

A PATIENT-IDENTIFICATION-ORIENTED NURSING SHIFT EXCHANGE SUPPORT SYSTEM USING WIRELESS RFID PDA TECHNIQUES

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Abstract: The objectives of this study were to test the feasibility of combining RFID and PDA technologies in nursing care workflow and to develop a nursing shift exchange support system that used cases of laparoscopic cholecystectomy clinical pathway. The system consists four major functions: patient identification, nursing shift exchange support system and data linkage to the backend database; designed to feature with “Positive Patient Identification” and “Point of Care” for patient’s safety and security. The evaluation of the study showed that major participants agree the system might be able to reduce the nursing shift exchange interval and improving nursing care quality. The most challenging part for the future work would be to embed the system into the real workflow and the priority of contents stored in RFID. Future study would be to examine the practical effectiveness of the system.

Introduction

The nursing shift exchange has been time consuming, inefficient, and having strong connection with patients’ safety [1]. It has been proposed by the JCAHO to enhance patient safety through a quality patient identification (ID) mechanism [2], which is also the core concern in Taiwan's hospital accreditation. Since the RFID has been proposed to be a good ID solution[3], we were interested in develop a ID-oriented nursing shift exchange support system by using the RFID technique and combination of mobile PDA device in a wireless environment to help nurses improve the accuracy of patient identification. Mean while, real time nursing shift exchange database can be established at the same time in order to provide patient clinical process progress and info search.

Materials and Methods

We interview the nursing supervisor, head nurse and three nurses of general surgical ward in the medical center in Taipei in order to understand the condition of nursing shift exchange in real clinical workflow and

demand of improvement which is to ensure the practicability of the our system design.

Base on the mobility of nursing care the system was composed of 4 important components: the PDA equipped with RFID reader and 802.11b wireless capability, the PC clinical path database server for data storage and data management, the Patient Wrist Band with portable patient medical data, and the ID card for nurses on duty, see Figure 1.

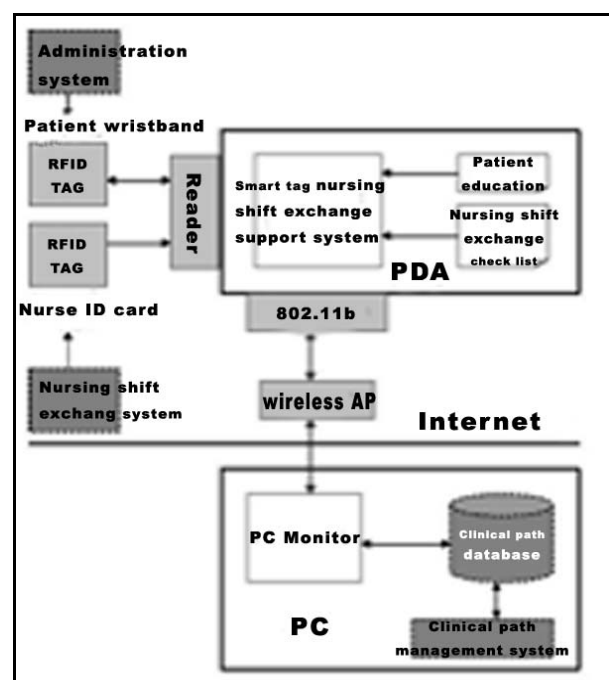


Figure 1: The system structure.

The 802.11b PDA was equipped with OMRON V720S CF I/F R/W RFID reader, and coded by the system which was designed by Microsoft Windows Platform SDK for Pocket PC and Microsoft eMbedded Visual Basic 3.0 applications. The PC subsystem was developed using Microsoft Visual Basic 6.0 included with Microsoft CE Winsock Control 6.0 and Microsoft Excel to simulate the data in PDA to PC database. The

clinical pathway of laparoscopic cholecystectomy was used as the workflow in nursing shift exchange support system design. The wristband was inserted a Philips 128 Bytes I-CODE II chip and the data content was based on the items on the nursing shift exchange check list for the clinical-pathway laparoscopic cholecystectomy patients, as well as the patient educational information. A passive RFID IC card was carried by the nurses.

DATA TYPE	PATIENT DATA(32BYTES)		CLINICAL PATHS(80BYTES)		SYSTEM AREA(16BYTES)	
PAGE	0 HEX	7 HEX	8 HEX	B HEX	C HEX	F HEX
BLANK	00HEX			01HEX		
AREA TYPE	USER MEMORY AREA(112BYTES)				SYSTEM AREA(16BYTES)	

Figure 2 : The Memory setting design in RFID Tag of Patient wristband.

10 participants from general surgical ward of a medical center in Taipei were invited to evaluate the system. We used an expert-validated TAM questionnaire in terms of their perceived ease of use and usefulness of the system. Table 1 shows the background of the participants.

Table 1 : Background of the participants (N=10)

	Age		Title	Education BG	
	<30	>30	RN	College	University or higher
number	5	5	10	2	8
%	50%	50%	100%	20%	80%

	Clinical experience		Frequency of using Computer		Have RFID using experience	
	<4year	>4year	<1time	>1time	Yes	No
number	3	7	1	9	7	3
%	30%	70%	10%	90%	70%	30%

Results

The system was designed to meet with the clinical pathway and nursing shift exchange requirement. Sample screens are shown in Figure 3-4. The majority of participants fully agreed that the system with RFID technique integrates could reduce the errors during the shift exchange and nursing process. PDA interface did not prefer in future implantation.

Figure 3 shows the beginning shot of nursing shift exchange system. Every nurse has to update her care list in staff ID card before starts daily routine to ensure the security of patient data.

Figure 4 shows Identification function of nursing staff. When the staffs ID card gets close to the RFID reader and click the ID Identification of system user on the screen it will update the data of nurse on duty. The Figure 5 shows the care list of nurse on duty at the moment.

Figure 6 shows the monitor screen of clinical pathway workflow, it was designed with intuitions and user-friendly.

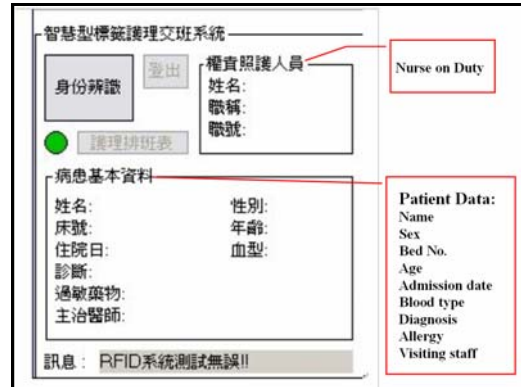


Figure 3 : The screen shot at the beginning.

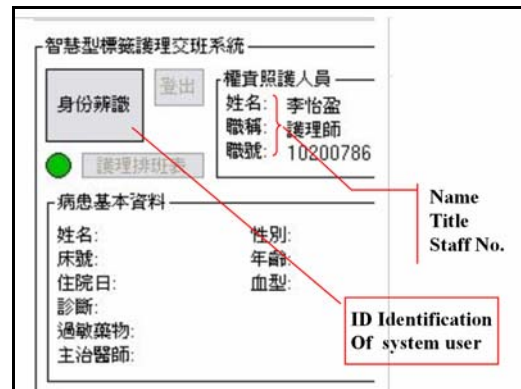


Figure 4 : The screen shot when update the nurse on duty.

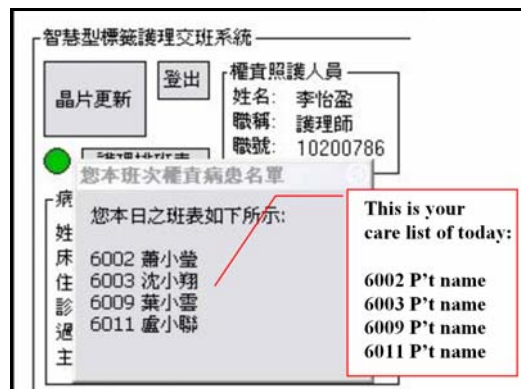


Figure 5 : The screen shot when update the care list.

Figure 7-10 show the contents of our nursing shift exchange support system which included clinical pathway check list on each stage of laparoscopic cholecystectomy patients, also the reasons of clinical pathway variations.

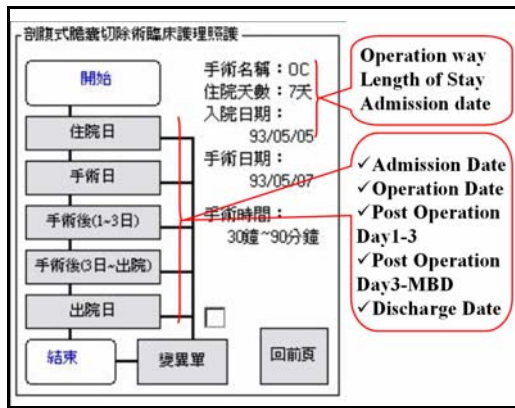


Figure 6 : The screen shot of clinical pathway workflow.



Figure 7 : The screen shot of fully update.

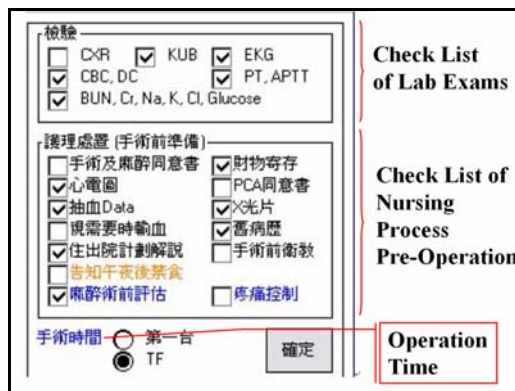


Figure 8 : The screen shot of clinical pathway check list on admission date.

Discussion

This study combined PDA and wireless RFID techniques to draw a prototype of nursing shift exchange support system. While the tool, place, time, and content of nursing shift exchange are complicated [4], so we have study the nursing shift exchange workflow and evaluate with nursing staffs during the whole study phase.

During the phase of system design, we face the problem of storage limitation of RFID chip and spend

most of the time discussing with nursing staffs about the priority of contents should be coded in RFID chip.

Although Barcode techniques are more popular and acceptable in hospitals [5], but using RFID techniques is a new trend in health care system.

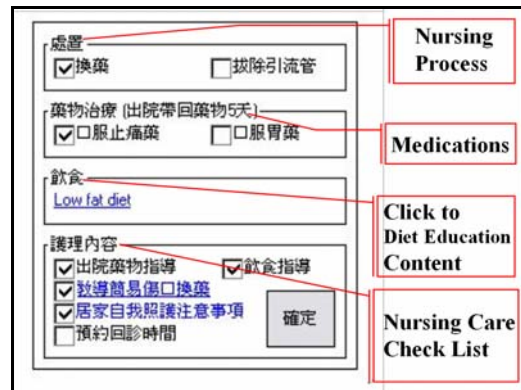


Figure 9 : The screen shot of clinical pathway check list on discharged date.

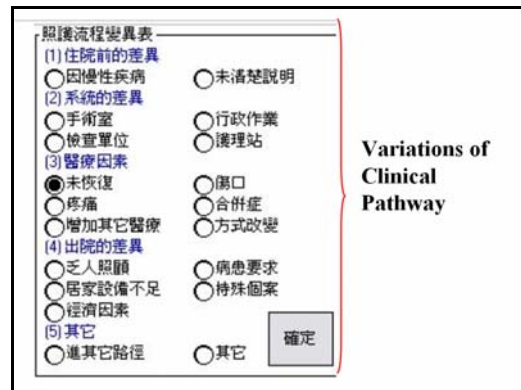


Figure 10 : The screen shot when patient out of clinical pathway.

Conclusions

Far from the beginning of 19th century, Florence Nightingale already pointed out that nurses must record the observations from patients, and these records will improve the quality of care and recover from disease [6]. So, it is important for nurses to record patients' data systemically and using them to manage the patients' health condition.

Most nursing shift exchange process is passing the patients' data by paper sheets and oral speeches [7]. Once these data are collected automatically by electronic system with accuracy, it would be a great improve on clinical nursing care quality and management.

The use of RFID technology can improve the shift exchange quality but how to standardize the patient data inside the limited space of wristband chip still needs to be studied to make this technology more useful and interoperable with Health Information System. It is also a challenge to design a better carrier for RFID reader with enough computing power.

References

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