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Healthcare Informatics Research

Usability of Academic Electronic Medical Record Application for Nursing Students' Clinical Practicum

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Objectives: Nursing curricula for undergraduate nursing students need to reflect the information technology used in current nursing practice. A smart-device Academic Electronic Medical Record (AEMR) application can help nursing students access and document records for the clinical practicum. We conducted a pilot study to evaluate the usability of an AEMR application before applying it to the clinical nursing practicum. **Methods:** A previously developed EMR application was modified as an AEMR to access patient information at bedside and to practice documentation. We added several features to the current EMR application to create an AEMR environment. We created a series of document forms and several useful scales on an external application, which included nursing admission notes, vital signs, and intake/output. The case scenarios and tasks were created by a research team to evaluate aspects of AEMRs, including their usability and functionality. Five nursing students completed 15 tasks using a think-aloud method with a tablet device. **Results:** Minor usability issues were identified and rectified. All participants indicated that they became familiar with the application with little effort. They said that the application icons were intuitive, which helped them find patient information more quickly and accurately. **Conclusions:** The application will improve timely access to patient data and documentation for nursing students. We are confident that this AEMR application will enhance nursing students' experience with their clinical practicum, and help them to better understand patient conditions and document them with ideal accessibility.

Keywords: Nursing Education, Computerized Medical Records Systems, Mobile Applications, Nursing Records, Pilot Projects

I. Introduction

With the transition from paper to Electronic Medical Records (EMRs), nursing curricula for undergraduate nursing students need to reflect the information technology used in current nursing practice [1-3]. Consequently, advancing nursing students towards informatics competencies is essential to enhance their critical thinking. Undergraduate nursing students have used EMRs without sufficient opportunity to explore their use at a patient's bedside and document on them during their clinical practicum. Academic EMRs (AEMRs) can assist nursing students in understanding

patients and care in a safe and efficient practicum environment [4,5]. The need for and importance of applying EMRs in classrooms and clinical teaching for nursing students and trainees in other healthcare professional fields are well documented [6-9].

A university hospital with a multi-hospital system in Seoul, Korea has developed and deployed an EMR application—a mobile solution for healthcare professionals at a hospital in an iOS environment [10]. The application has been modified for nursing students to access patient information at bedside and to practice documentation. Before the iPad-based application could be adopted for nursing students' clinical practicum and for an experimental study, it was necessary to determine its usability and functionality. A pilot study was conducted to evaluate the usability and functionality of an AEMR application. The purpose of this study was to assess the pilot test results before the adoption of the application for the clinical nursing practicum.

II. Case Description

1. Setting and Sample Selection
Participants were five third-year nursing students in a four-year nursing program at a university in Seoul, Korea. These third-year nursing students started their first clinical practicum in March 2014 and had been using a PC-based EMR for their clinical practicum. The recruit flyer explaining this pilot study was posted on a bulletin board. The study was conducted in July and August 2014.

2. Description of Features of the AEMR Application
The device was an iPad mini with retina display with a secured wireless network connection that allowed access to the EMR for patient information with protection. Thus, users could not access the EMR through any other wireless network connection. In addition, a passcode was set to protect data in a device. We selected this among iOS-based tablet devices owing to its portability, weight, and resolution, which made it easy to carry and provided good screen quality for diagnostic imaging.

We added several features to the current EMR application to create an AEMR environment. Because the EMR application presented real-time patient information, the AEMR was set to be read-only to prevent accidental altering of patient records by students. To supplement the limitation of this EMR application, we created a series of document forms on an external application, Numbers, which is a spreadsheet application that allows users to enter numbers or texts. The documents built into Numbers include nursing admission

notes, vital signs, and intake/output. In addition, several scales were designed to assist students in assessing patient information regarding fatigue, sleep quality, and so on. Those forms were created with a built-in calculation function so that the total score could be automatically added when students entered data. Lastly, those documents and scales were set to be sent to the students' email accounts for further use as a study resource. Figure 1 shows a participant entering vital sign data on the vital sign sheet on the AEMR.

3. Development of Cases and Tasks for Usability Assessment
The case scenarios and tasks were created by a research team to evaluate aspects of AEMRs, including their usability and functionality. We selected two patient cases from the EMR and developed 22 tasks for usability and functionality assessment. The cases and tasks were based on a normal clinical day in a hospital. Tasks had varying levels of difficulty from "Log into the AEMR application" to "Interview a patient, fill in the nursing assessment document form (or fatigue scale), and send it to your e-mail" and Table 1 shows the tasks used in this study. For the task of interviewing a patient, one research assistant acted as a patient to answer a participant's inquiry.

Two clinical instructors from the college of nursing reviewed these cases and tasks prior to the pilot test. They recommended adding a task pertinent to nursing diagnosis and nursing record keeping. Finally, 22 tasks were developed, and eight tasks among these were common to both cases, and seven tasks unique to each case, which yielded a total of 15 tasks per case. The two scenarios used in this pilot study are summarized below.

1) Case 1
Ms. Lee is a 43-year-old female patient who has had a severe, sharp backache that began two days ago. Aortic dissection

Figure 1. Usability test to evaluate the Academic Electronic Medical Record (AEMR) application.

Table 1. Tasks for usability testing

	Item
Common task (8 items)	Log into the AEMR application.
	Find your patient from the patient list.
	Find chief complaints when he/she was admitted.
	Find a primary diagnosis.
	Find and write down the first record of vital signs on admission.
	Find and write down the patient's nursing diagnoses.
	Enter the following data in the vital signs sheet: blood pressure (101/58 mmHg); heart rate (61 beats per minute); respiratory rate (25 breadths per minute); and body temperature (36.2°C).
	Log out.
Task for case 1 (7 items)	Find and write down the total amount of urine output.
	Find and write down medications in the morning.
	Find the latest progress notes and write down a physician's comment.
	Find and write down the latest laboratory result for serum creatinine and compare with reference presented on the screen.
	Find a nutrient management plan for the patient and write down whether the patient is at low-risk or high-risk.
	Find and write down medications before the surgery.
	Interview the patient[a], fill in the nurse's assessment form, and send it to your e-mail.
Task for case 2 (7 items)	Find and write down the total of intake/output.
	Find and write down the latest laboratory result for hemoglobin and compare it with the reference presented on the screen.
	Find the latest progress notes and write down a care plan for dyspnea on exertion.
	Find and write down a diet for the patient.
	Find the purpose of referral to a psychiatric department.
	Find the electrocardiogram result and write down the heart rate.
	Interview the patient[a], fill in the fatigue scale, and send it to your e-mail.

[a]A trained research assistant acted as a patient for the interview.

was suspected in computed tomography. She was admitted to the hospital yesterday.

2) Case 2

Mr. Kim is a 67-year-old male patient with heart failure (HF). He has mitral valve regurgitation and has developed severe dyspnea, beginning four months ago. He was readmitted via the emergency department because of HF symptom aggravation.

4. Data Collection Procedure

Among students who were recruited for this pilot study, a convenient meeting time was scheduled for each participant with our research team to carry out an individual usability assessment. After a participant gave an informed consent, a 15-minute introductory overview on how to use the application followed. Each participant was given a paper sheet of one case with random choice and a test device, an iPad mini with retina display with a secured wireless network connection. They were then asked to complete the patient case with 15 tasks using the AEMR application on an iPad. Participants were provided as much time as required to complete the tasks.

We used the 'think-aloud' method, which is known as an effective method to assess a users' ability to interact with technology by asking them to express verbally what they are thinking about as they interact with technology [11,12]. Student participants were asked to talk aloud while they solved tasks. The comments from participants were recorded and transcribed by our research team to extract the strengths and weaknesses of the AEMR application, which were used to modify and refine the AEMR application.

The duration of each task was checked, and user interactions with the software were recorded using both screen-

Table 2. Participants' feedback on the AEMR application

	Description
Strengths	It required little effort to become familiar with the application.
	Application icons were more intuitive than those of PC EMRs, which made finding patient information much easier.
	Documentation opportunities during patient interview were valuable.
	It included almost all patients' data that students want to know for the clinical practicum.
	The e-mail sending function could be useful for case studies.
Weaknesses	Using linked web document forms might incur a loss of data previously entered when leaving the form to find additional data.
	Using a smart device in front of a patient might make them uncomfortable.
	The smart device is somewhat big to carry.

AEMR: Academic Electronic Medical Record, EMR: Electronic Medical Record.

recording software and a camcorder. After the tasks were completed, we asked the participants to share any problems encountered when they navigated the application to complete the tasks. The required time commitment for each participant was approximately 60 minutes: instructions for the test for 15 minutes, usability assessment for about 20–30 minutes, and interview for 15 minutes.

After completion of the participation, a gift card valued at $20 was provided to each participant. This study was approved by the Institutional Review Board of the Yonsei University College of Nursing in Seoul, South Korea (No. 2014-0026-1).

5. Findings of Usability Analysis

The mean time required for each student to complete the tasks was 19 minutes 39 seconds, with all times ranging from 11 minutes 9 seconds to 23 minutes 55 seconds. The most difficult tasks were "Find the result of the nutritional assessment and current diet" and "Assess the standard patients and fill out the admission nursing documentation in the linked document form." The easiest tasks were "Log out" and "Select the target patient from the 'patient list' screen."

Few usability and design issues were identified. The strengths and weaknesses of the AEMR application expressed by the participating students are shown in Table 2. All participants indicated that they became familiar with the application with little effort and that the documentation functions were valuable. They said that the application structures were more intuitive and that it was easier to find patient information more quickly and accurately than on PC EMRs. The participants expressed concern about the possibility of losing data that they had entered when they left the form to find additional data.

III. Discussion

The findings from this pilot study demonstrated that the AEMR application had minimal usability and design issues when the participants attempted to locate the necessary information to understand their patients. Also, the participants expressed favorable attitudes toward AEMR use and thought it was beneficial. A previous study that assessed the usability of EMRs for nursing students also reported positive experience with EMR use for nursing documentation [12].

Based on the results of this pilot study, we slightly modified and reevaluated the tasks and functions of the application. Based on the weaknesses indicated by participants from the usability assessment, we made changes to allow users to save a file under a different file name so that a student is able to reopen and make change to the file s/he created. Further, we instructed the students to ask for consent from patients to use the AEMR during interviews. The device size was already chosen because of its small size and light weight as a tablet; thus, we decided to continue using this device.

In conclusion, the AEMR application provided an environment in which nursing students could conveniently and quickly access patient information at bedside. We are confident that this AEMR application will enhance nursing students' experience with their clinical practicum and help them to better understand patient conditions and document them with ideal accessibility. This will lead to improved planning and provision of appropriate nursing care during nursing students' clinical practicum. After the AEMR is applied in clinical nursing practicum, students' satisfaction with it should be evaluated.

Conflict of Interest

Acknowledgments

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