

Medical information support system using Personal Digital Assistants (PDAs)

ABSTRACT

Kyoto Second Red Cross Hospital in Japan has introduced a medical information support system using Personal Digital Assistants (PDAs). This system, which is connected to the Electronic Medical Record (EMR) system, enables clinical staff to easily verify and record that the right medication is administered to the right patient. Currently, seven types of PDAs are in operation for the purpose of risk management and to provide service support to nursing staff; the use of PDAs contributes to reducing risks and to streamlining the work of the medical office.



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Background

Medical safety issues have been coming under increasingly intensive public scrutiny in Japan, with many critical eyes being turned on medical institutions. Any case of medical malpractice in a medical institution could lead to liability for massive financial compensation to the affected patient and/or their family, including damages and legal costs. Furthermore, such a case would seriously impair patient/user trust in the medical institution concerned and rebuilding that relationship could take a long time. The potential for such situations to arise further underscores the importance of risk management in medical practice.

Kyoto Second Red Cross Hospital in Japan is fully committed to risk management aided by use of Personal Digital Assistants (PDAs).

Overview of Kyoto Second Red Cross Hospital

The hospital is a 640-bed, acute tertiary care facility with a medical emergency centre. Since June 2006, it has been implementing a fixed amount payment system based on the "Diagnosis Procedure Combination" (DPC). An Electronic Medical Record (EMR) system was introduced in January 2004 and some 700 desktop terminals are currently in operation.

With the introduction of EMR, the hospital also introduced a risk management system for medications using PDAs. Through the PDAs, the system records and verifies all the data relating to infusions, thus making it possible to reduce risks and mistakes. Based on the result of the operation of this system in 13 wards, the use of PDAs has been extended to other hospital information systems such as a system for operating room support, endoscopic operations and in-hospital distribution.

System overview

Currently, seven types of PDA units are in operation at the hospital. These fall into two broad categories: risk management and service support (recording by nursing staff).

1. PDAs for risk management

(1) PDAs used for identifying IV medications

As part of the system for identifying IV medications in hospital wards, the following checkpoints should normally be observed:

- Verifying the identity of the patient when administering an IV medication
- Ensuring that the prepared IV solution is in line with the doctor's prescription.

In order to achieve this, the hospital has implemented the "Solemio NURSE" system and provided its clinical staff with PDAs. This system enables the pharmaceutical department to prepare the medication according to a doctor's prescription as shown in the EMR, and to issue a barcode label for the IV fluid bottle. In the wards, nurses scan, with a barcode scanner, the barcode on each vial/ampoule of medicine to be mixed; the barcode contains its Global Trade Item Number (GTIN). This process verifies that the details of the mixed medication match those in the doctor's prescription (Fig. 1). In addition, nurses use PDAs equipped with a barcode scanner to verify the identity of the patient and the fluid bottle upon giving an IV infusion and removing a needle. This data is transferred to the EMR system via wireless Local Area Network (LAN). Thus control of every single aspect of "6W1H" (when, who, whom, what, where, why, and how) can be attained (Fig. 2).

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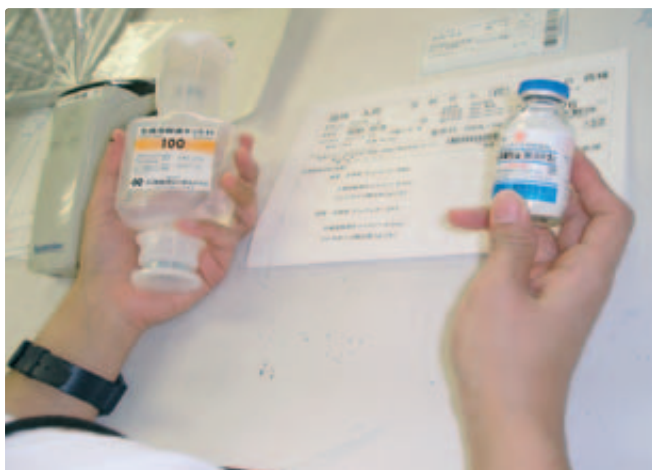


Fig. 1 Barcode for IV fluid bottle and mixing medications

This system is extremely effective in ensuring that the IV infusion given to a patient conforms to the doctor's prescription and, as it holds 6W1H data for each given IV infusion, it can be queried at any time.

Most PDA-based systems offered by other manufacturers cannot provide doctors' instructions in real time, this means that a time limit has to be set when issuing an IV instruction. Such an operational shortcoming can sometimes seriously reduce the advantages of electronic systems.

(2) PDAs used for Endoscopy Support System

"Solemio ENDO" system, which is in use for endoscopic examinations in the hospital, fully embodies the concept of "entry upon implementation" which refers to data entry at the time of examination. In addition, it enables data entry and data management of details of pre-exam procedures and treatment devices used. In the examination room, the PDAs display a list of examinations to be conducted on that day and the patients that are to be prepared for pre-treatment are confirmed. The barcode scanner PDA is used to scan the drugs used for pre-treatment. A GS1-128 barcode can be scanned from a list issued by the hospital distribution system for medical materials that are used but are not marked with a bar code. The GS1-128 barcodes use a standardised system with application identifiers, enabling not only internal ordering within the hospitals but also external ordering from suppliers.

2. PDAs for service support purposes

(1) PDAs as media for recording nursing care in hospital wards

Due to their simplicity and portability, this is the most common usage of PDAs, recording a patient's conditions right at the bedside. In contrast, there has been a similar identification system using mobile notebook PCs. However, in the event of an emergency, it may be more likely that the notebook PCs be left in a patient's room.

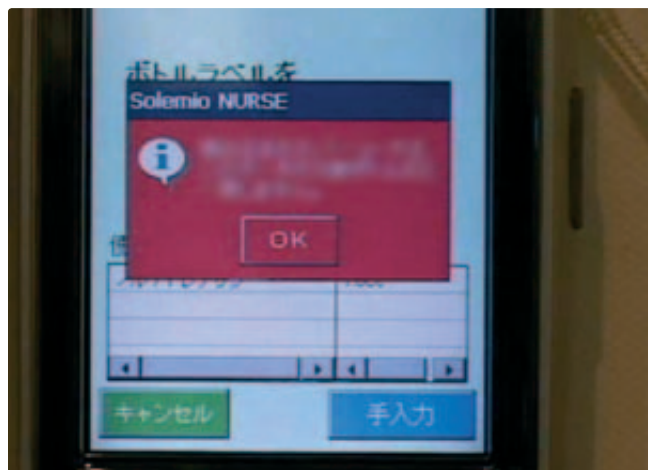


Fig. 2 Patient identity verification upon IV injection

(2) PDAs used for operating room support system

The operating room support system is also adopting PDAs. The function of "Time Stamp" of PDA is fully utilized to record all the data of the treatment during operations.

The scheduled operations for that day are transmitted to the PDAs. This information is checked against the barcode on a patient's wristband to verify those who are scheduled for surgery. Barcodes for medications and medical/surgical materials are internally integrated GS1-128 barcodes issued from the distribution system. During the operation, scrub nurses record implementation information by scanning each barcode of every medication and medical/surgical material used (Fig. 3).



Fig. 3 Operating Room Support System

(3) Application for endoscope disinfection (RFID-based PDAs)

PDAs equipped with IC-tag readers are used in endoscope cleansing and disinfection. This has enabled the establishment and implementation of an endoscope disinfection management system whereby every endoscope that has an IC-tag showing its type and serial number is linked to the disinfection machine and the disinfection personnel (Fig. 4).

(4) PDAs used for distribution system

In the case of emergencies, when medication is used from ward stock rather than dispensing from the pharmaceutical department, PDAs on the ward are used to scan and record the dosages. Thus, the system not only holds usage history but also facilitates order management (Fig. 5).

(5) PDA operation in ECG system

Many commercially available electrocardiograph monitors are huge in size, which can sometimes lead to significant difficulties in shifting the equipment in the event of an emergency or in using it in a cramped environment. Therefore, the hospital has introduced a system where a PCI card with electrode cables is inserted into PDA slot this enables 12-lead electrocardiograms. The cardio graphic record once stored in the PDA can easily be transferred to the EMR system. The physiological laboratory operates a system where patients' electrocardiograms when at rest can be easily viewed and compared to those taken during an attack via the Web server.

Barcode use with other than PDAs

Currently, sterilisation is performed in the Central Sterilisation Room. To manage instruments by set and by unit, the hospital places barcodes on the set tray or the unit after sterilization. When the instruments are used in the Operating Room or Treatment Room, data on whom they were used and for what treatment is captured and held in the hospital system. In the case of insufficient sterilization or an infection outbreak this information can be retrieved and appropriate action taken.

Secondary use of data

In addition to preventing errors themselves, analysis of "warning" occurrences that happened at the time scanning can lead to measures for reducing risks. Here, "warning" means alert messages given in the event of misidentification, thereby successfully averting or preventing a potential malpractice situation. The hospital analyses nurses' work details, total workload and "warning" information at the time of, for example, an injection (all of this data is obtained using PDAs), demonstrating the facility's total commitment to improving operating processes. To cite an example, it was found that warnings frequently occur in wards where certain medical practices (e.g., chemotherapy) involve frequent changing of doctor's orders due to changes in patients'



Fig. 4 IC tag attached to endoscope



Fig. 5 Application of PDA for distribution system

conditions or blood test results. Based on such results, doctors are instructed to ensure the notification of order changes, and this has proven to be effective.

Conclusion

Use of PDAs within the hospital has resulted in a system that allows data management in every aspect, regardless of time or location. In terms of establishing a "ubiquitous environment," use of PDAs appears to meet medical institutions' needs. From the perspectives of achieving medical safety, ensuring patient safety, developing traceability, and streamlining medical office work, Kyoto Second Red Cross Hospital has certainly proved that PDAs can be used as effective tools.

ABOUT THE AUTHOR

Dr. Kiyohito Tanaka is Vice-Director of the department of Gastroenterology and Project Manager of hospital distribution in Kyoto Second Red Cross Hospital (K2RC). He leads four projects: optimization of Purchase for Medical Material Project, safety management for injection and infusion, business improvement for operation room and sterilization centre, and business support for endoscopic centre.