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Submission date: 14-Mar-2024 10:53PM (UTC-0400)
Submission ID: 2320829262
File name: 004.mobile_nursing_care_plan.pdf (838.62K)
Word count: 3541
Character count: 19286

European Review for Medical and Pharmacological Sciences 2022; 26: 13-19

Mobile nursing care plan information system for nursing service in hospitals

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Abstract. – OBJECTIVE: The COVID-19 pandemic has greatly affected the health sector, especially the speed of healthcare services in hospitals, such as nursing care. This is caused by the low ratio between the number of resources available and the number of cases handled, which leads to suboptimal services. One of the solutions to this problem is to implement a digital (mobile) nursing care information system. Therefore, this study aims to produce a digital (mobile) nursing information system model that is suitable for hospitals.

SUBJECTS AND METHODS: The research and development (RnD) method used in this study was carried out in three stages, namely, analysis of information system needs, preparation of the model design, and trial of Mobile Nursing Care Plan Information System (MNCPIS). The design was prepared with the Framework for Application of System Technique (FAST). A total of 148 nurses were selected as respondents using a simple random sampling approach. Data were then collected through interviews, focus group discussions, and questionnaires. Furthermore, MNCPIS was assessed with system requirements analysis using the Performance, Information, Economic, Control/Security, Efficiency, and Service (PIECES) framework.

RESULTS: The *t*-test results indicate that MNCPIS was more effective and appropriate compared to the conventional (manual) types. This was indicated by all the variables measured in the MNCPIS component, including assessment, nursing diagnosis and evaluation, planning, and implementation. Based on these findings, the model can be developed as a nursing care information system to improve the quality assurance of services rendered by nurses.

CONCLUSIONS: A mobile plan information system can be implemented in the nursing care department in hospitals to ensure satisfaction and quality assurance for the services provided in hospitals.

Key Words:
Nursing care plan, Information system, Mobile, Technology, Nursing service.

Introduction

The COVID-19 pandemic has greatly affected the health sector, especially healthcare services in hospitals, including nursing care. Furthermore, the number of nurse resources is inadequate to cater to the high number of hospital cases, thereby leading to suboptimal nursing services. Moreover, the handling of cases is not accompanied by a fast-nursing care recording and reporting system, and this reduces the productivity, effectiveness, and quality of services. This problem is relatively common in Indonesian hospitals compared to others outside the country. In 2019, only 36 hospitals among 2.820 in the country met international accreditation standards, while 25% have not been accredited based on national standards[1]. One of the factors influencing the service quality in these facilities is the speed of nursing services, including the use of nursing care manual information systems[2].

Most hospitals in Indonesia still use manual methods, leading to slow and low-quality services by nurses[3,4]. One of the solutions to this problem is to implement a digital-based nursing care information system, coined the Mobile Nursing Care Plan Information System (MNCPIS). This technology is expected to optimize and increase the effectiveness of nurse activities, starting from assessing patient data, establishing a diagnosis, planning, action records, and evaluations through digital methods. Several studies[5,6] explored the positive impact of nursing information systems on hospital services. Sulastri and Sari[5] (2018) reported that electronic-based documentation by nurses reduced the risk of errors in intervening, helped in fulfilling responsibilities, and improved patient safety by reducing medical errors.

COVID-19 has demanded the prompt need for a gitization system in nursing care records; hence, it is important to consider a digital-based nursing care information system (MNCPIS), which is lack-

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ing in Indonesia. Therefore, this study aims to analyze the needs of the MNCPIS as well as to develop an accessible, flexible, and accurate information system model for patients in Indonesian hospitals.

Subjects and Methods

Study Setting and Participants

The research and development (RnD) approach used in this study has three stages, namely, analysis of information system needs, preparation of a digital-based nursing care information system design (mobile nursing care plan), and trial of the model. Furthermore, the preparation stage was carried out using the Framework for Application of System Technique (FAST). This study was carried out at three private hospitals in East Java Province, Indonesia from March 1 to July 30, 2022. The participants were selected based on the classification of hospitals in the country. The sample size was determined using the formula proposed by Lwanga et al[7]. A total of 148 nurses were then selected as respondents using simple random sampling. The inclusion criteria comprise a working period of more than two years, registration as a nurse in a hospital, and willingness to become a respondent. The exclusion criteria were nurses who have a high position, such as head of room or department.

Questionnaire

The respondents' sociodemographic data include age, gender, working period, and education level. The data were collected through interviews, focus group discussions, and a questionnaire. Furthermore, the questionnaire was used to assess the MNCPIS application using ten questions, which served as indicators of the purpose, ease (accessibility), facilities, benefits, performance, information, economics, control/security, efficiency, and service (Cronbach's α-value = 0.807).

Data Collection

Data were collected from respondents in three hospitals from January to July 2022 through an assessment questionnaire using the MNCPIS application. Nurses who had difficulty filling out the questionnaire were assisted. The purpose, benefits, disadvantages, and data confidentiality principles were explained to all respondents. They were also given full freedom to agree or disagree to participate, as well as the privilege to withdraw at any time. The participants were then asked to sign a consent form, after which they completed the questionnaire.

Statistical Analysis

Data from the in-depth interviews and patients' health information needs were analyzed using content and qualitative analyses, respectively. Meanwhile, inferential analysis was carried out in the second and third stages to obtain the difference between the group with the MNCPIS and the control group (conventional) using a *t*-test, with a significance value of $p<0.05$.

Ethical Consideration

This study was approved by the Ethical Review Board (ERB) Committee of Surabaya Muhammadiyah University, Indonesia (ERB number 631/2022). The consent form contains a statement that the participants can withdraw at any time, and that the collected data were to be used for only this study. They were also assured of their anonymity. Subsequently, the participants gave their voluntary consent after a thorough explanation.

Results

Respondents Characteristics

A total of 148 nurses were selected as the study respondents. A total of 59.5% of them were between the ages of 25-35 years, 64.3% were females, 53.4% had a diploma in nursing, and 42.9% had worked as nurses for over ten years (Table I).

Mobile Nursing Care Plan Information System

Figures 1-4 present the preparation results of a digital/MNCPIS-based nursing information system model. The process started with a use case diagram

Table I. Respondents characteristics (n = 148).

Variable	n	%
Age		
< 25 years	4	(2.4)
25-35 years	88	(59.5)
35-45 years	39	(26.2)
>45 years	18	(11.9)
Gender		
Female	95	(64.3)
Male	53	(35.7)
Educational level		
Diploma	79	(53.4)
Bachelor/Nurse Profession	69	(46.6)
Working period		
< 5 years	35	(23.8)
5-10 years	49	(33.3)
>10 years	63	(42.9)

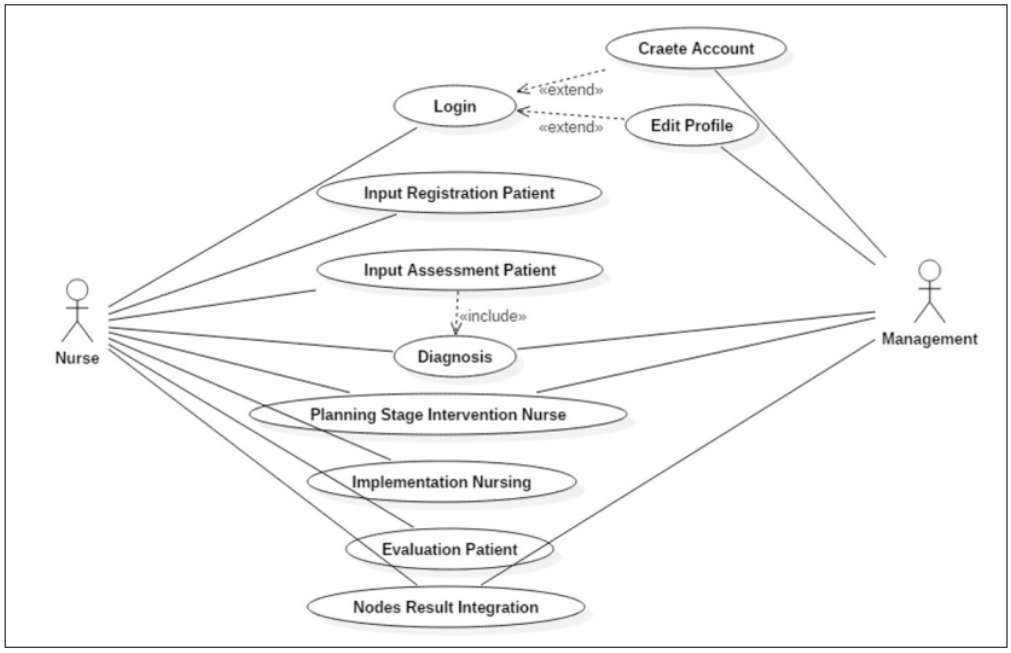

Figure 1. Use case diagram of a digital-based nursing care information system (MNCPIS).

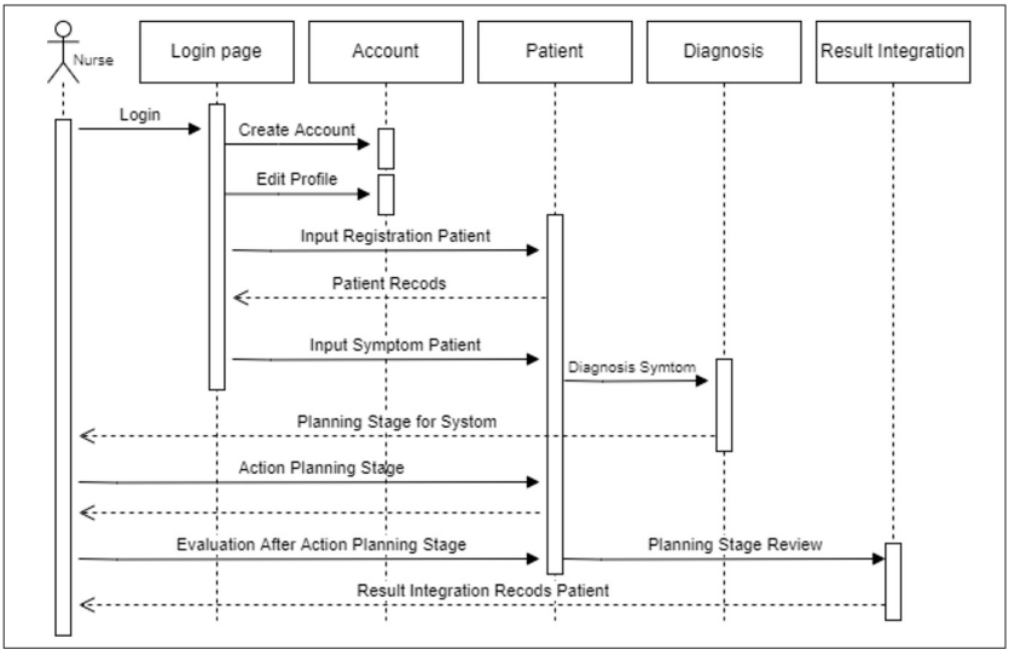

Figure 2. Sequence diagram MNCPIS.

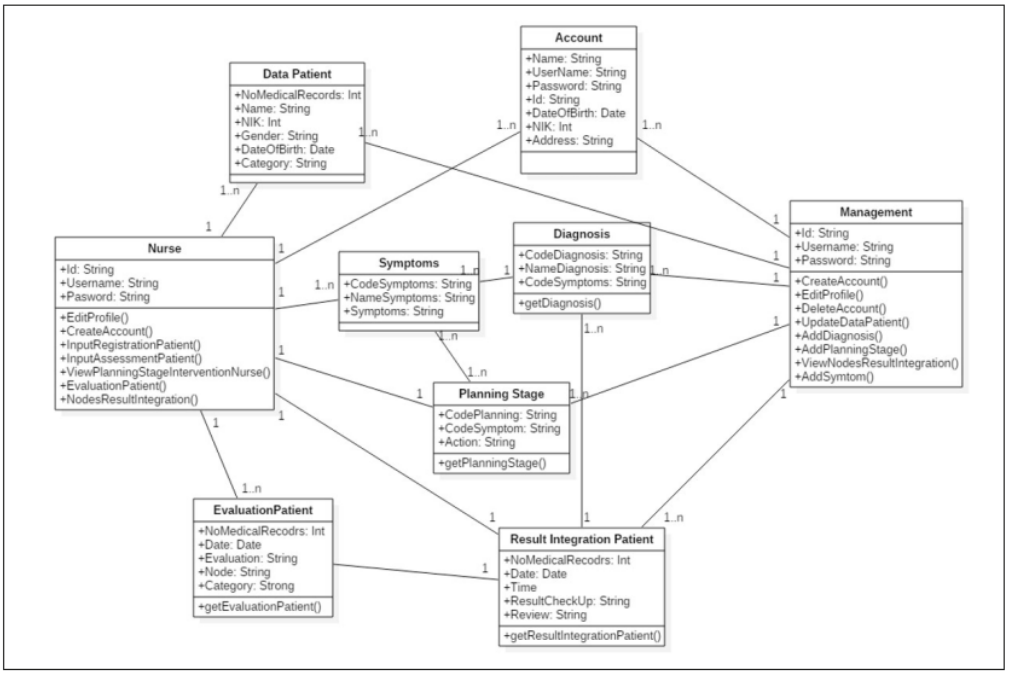

Figure 3. Class diagram MNCPIS.

of the stages of development, as shown in Figure 1. Furthermore, Figure 2 presents the Sequence Diagram of the MNCPIS, while the model for the class diagram of the MNCPIS is shown in Figure 3.

Figure 1 shows the MNCPIS process, which began with the username and password input process, log in, patient registration, and patient assessment data. After inputting the patient assessment, a nursing diagnosis automatically appeared. The planning stage involved selecting existing nursing diagnoses based on priorities. The responses were then automatically displayed in

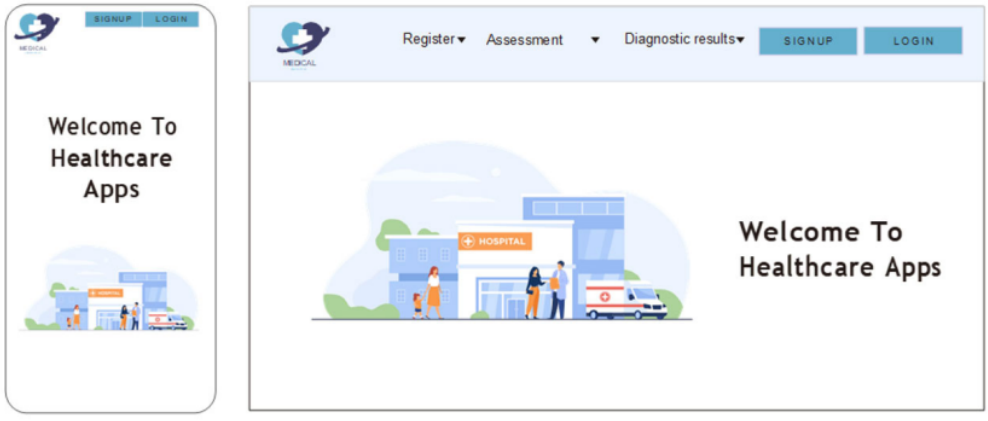

Figure 4. Login interface image for MNCPIS.

the component menu display, and they included objectives, outcome criteria, and a list of action plans. Furthermore, some options can be selected according to patients' needs from the list of action plans. The next stage involves the implementation of virginity, which appears automatically after the planning stage. Nurses only provided a record of the hours, the care date, and the nursing action taken. The last stage was the evaluation and integrated records from other health professions. This is the end of the process, and indicates that the MNCPIS process is complete.

Figure 2 shows a Sequence Diagram of an example of MNCPIS, specifically at the patients' assessment stage. This includes log in, create account, edit profile, input registration patient, patient records, input patient symptoms, diagnosis symptoms, planning stage for symptoms, action planning stage, evaluation after action planning stage, planning stage review, and result integration record patient.

Figure 3 shows the systematic arrangement of files that make up the database in the MNCPIS to display various related data.

Table II shows the effectiveness of using MNCPIS for nursing services in hospitals in terms of its Performance, Information, Economics, Control/Security, Efficiency, and Service aspects for all variables (p=0.000).

Discussion

Several studies[8-12] were carried out on information systems in Indonesia's health services. However, this is the first study to produce a digital-based nursing information system model, coined 'MNCPIS'. It can be used by nurses to conduct assessments, diagnosis analysis, nursing planning, auction records, and evaluation in hospitals. This study developed a digital (mobile-based) nursing care information system that is suitable for nurses in hospitals. The speed and accuracy of nursing care records often affect the time taken to perform other duties. To find the correct and appropriate model needed, a digital-based information system was developed. The model was tested, and a *t*-test was carried out to assess the difference between the use of conventional and digital (MNCPIS) models. Although the use of nursing care information systems is diverse, the digital-based type can still be adopted.

This study demonstrated that the average suitability assessment of the product was suitable for the needs with an average value of 3.47 on all variables/components. This finding indicates that the information system is appropriate for nursing services in hospitals. The respondents also rated the model as less suitable for conventional (manual) nursing care information systems with an average rating of 1.799 on all variables. The assessment of the digital nursing care model was twice as good as the conventional type.

The results suggest that the mobile-based nursing care information system is in line with modern real-world settings. This is because the android system has beneficial features, including an application framework where users can use and transfer components, such as mobile devices, 2D graphics, and 3D graphics based on the open GL library. It also contains media support facilities, such as audio and video in various image formats, as well as data communication channels, including GSM, Bluetooth, Wifi, a camera, a global positioning sys-

Table II. Testing the effectiveness of using MNCPIS for nursing services in hospitals between the control and experimental groups (n = 148).

Variable	Group: Nursing Care Plan with Mobile Nursing Care Plan (experimental group) Mean ± SD	Group: Nursing Care Plan with Traditional (manual) (control group) Mean ± SD	*p*-value
Nursing Assessment	3.938 ± 0.240	2.227 ± 0.422	0.000*
Nursing Diagnosis	3.938 ± 0.240	1.136 ± 0.345	0.000*
Nursing Planning	3.953 ± 0.209	2.287 ± 0.456	0.000*
Nursing Intervention	3.953 ± 0.209	1.984 ± 0.540	0.000*
Nursing Evaluation	3.923 ± 0.266	1.363 ± 0.484	0.000*

*Significant value at p<0.05. Statistic *t-test*.

tem (GPS) compass, and an accelerator meter. The presence of an android application development environment, including emulators, debugging tools, and plugins for the Eclipse IDE were also utilized[13-16]. As an open-source system for building an application without any limitations, the Android Software Development Kit (SDK) provided the tools and Application Programming Interfaces (APIs) needed to develop an application using the Java programming language[17-21].

The model developed in this study does not turn off other applications, and can easily be used/implemented. Based on the principle of an information system, its data accessibility was presented on time, accurately, and appropriately, according to users' needs.

This study is in line with that by Su et al[22], where clinical nursing uses an information system with a systematic approach based on Mobile Human-Computer Interaction (M-HCI). The model can respond to patient conditions in real-time and reduce delays in information availability[22]. Moreover, a system that combines small screen interface design principles with user-defined requirements can help users learn faster with less working memory. Through its implementation, the accumulated knowledge and experience of the continuous care model are expected to help staff evaluate the discharge planning process to achieve efficient treatment procedures[23]. These findings are consistent with those by Bikmoradi et al[24], who report that the use of technology through tele-nursing has an effect on adherence to the treatment plan. Based on these two studies, it is clear that information technology in nursing is needed to improve the quality of healthcare services provided by nurses.

The use of a digital-based nursing care system can reduce the use of paper for recording, which requires time to write. This model started with an assessment, followed by nursing diagnosis enforcement, planning, intervention, and evaluation. The proposed model can also assist nurses in treating patients more efficiently. It can also reduce errors in documenting and evaluating the results of the nursing actions given. The results show that nurses were more effective, efficient, and optimal in carrying out their duties. The utilization of a system that is accurate and paperless with real-time data makes it easier to audit the nurses working at a hospital. It also makes nursing care more integrated, improves patients' safety and quality of care, and increases the use of planning based on these standards. Its usage also helps multidisciplinary team members to interact based on quality standards, improve service quality, and expand access to nursing[5,25,26]. Furthermore, mobile technology is directly involved in health services provided in hospitals. There are several health innovations based on mobile systems, since they are modern and efficient information systems[27].

One of the strengths of this study is that it used representative data based on the inclusion criteria. A test was also carried out to determine the suitability and accuracy of a digital-based nursing care information system model (MNCPIS) for the needs of nurses in nursing care records to provide health services.

Conclusions

The use of conventional nursing care information systems increased the time required by nurses to engage in administrative actions, specifically in recording nursing care, and this led to low-quality services. This situation was experienced during the COVID-19 pandemic, and an increasing number of positive cases. However, the use of MNCPIS led to a fast and flexible recording time in nursing care. The mobile model was easy to access. Special attention must be paid to caring actions, which help to increase the quality of nursing services in hospitals. Training related to MNCPIS is also needed to provide more information about its adoption. Digital literacy skills in nursing must be improved to ensure that all nurses can use new information technology, specifically the digital-based nursing care systems.

Acknowledgments

The authors are grateful to the Directorate of Research, Technology, and Community Service, as well as the Ministry of Education, Culture, Research, and Technology, Indonesia, for facilitating this study.

Ethics Approval

Not applicable to this study because it did not involve humans or animals.

Informed Consent

Informed consent was obtained from all subjects involved in this study.

Conflict of Interests

The authors declared that they have no conflict of interests.

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