Usability Evaluation of the Hospital Management Information System: Case Study of an Emergency Installation Application of a Regional Public Hospital

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Abstract— **The use of information technology has been extended to hospitals. The purpose of the Hospital Management Information System (HMIS) is to improve the quality of patient care and to increase the efficiency and effectiveness of the workers. This study aims to look for usability issues and provide recommendations to achieve the purpose of the system. The usability evaluation was carried out by using the contextual inquiry method involving five doctors as the users of the system. The study was conducted at an emergency room of one regional public hospital in Jakarta. The results show that the system applied the interaction design principles, and it was quite easy to be used by doctors, but it still needed to be improved. The end results of this study are prototype recommendations of the system in accordance with the principles of the interaction design.**

Keywords— **usability evaluation; contextual inquiry; hospital management information system; emergency room.**

I. INTRODUCTION

Information technology has been used in a lot of different work scopes, including hospitals. A hospital is a health care institution that has medical workers, management, and other work sections. It also has inpatient facilities and gives healthcare facilities for its patient [1]. Indonesia's Health Minister stated that hospitals often have difficulties in using its information management [2]. The use of information technology is an effort to increase the use of information management to become more efficient, faster, easier, more accurate, cheaper, more secure, more integrated, and more accountable [2]. It is reported that 740 hospitals have the HMIS [3].

HMIS is crucial because it concerns the quality of patient treatment. Medical errors cannot be separated from human errors [4]. According to Reason, the increase of complexity has a consequence for patient's safety [5] because it can increase the risk of human errors [6].

The information display is important to support effective health care and reduce human errors [7]. The usability error happens because the system is complex, the functionality is not user-friendly, the workflow is not compatible, or the user has limited access to the system [8, 9]. Wrong functionality can mislead some doctors, especially when the display looks confusing [9].

We need to do usability evaluation for the HMIS to prevent human errors with the system. With the usability evaluation, we can understand whether the system is effective, efficient, and how satisfied the users are when they use it. The results of the usability evaluation can be used as a reference to develop the system in the future, so it could reach the purpose of HMIS. To achieve this goal, this research studied the HMIS at a regional public hospital in Jakarta used by the doctors.

The following subsections explain about the hospital management information system, usability, user-centered design, and prototype. The usability of HMIS will be explained in more detail. This section will cover the usability evaluation and a usability evaluation method called a contextual inquiry.

A. Hospital Management Information System

A Hospital Management Information System (HMIS) is a system that supports the primary and secondary processes from a hospital by integrating organizational structure, information flow, and solutions using information and communication technology [10]. Sheldon states that the purpose of the hospital information system is to manage the information which the health professional needs to do their work efficiently and effectively [11]. According to Caccia, admission, anamnesis, diagnosis, treatment, release, and follow-up are the primary processes that interact directly with the patient treatment [10, 12]. Locatelli explains from

the functionality viewpoint that clinical areas support those primary processes [10, 13].

B. Usability

Nielsen explains that usability is a quality attribute that indicates how easy the user interface is [14]. Usability measures to what extent a system, product, or a service can be used by certain users to reach certain goals with effectiveness, efficiency, and satisfaction [15]. Usability from user personal goals perspective could cover the perceptual and the emotional aspect [15].

Usability evaluation has been conducted in many areas including e-Health. There are two previous studies related to HMIS evaluation: E-Hospital Management & Hospital Information Systems – Changing Trends [16] and Developing Effective Hospital Management Information Systems: A Technology Ecosystem Perspective [17]. In the first paper, it is stated that the success factors of E-HMS/HIS tend to vary depending on leadership support, training, technology adoption, user-friendliness, etc. One of them is user-friendliness, therefore evaluating the HMIS based on their usability is important for further research. [16]. Moreover, the second paper explains that some features of the Surgery and Nursing Executive at the site indicated a very positive change because of the advent of Graphical User Interface (GUI) and more intuitive system. Consequently, to create a more intuitive system, researching HMIS by usability evaluation is a must [17].

C. Contextual Inquiry

A contextual inquiry or contextual interview is a systematic study of people, work, procedures, and workplace environment to define new development opportunities or to improve the existing system [19]. Contextual inquiry combines observation with the interview, so the researcher can see and listen to when the user works in their environment with the actual technology Contextual inquiry enables a researcher to understand who the user is and how they do their daily work [20].

D. User-Centered Design

A User-Centered Design (UCD) is a design that focuses on the ease of use for users in completing their task [21], making sure the product fits the users. Barnum explains that a user decides the usability of the system based on their perception of the quality and functionality of the system, and their appreciation about the effectivity of it [22, 23]. A system that has been developed should correspond to the user's ability to reduce errors, increase satisfaction, and increase productivity [23].

II. Material and Method

This section explains about the contextual inquiry; the usability method that was used to evaluate and propose the hospital information system prototype. The data analysis and the preparation of prototype will also be explained in this section.

In the first stage of the current study, the researcher conducted a literature study. After sufficient information had been studied carefully, the researcher began to design the research method. From the method, the researcher began to find the appropriate participants and then made the research instrument to implement it. Then, the researcher implemented the usability evaluation; the method that was used to evaluate was a contextual inquiry. From the result of the usability evaluation, the researcher began to analyse the data. Those data were used to develop the desired prototype.

A. Designing Research Method

Designing research method has been done according to the usability evaluation method. The usability evaluation method that was used was a contextual inquiry. The contextual inquiry was used to get a usability problem from the system which the users used [21].

The contextual inquiry was made at the user's workplace, and it involved the target users. This involvement aimed to share the users' experience, knowledge, and to know the users' expectations with the system. Privitera explains that there is no ideal number for contextual inquiry participants. It usually ranges from 7 to 12 participants, but it may vary widely [19]. Nielsen states that three to five participants are required to identify the system design problems [24]. This research involved five participants also because it was quite difficult to ask doctors to participate.

The researcher recorded, wrote, and observed all users' activities through the system. The contextual inquiry was made within 30 to 60 minutes. The participants answered some questions, provided comments to the system, and did their usual work while explaining their usability step by step when the contextual inquiry took place. After the contextual inquiry was finished, the participants were given their contextual inquiry summary to ensure that the researcher took the correct notes.

B. Participant Search

One criterion for the contextual inquiry was that the hospital had an HMIS used by the doctors. The system chosen for this research was a system that was used in a critical workplace. The researcher had searched for participants in some regional hospitals within Jakarta. Nevertheless, the bureaucratic difficulties made it hard to study more hospitals.

Fortunately, there was one public hospital that met the criteria. The research was done on the HMIS used in the hospital's Emergency Department. This research involved five users (who were all doctors) as participants. The selection process was conducted through convenience sampling by considering the doctors' experience (e.g., minimum three years of experience). The detail of the users can be seen in Table 1.

TABLE I
Contextual Inquiry Participants

Participants	Position	Experience as a Doctor
DR01	The Chairman of Emergency Department and Doctor of Emergency Departments	Approximately 4 Years
DR02	Doctor of Emergency Department	Approximately 4 Years
DR03	Doctor of Emergency Department and Inpatient	Approximately 5Years
DR04	Doctor of Emergency	Approximately 5

Participants	Position	Experience as a Doctor
	Department and Inpatient	years
DR05	Doctor of Emergency Department and Inpatient	Approximately 5 Years

C. The Construction of Research Instruments

For the preparation of the research implementation, the researcher constructed the research instruments. The contextual inquiry needs a list of questions, a video recorder, an audio recorder, notes, a tripod, and stationeries [19]. The list of questions was made based on Privitera's book, which included background information, the exploration of the primary task, procedure(s), or activity knowledge, product knowledge, and wrap up [19].

The background information inquires the participant's personal data. The exploration of the primary task contains an explanation of the participant's work. The procedures explain the participant's work when they interact with the system. Product knowledge asks about how familiar the participant is with the devices they use to access the system. Wrap up is used to synchronize the participant's perception with the researcher about the participant's previous explanation.

D. Usability Evaluation

The usability evaluation was done using contextual inquiry. The evaluation took place in the patient examination system in the Emergency Department. This evaluation was recorded, written, and observed to be analyzed in the next step.

E. Data Analysis

The results of the contextual inquiry were analyzed to get prototype requirements. The data were recapitulated from the notes, video recorder, and audio recorder [19]. Themes were made from dominant elements which were observed and discussed with the participants to simplify the code construction which contains references, figures, and/or observation results [19]. The summarized themes and codes were then connected with the design insights found in the contextual inquiry. The themes, codes, and design insights were analyzed for the improvement points.

F. Prototype Development

The improvement points found were applied in the prototype construction of the recommended system. The prototype was made with the Axure application because it was fast and easy to use [25]. The prototype interaction was made using InVision to complete the construction of the prototype interaction in Axure. In addition, the prototype development was done based on the interface design principles and design psychology.

The following subsection explains briefly about the business process in the public hospital.

A. Business Process

The public hospital has implemented the HMIS to the data service and hospital information. The system must be aligned with the hospital business process [2]. The hospital business process can be divided into two: the front-office and the back-office business process [2]. The front office

business process starts from the patient signing up to the hospital until they leave the hospital [2]. The back-office business process includes the management of physical resources such as humans, money, and assets [2]. Moreover, the back-office business process relates to the front office business process in a lot of terms including money management, assets management, inventory, budgets, and so on.

The front-office business process in every hospital is generally the same. A patient comes to a hospital and signs up for the registration. Then, the patient is checked in the polyclinic first. Based on the check-up result, it will be decided if the patient will receive inpatient or outpatient care. Inpatient patient will be registered again. During the treatment, the inpatient or outpatient care can have supporting services like laboratory and pharmacy. After the treatment finishes, the patient goes to the drugstore to buy the doctor's prescription. All the costs will be paid at the cashier. The business process applied to the Hospital Management System Information is shown in Figure 1. Figure 1 is a minimal architecture of the HMIS Information [2].

The system that has been used in the emergency department of the public hospital for its front office includes care services, depot, and front office. The care services were used by the doctors and nurses. The depot is used by the pharmacy depot department. The front office is used by the registration and the cashier. The care services application used in the Emergency Department are divided into two parts: (1) Doctor (Emergency Department) Dashboard and (2) Emergency Department services.
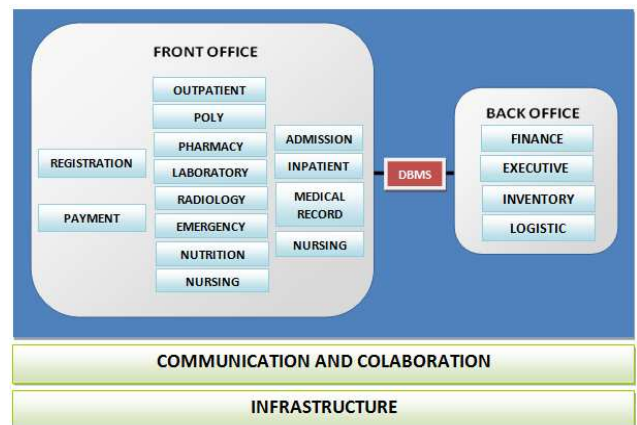

Fig. 1. The Hospital Management Information System Application Architecture [Translated From 2]

The following are the tasks that an Emergency Department doctor can do in the Doctor Dashboard application:

1. Login
2. Choose a patient to be examined
3. Look at the order status of the patient list
4. Examine the patient
5. Book the laboratory
6. Give drugs and medical devices in the Emergency Department
7. Book the radiology service
8. Allow the patient to return
9. Look at the history of the patient

10. Make templates
11. Fill in a form
12. Look at the nurse examination results
13. Change the order
14. Change the examination data
15. Finish all the examination in the Emergency Department.

The following subsection explains about the data analysis of the results of the contextual inquiry and the list of improvement recommendations based on those results.

A. Data Analysis Mechanism

Based on the previous section, the data results of the contextual inquiry were recapitulated into the contextual inquiry notes from the video recorder, audio recorder, and examiner notes. The data were analyzed per task, page, or part of the system, themes, and general themes.

The data were in the form of the doctor's statement when they explained about the usability of the system and gave their feedback about it. The statements or design insights were grouped based on the themes that represented behaviours, ideas, or dominant trends. Each theme was categorized into general themes. General themes were obtained from the observation result of the contextual inquiry, which includes positive feedbacks, problem identification in the system, and suggestions.

Positive feedback on the general theme was analyzed into the system requirements. The system problem identification of the general theme was analyzed into improvement points. The suggestions for the general theme were analyzed and considered to support the system problem identification of the general theme.

1) The Analysis Result of the Positive Feedback on the General Theme: The result of the contextual inquiry shows ten positive feedbacks, which include the list of the patient's features, the emergency department data text feature, O template feature, the list of laboratory and radiology, booking the laboratory and radiology feature, the patient's history page, nurse examination results, and the medical resume form. The theme was given KPXX code with XX for the code number, for example, KP01. KP is an abbreviation of "*Kesan Positif*" (Positive Feedback). Table 2 is the summary of the analysis results of the positive feedback on a general theme.

TABLE II
THE ANALYSIS RESULT OF POSITIVE FEEDBACKS IN THE GENERAL THEME

Code	Theme	Feedback
KP01	The list of patient features that facilitate the doctors in searching for their patients	DR02 likes the list of patients with the sorted queue, and they were sorted based on the examination status. DR04 prefers the list of patients with a descending name. He did not find any difficulties in searching the patients' names because he could use the search feature.
KP02	The data entry in ICD (Diagnosis with doctor's action) has the ease for the doctor with the free text feature	DR01 likes ICD to be written in text. DR04 prefers ICD using a free text.

Code	Theme	Feedback
KP03	The data entry O (Objective) is easy to do with template feature.	DR02 loves to fill the O data because it has a template. DR03 said that the O template was the easiest template because it could make a special template that could be set into every doctor's taste.
KP04	The selection list of the laboratories is already complete.	DR01 said that the list of laboratories was already appropriate based on hospital accreditation. DR02 said that the list was already complete.
KP05	The booking of the laboratory feature has facilitated the doctor.	DR02 prefers booking the laboratory with the checklist method. DR04 prefers to use the text input method when he did not know where the laboratory is on the selection list because it is faster than the checklist method.
KP06	The selection list of radiology is already complete.	DR01 said that the list of radiology was already appropriate based on the hospital's accreditation.
KP07	The booking of the radiology feature has facilitated the doctors.	DR02 prefers booking the radiology with the checklist method.
KP08	The examination history page has facilitated the doctor to see their patient's data, for example, their lab results, their examinations, their radiology, and pharmacy.	DR03 said it facilitated the doctor to see their patient's data history. DR04 said it facilitated the doctor to see their patient's previous examination.
KP09	The medical resume form filling feature is easy enough to be done by every doctor.	DR04 said that to fill out the medical record, he could easily copy it from SOAP (Patient Examination Results) data that he created.
KP10	The nurse button facilitated the doctor to predict the patient diseases by seeing the nurse examination results.	DR02 said that the button really helped the doctor especially when the Emergency Unit was crowded.

For the task of "choose a patient to be examined", two doctors (DR02 and DR04) have different habits. DR02 likes a list of patients with sorted queue, and the patients have been sorted based on their examined status. DR04 prefers a list of patients with descending names. However, DR04 does not find any difficulties in searching the names of the patients because there is a search feature in the system (KP01).

When the doctor did an examination, data entry in ICD helped the doctor with text input (KP02). Based on the doctor's explanation, there was a case mix part that could translate ICD text version into ICD code version. The data entry in the examination part O had positive feedback too because the doctor could make a special template that could be set into every doctor's taste (KP03).

"Booking the laboratory" also has positive feedback from the doctor. A list of the laboratories was already complete because the list was already appropriate based on the hospital's accreditation (KP04). This feature facilitated the doctor because it included two user styles (KP05). DR02 prefers booking the laboratory with the checklist method, while DR04 likes the checklist method if he knew where the laboratory in the selection list was and preferred to use the

text input method when he did not know where the laboratory in the selection list was because it was faster than the checklist method.

"Booking the radiology" has the same method as "booking the laboratory". It has the same positive feedback: the list of radiology is already complete based on the hospital's accreditation (KP06), and the booking checklist method is easy enough for every doctor (KP07).

Every doctor could see the examination history of their patient with the application history feature (KP08). The patient history page has facilitated the doctor because they could see the previous examinations, pharmacy data, results of the laboratory, and results of the radiology. The medical resume form filling feature is easy enough to be done by every doctor (KP09). The form contains the data that has been copied from results of examination of the SOAP data. The nurse button facilitates the doctor in predicting the patient diseases by seeing the nurse examination result (KP10).

2) *The Analysis Result of Identification of Problems and Suggestions:* The result of the contextual inquiry shows 23 identifications of problems in the system, as shown in Table 3. The themes were given IMXX code with XX as a code number, for example, IM01. Those problems were found in the login section, the list of patients, examination, giving drugs and medical devices, laboratory, navigation, return recipe, template, and forms. The identifications of problems were analyzed to get improvement points.

TABLE III
THE ANALYSIS RESULTS OF IDENTIFICATIONS OF PROBLEMS IN THE SYSTEM

Code	Themes	Design Insight
IM01	The change password feature in HMIS Emergency Department is not available yet.	DR04 said that the change password feature could not be accessed in the system.
IM02	The communication between fields using different font colours for the laboratory and radiology status is not effective.	DR01 said that L and R signs next to patient's name were not important. Furthermore, it did not increase communication at all. DR03 said that the colour of L and R signs did not represent the real examination status. He needed notification to communicate between fields. DR04 said that the communication between fields was not available.
IM03	The portrayal of the localist patients requires a lot of time.	DR03 said the localist status was the most bizarre feature. DR04 said that drawing localist patients required a lot of time.
IM04	The portrayal of the localist patients in the system is not as free and detailed as the portrayal of localist patients on paper.	DR04 said the system could not illustrate their patients' wounds completely.
IM05	The picture saving processes of the localist patients sometimes fail.	DR03 said that sometimes the picture that had been made could not be saved.
IM06	The need to click the localist status button	DR04 said that the draw feature was good, but it had to be clicked to be

Code	Themes	Design Insight
	to draw the localist patients.	used.
IM07	The use of the ICD keywords in the database is not consistent.	DR04 said that the keyword was not accurate.
IM08	The section of the allergy patients, history of family diseases, history of family allergies, complication, education, nutritional status, and special notes are written in SOAP section for practical reasons.	DR04 usually wrote the patient's data in SOAP section. DR02 said that for practical reasons the data were written in the SOAP section. DR03 said that other than the SOAP section like allergy section, additional notes, and others, they had never been used.
IM09	The fonts for the vital sign are not big enough.	DR04 said that the fonts of vital sign were not big enough
IM10	The form filling in section P is not effective yet.	DR04 said that section P did not have any templates yet.
IM11	Need to click the navigation to fill in the data.	DR04 said that the process was too long. He had to remember every process that he had done.
IM12	The small form column in the drugs and small medical devices administration.	DR04 said that the form column was small.
IM13	The pharmacy notes are rarely seen by the doctors because they have already understood the categories of drugs.	DR04 said that the pharmacy notes were rarely seen by the doctors because they had already understood the categories of drugs.
IM14	The use of drug names in the database is not consistent.	DR04 said that the drug search feature was not right. Sometimes the doctor did not know whether the system used the name of the drug or the name of the drug manufacturer.
IM15	The get formula button and get history button are not used in the Emergency Department	DR04 said that the get formula button and the get history button had never been used in the Emergency Department.
IM16	Too many clicks for writing receipt and concoction.	DR04 said that there were too many steps in the process of writing receipt and concoction.
IM17	The receipt formula template is not effective.	DR03 said that the receipt formula template was rarely used. DR04 said that the receipt formula template was never used.
IM18	The action template is not used by the doctor.	DR04 said that the action template was not used by the doctor.
IM19	The inpatient form is not effective yet.	DR03 said that the inpatient form was not online yet so it was rarely used. DR05 said that filling the form in the system was faster than filling it manually
IM20	The form feature cannot handle the part that needs physical evidence, like stamp and signature.	DR04 said that the form feature could not handle the part that needed physical evidence, like stamp and signature.
IM21	The laboratory ordering data that have been processed cannot be changed by the doctor.	DR02 said that the laboratory data section could only be changed by an admin. DR05 said that he could not cancel the input if there were some input errors.

Code	Themes	Design Insight
IM22	The SOAP data view is confusing, and it requires too much scrolling.	DR04 said that the SOAP data view was confusing and too much scrolling
IM23	The consultation form is not effective yet.	DR02 said that the use of the consultation form was rarely used. DR03 said that the consultation was done better by phone. DR04 said that sometimes there were system errors. DR05 never used the consultation form.

B. Purposes of Improvement

Table 4 shows the results of theme summary mapping from the previous sub-sections with improvements. The purpose of the improvement was the result of the suggestion comparison with design interaction and interface theories. The theoretical bases used were the Eight Golden Rules of Interface Design [26] and the User Interface Design Principles for Interaction Design [27]. If there were any conflicting issues about selection advice in any theme, the advice selected was the one that had the most suggestions based on the foundation of design theories.

TABLE IV
THE RESULTS OF THEME SUMMARY MAPPING WITH IMPROVEMENT

No.	Improvement Purpose	Theme	Theory
1	Provision of "change password" feature	RIM01	Interface is Content: Design Interface Elements That Minimize Interface and Maximize Content [27]
2	Status replacement for L and R in the list of patients with notification tab for communication between fields	RIM02	Offer informative feedback. [26] Feedback: Design Tangible Responses to Apt User Actions. [27] Landmarks: Design Landmarks as a Reference for Context. [27] Design dialog to yield closure. [26] Unpredictability keeps people searching. [28] Interface is Content: Design Interface Elements That Minimize Interface and Maximize Content. [27]
3	The addition of the way to draw the localist patient image, such as image template for parts of the body, the list of images saved, and the delete image button.	RIM03	Observe Conventions: Identify and Consider the Impact of Familiar Interface Conventions. [27]
4	The addition of the save button and the amount of localist status image information saved at the localist status button.	RIM04	Feedback: Design Tangible Responses to Apt User Actions. [27] Offer informative feedback. [26]
5	Section elimination of the history of family diseases, history of family allergies, and complication. Moreover, the addition of the description in the history of family diseases, history of family allergies, and complication at the S form. It started from the history of diseases first.	RIM05	Interface is Content: Design Interface Elements That Minimize Interface and Maximize Content. [27]
6	Elimination of the education section and addition of the education description at P form		People are inherently lazy [28]
7	Elimination of the nutritional status section and special notes, and addition of the nutritional status description and special notes in O section		Proximity: Design Interface Elements in Consistent Proximity to Their Content Objects and to Each Other [27]
8	Removal of the allergy form filling location after S and addition of selection with "No Allergy" as the content	RIM05	Proximity: Design Interface Elements in Consistent Proximity to Their Content Objects and to Each Other [27] People believe that things that are close together belong together [26]
9	Enlargement fonts in vital signs	RIM06	Reading a computer screen is harder than reading paper. [28] Font size matters [28]
10	Name replacement of the O template to master template and addition of the template P feature at the master template, also an addition of the template P at the P section.	RIM07	Enable frequent users to use shortcuts [26] Adaptation: Design an Interface That Adapts or is Adapted to Use [27]
11	Labelling with the change of colour in the drug given and medical devices navigation, laboratory, radiology, and return receipt which shows whether the section has been filled	RIM08	Landmarks: Design Landmarks as a Reference for Context [27] Design dialog to yield closure [26]
12	Administration of the drug column enlargement in the Emergency Department	RIM09	Font size matters [28] Reading a computer screen is harder than reading paper [28]
13	Removal of the get formula button and get history button to return the receipt form filled	RIM13	Proximity: Design Interface Elements in Consistent Proximity to Their Content Objects and to Each Other [27] People believe that things that are close together belong together [28]
14	Name replacement of the get formula button to get formula receipt	RIM13	Consistent Logic: Design an Internally Consistent Logic for Content, Actions, and Effects [27]

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No.	Improvement Purpose	Theme	Theory
			Strive for consistency [26]
15	Deletion of the action template feature	RIM10	Interface is Content: Design Interface Elements That Minimize Interface and Maximize Content [27]
16	Addition of order list feedback after saving an order to get confirmation.	RIM11	Offer informative feedback [26] Feedback: Design Tangible Responses to Apt User Actions [27]
17	Only updated SOAP data that will be shown. The old data will be hidden and can be selected if necessary.	RIM12	Proximity: Design Interface Elements in Consistent Proximity to Their Content Objects and to Each Other [27] Reading a computer screen is harder than reading paper [28]
18	Addition of a button to open the localist status image created at the SOAP data.	RIM04	Consistent Logic: Design an Internally Consistent Logic for Content, Actions, and Effects [27] Strive for consistency [26]

III. RESULTS AND DISCUSSION

This section contains the prototype development results for the improvement recommendations related to the usability aspects based on the results of the analysis. They are presented with the images of the actual system and the recommendation prototype.

A. Prototype Development in the Login Page

The previous system did not have the change password feature. The revision done to the login page was to implement the change password feature. Figure 2 is the Login Page in the actual system before the revision. The highlighted part is the part that was improved. From that part, the change password feature was added. The feature location can be seen in Figure 3.

Fig. 2 Login Page in the Actual System

Fig. 3 Login Page (Prototype Version)

B. Improvement Version of the List of the Patient Section

Based on the result of the previous chapter, the status feature in the list of the patient section, which can be seen in Figure 4 (see the leftmost part), was erased. Figure 5 is the improved version of the list of the patient section.

Fig. 4 List of Patient Sections in the Actual System

Fig. 5 List of Patient Sections in the Actual System

C. Improvement Version in the Examination Section

The Examination Page in the actual system can be seen in Figure 6. The improvement was made in SOAP data, the localist status, and vital signs. Figure 7 shows the result of the revision.

Fig. 6 List of Patient Sections in the Actual System

Fig. 7 List of Patient Sections in the Actual System

D. Giving Drugs and Medical Devices Page

The revision that was done on this page was to enlarge the column in "giving drugs" page.

E. Return Receipt Page

In this page, there were a lot of improvements, such as relocation of the button, replacement of the button's name, the appearance of the form, and the addition of return receipt confirmation.

F. Navigation Section

The revision of this section was the addition of discoloration, notification menu, replacement of submenu's name, and deletion of the submenu.

G. Laboratory Page

The improvement of this page was the addition of the laboratory order confirmation so that the doctor examines the list of their patients before the confirmation is made.

H. Radiology Page

The improvement of this page was similar to the laboratory page. There was an addition to having confirmation for the order.

I. Template Section

The revision that was done in this section was adding a new feature to create P template in O template page.

IV. CONCLUSION

In general, the use of HMIS in a regional public hospital in Jakarta was quite satisfactory. This was indicated by ten positive feedbacks from the users. Moreover, the users could explain how to use the system clearly. Furthermore, the system was enough to give shortcuts and options that fit every user's taste, and it had a list that was based on the hospital's accreditation.

These are the suggestions for future works based on the process and the results of the research:

First, for researchers, the next research can be done with another usability evaluation method, such as usability testing and expert evaluation. Similar studies can be done in the same or different hospitals by evaluating HMIS in every hospital department with another target user, like the nurses and pharmacists. Second, for future development, this research produces a lot of recommendations that can be considered for future development, for example, connection improvement between fields. Furthermore, the results of the prototype recommendation can be applied to the next development. Moreover, the usability evaluation can be done to get feedback from the prototype recommendation produced from this research.

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