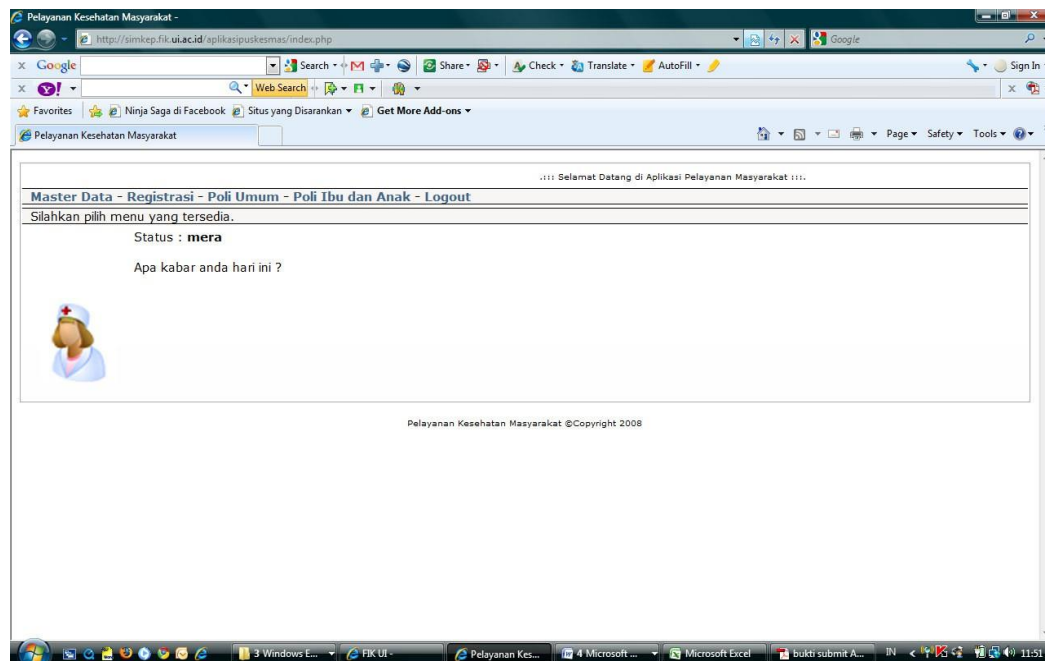


Figure 10. web. <http://simkep.fik.ui.ac.id> for nursing management syastem informatics in Puskesmas who we developed in this research.

in conducting the health services in the community, altogether with the City/Provincial health Office as the front line governing agency, and the hospital have to embrace each other by good coordination and collaboration to optimize the health care services in term of the health promotion to health rehabilitation. Although still not assessed the effectiveness and efficiency mea-

sures, but the results of this research can offer that the informatics system attempts to bridge a more efficient and integrated coordination between these health care entities. The information technology application will both affect and be affected by many aspects in an organization. The NMIS is one of the IT applications that provide information for the health care function (Soegijoko,

2003). The NMIS offers the information support for the decision making at all level of health care administration. On the primary health care unit like Puskesmas, and also hospital, the NMIS may assist the patients' case management toward an optimal health care delivery. This research in accordance with the opinion that Nursing management information system has function to guaranteed for contiunity of nursing care (Pereira, 2005), and also as legal documentation and as tools of comunication for health teams (Fuller, 2009). Nurse Managers also reported high satisfaction with the NMIS, the information and decision support provided, and its ease of use (Ruland and Ravn, 2003).

The cooperation of the medical team, and the facility provided will influence the implementation of the system. Unfortunately, it often happened that the nurses could not get the sufficient information so that it will hinder the implementation of the program. The training about operational system was highly needed and the organization support will affect the success of this system (Moody et al., 2004). In this study, after try out had been carried out, it should be continued by training the nurse, and the support from the organization, and also the support from the infrastructure, espically in providing the computer, since it would affect the implementation of NMIS. The training is one of the key success for nursing informatics system (Brender, 2006).

CONCLUSION AND RECOMMENDATION

The accurate documentation and report is a crucial part of the health care services. Inaccurate and delayed documentation may lead to the impediment of the decision making and action in managing the health care problems. This research is a preliminary study of the management information system development in the hospital and Puskesmas. It is aimed to improve the accuracy and efficiency of the documentation and report process. At the same time, it may enhance better coordination and collaboration between the Puskesmas, hospital, and other related party to foster an integrated and continuing health care services for the community. The research has already developed a prototype but has not fully undergone tryout in the health care settings.

Although still not assessed, the effectiveness and efficiency measures, but the results of this research can offer that the informatics system attempts to bridge a more efficient and integrated coordination between these health care entities. Accordingly, the research needs to be continued to the try out and implementation phase in the Puskesmas and the hospital setting.

ACKNOWLEDGMENTS

Thanks to the Strategis Nasional of the Ministry of Education year 2009-2010, DRPM UI, FON UI, Bunda Hospital, Bhakti Yuda Hospital, Sawangan, Pancoran Mas and Sukmajaya Puskesmas. Also thanks to the research team members: Ariesta, Yusnita, Ade, Kinta, Nuraeni, Via, Aniatul, Rina, Heidi.

REFERENCES

- Bappenas BPS (2005). Developing indicator of social and economic Indonesia. BPS: Jakarta.
- Brender J (2006). Evaluation of Health Information Applications in a Lifecycle Perspective. May 15, 2010. www.ncbi.nlm.nih.gov/pubmed/16482372
- Denzin NK, Lincoln YS (2005). Qualitative research.USA: Sage Pub., pp. 3-5.
- Engle W (2009). The approaching telehealth revolution in homecare.<http://tie.telemed.org/articles/article.on> 20 April 2009.
- Fuller DC (2009). Challenges in nursing informatics. RN J. Oktober, J. nursing 22,2010.<http://www.rnjournal.com>.
- Graham DR (1990). Incremental development and delivery for large software syst. Published in Software Engineering for Large Software Syst.ed.B.A Kitchenham.<http://hem.bredband.net/andule/evogilb/graham1.htm>
- Greenspan J, Bulger B (2001). MySQL/PHP Database Applications. M&T Books. 20-24. Foster City.
- Hannah KJ, Ball MJ (2006). Health informatics: Formerly computer in health care.USA:Springer Sci., pp. 6-13.
- Kadir A (2003). Introduction of information syst. Andi Pub. Yogyakarta.
- Ministry of Health (2005). Plan of action, preventive and rehabilitative malnutrition 2005-2009, Jakarta.
- Merriam SB (2009). Qualitative research: A guide to design and implementation. San Fransisco:Jossey-Bass, p. 5.
- Moody LE, Slocumb E, Berg B, Jackson D (2004). Electronic health records documentation in nursing: Nurses' perception, attitudes, and preferences. J. Comput. Infor. Nurs., 22(6): 337-344. Lippincott Williams & Wilkins. Inc.
- Pressman RS (1997). Software Engineering: A Practitioner's Approach. McGraw-Hill Book Co., pp. 30-35. New York
- Ruland C, Ravn IH (2003). Usefulness and effects on costs and staff management of a nursing resource management information syst. J. Nurs. Manage.,11: 208-215.
- Soegijoko S (2003). Development of Telemedicine Technology and Its Applications.Telemedicine Seminar.
- Swansburg RC, Swansburg JR (1999). Introductory management and leadership for Nurses. Toronto: Jones and Bartlert Pub.Ca.
- Sander L (1995). Data modelling. USA: Boyd & Fraser Publication.