

Construction and Evaluation of EHR which Supports Team Practice

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Abstract

Purpose: The new type of EHR is designed to share the information among all medical staff and the patient concerned to promote team practice, which is expected to enhance safety and high-quality medical care. From the viewpoint, the new type of EHR has been constructed and operated in the Hiroshima University hospital since 2003. And the usability of the new type of EHR is evaluated. Methods: The evaluation is done by the questionnaire survey to all of the hospital staff using the HNS. The result of recovering is simple tabulation. Results: About 70 % of the whole answered that the EHR facilitated information sharing among the professions concerned with the medical team. Also, about 65 % of the whole answered that the safety management system was contributing to the improvement of the patient safety. About 66 % of the whole answered that the new EHR contributed to the increase in efficiency of the clinical work. Conclusion: The new type of EHR system is useful for team practice.

1. Introduction

In Japan, information systems in the healthcare field have been developed from the viewpoint of hospital administration for over 30 years. The resulting products off course were still not sufficiently fit for clinical scene. Therefore, making the information system to support clinical staff, over 20 years of the pasts, our interest gradually shifted to EHR.

In the research, we thought that it was important that the future EHR has played a role as a navigator of clinical process in team practice, and a supporting tool for patient safety.

From the above viewpoint, we reexamined the basic design of the conventional information system for the hospital administration, and then the new of EHR for patient-centered team practice has been operated in the Hiroshima University hospital since 2003 [1].

In this paper, the evaluation of the new EHR by the end users is reported, and based on the result, the usability of the system is considered.

2. Materials and Methods

2.1. Requirement of the new EHR

The ordering system got excellent results for the abridgment of the patient waiting time and so on, but could not contribute to the efficiency of treatment and nursing process of medical team and to the improvement of the patient safety. Therefore, the authors analyzed the workflow of the ward at Hiroshima university hospital and organized the factor which obstructs the efficiency of them practice and the patient safety as the following.

(1)The medical staff was managing the latest patient information intensively at the staff station, but a lot of posting work was carried out because of the information sharing among the medical staff. The posting work became a new risk factor and also hindered the realtime information sharing among the medical staff. Moreover, the sharing of the information on the urgently changed instruction was impossible.

(2)Because the treatment and nursing care plan were changed frequently, the grasping of the progress of the process was difficult. Therefore, according to the grasping mistake of the latest information, there was possibility of the overlap and non-implementation of medical treatment and nursing care.

(3)The medical staff could not provide the observation and the implementation data occurring at the bedside for the other member of the medical team efficiently until it returned to the staff station.

(4)In the confirmation of the patient who should implement the medical practice, the medical staff sometimes made a mistake.

In order to improve the above-mentioned risk factors, we defined the requirement of the new EHR as the following.: (a)The system should be designed to be able to share the information among the patient and the all of medical professionals concerned to promote team practice, which is expected to enhance patient safety and high-quality medical care. (b)The system should be designed so that the medical professional can simply and surely input the healthcare record in process of medical and/or nursing treatment. Moreover, in the necessary place when necessary, the system should be able to provide an accumulated healthcare record for the medical profession in a form suitable for various scenes of clinical process. (c)The system should have a common browser for all the medical professional of the medical team to grasp the status of progress of medical and/or nursing process. Progress of the clinical process is managed and presented on the browser





chronologically. (d)The system should be designed to lose the posting work and to reduce a work load of the medical professionals. (e)The system should have a function to prevent from the mistaking of a pharmaceutical and/or a patient. (f)The system should be designed that accumulated clinical process data can be used for the rational hospital management.

2.2. Outline of the construction system

Being based on the requirements defined in subsection 2.1., we have constructed the EHR with the following functions in the Hiroshima Univ. hospital since 2003.

(a) We introduced 10 laptop computers which the wireless LAN works per 50 beds. Moreover, we developed the special wagon (hereafter, we call it “Bedside Wagon”) to put the laptop computer on the top board. Using the bedside wagon, all medical professionals can carry the laptop PC to wherever the medical practice is done in the ward (for example, patient’s bedside, treatment room, and so on), and can input the clinical data while referring the latest status of the progress of medical practices to be done, or patient’s healthcare information in the appropriate timing and place.

(b) To facilitate safe team practice, we designed and implemented the healthcare navigation system (HNS) to support information management in the clinical process (Fig.1). (A model of the HNS, which is the core of the EHR in the Hiroshima University Hospital, may serve as a practical example of the implementation of HNS in the service of safety management). This tool supports to accumulate the practice data, such as “Watch”, “Think”, “Order”, “To do”, and “Do/Done” to treat patients as team practice, and to use these for decision-making and evaluation. These data are available not only to the physicians but also to all other medical professionals concerned. EHR data are recorded not only by physicians, but also by all co-workers. This may be the basis for team communication and a reliable way of treating in such a way that the evidence of conducted practices is traced.

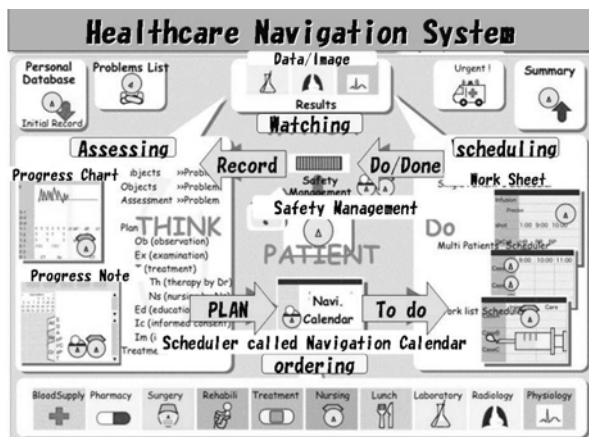


Figure 1. Healthcare Navigation process in EHR

(b-1) Support of preparing Personal Health Database: While referring to the anamnesis (support the next item “Watch”), input the basic information to confirm, and make the “Problem List” and prepare the short-term program and the long-term clinical and nursing Policy

(b-2) Support of “Watch”: Develop the data chronologically (calendar) to support the clinical process. This facilitates selection, retrieval, and understanding of patients’ data.

(b-3) Support of “Think”: This is comprised of Progress Note in accordance with the POS system and Flow Sheet describing the process to be done by the medical professionals. Information can be input byfrom both physicians and nursing staff according to the purpose of practices and is displayed concurrently. DuringWhile inputting of the information, professionals consider and refer to the patient’s condition, process, and the information which other professionals have input. “Input time and date” and “the name of the operator” are automatically attached and accumulated.

(b-4) Support of “Order”: This is the function to deal with orders to the other professionals. While referring to the progress, this has the calendar-formed launcher function (called “navigation calendar”; fig.2) to support make future order systematically. Construction of the orders.

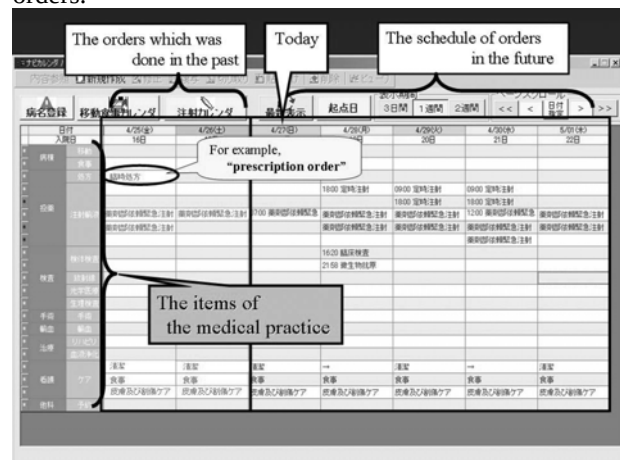


Figure 2. Example of the “navigation calendar”

(b-5) Support of “Do/Done”:

a) Work navigation Orders are made as a list to do and compiled in a “scheduler” (fig.3) by individual patients or physician in charge, and displayed on a calendar form. The process of the practices is displayed in a parallel line along with the actual time until the orders are completed



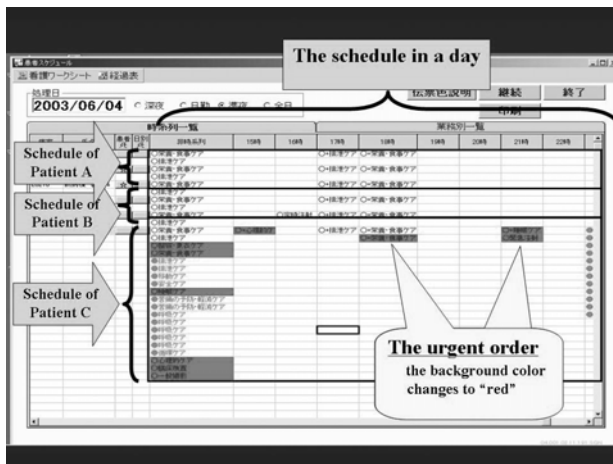


Figure 3. Example of the “scheduler”

b) Safety management Throughout the process from the order to dosage, treatment, and other practices, safety management is conducted by CMS to prevent from treating the wrong patient or administering the wrong dosage. Basically, a barcode reader reads “3 items” to confirm “patient”, “practice (including confirmation of medical materials)” and “doer” and logs them with the time (Fig. 4).

The collected data can be accessed on a calendar table, which is easy indicated to recognize when a critical we make close examination procedure is being performed such as comparison between infusion volume and out of water volume for critical cases.

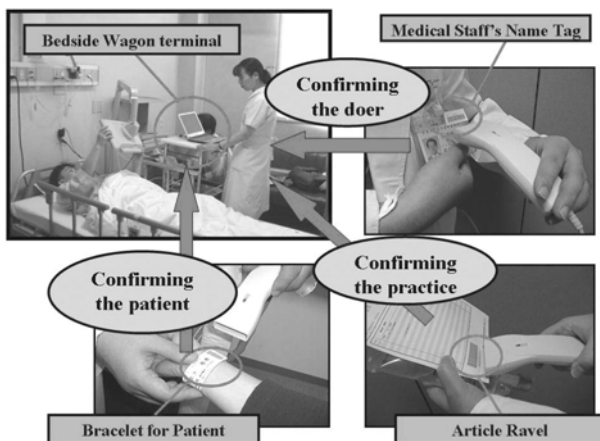


Figure 4. “Three steps confirmation” system both by mobile terminal and barcodes to confirm “patient”, “practice” and “doer”

3. Results

3.1 Evaluation Method

By the questionnaire survey to the user of the system, we evaluated the EHR. The questionnaires methods are as follows.

#The period: August 24~30, 2005.

#The object: All of the hospital staff using the HNS (distribution of 1320).

#The answer method: The automatic recording custody method by the questionnaire of the own composition.

#The question contents: “It is possible to do information sharing using the HNS?”, “the contribution to team practice of the HNS?”, “the situation of utilization of the injection safety management system?”, etc..

#The number of answer: Valid answer 784 (Physician 237, nursing staff 411, staff of the central diagnostic and treatment department 136), 59.4 % of answering ratios.

#An analytical method: The result of recovering is simple tabulation.

3.2. Result

(a)About 70 % of the valid respondent answered that the HNS facilitated the sharing of medical care information among the medical care staff. Also, about 66 % (82 % if limiting to nursing staff) answered that the HNS was useful for team practice. 30 % of the respondents evaluated the system negatively. The opinion of the respondents was classified into the following three. (a1)The part of the medical record is written using the paper medium, for example the report of the physiology inspection and the pathology inspection and so on. Therefore, the medical staff must refer to both of the PC terminal screen and the paper. This forces a medical staff into the complication and the risk (20 respondents answer). (a2)Because the system response is bad, the system hinders the medical profession works smoothly (19 respondents). (a3)It is sometimes impossible to use a PC terminal when the medical staff needs it because the PC terminals don't exist sufficiently (22 respondents).

(b)About 98 % of nursing staffs answered that they used an injection safety-check system near the patient at the sickroom before the injection. Also, 65 % of the valid respondents (88 % if limiting to nursing staff) answered that this system contributed to the improvement of the patient safety. The opinion of the negative respondents was classified into the following two. (b1)It is sometimes impossible to use the PC terminal when the medical staff needs it because the terminals don't exist sufficiently. (b2)Because the computer doesn't check necessary pharmaceutical individually in this system, the medical staff must confirm with its eyes. If the medical staff mistakes in this step, the patient safety can not be guaranteed.

(c)About 66 % of the valid respondents answered that the efficiency of the medical practice improved by using this system. Specifically, about 60 % of nursing staff answered. that the time spending to create a nursing record decreased. For example, the handwriting job which spends 1 hour reduced to about 10 minutes after the introduction of the system. The reduced time





is effectively reused for patient care at the bedside, conference, and decrease of the overwork time.

On the other hand, the opinion of the negative respondents was classified into the following four. (c1)The system response is bad. (c2)There are few PC terminals. (c3)The medical data which was managed with the paper medium exists. (c4)The perspicuity of the information is bad, because the required data is dispersed on more than one screen.(c1)- (c3) are the same as being pointed out in (a1-3). (c2) and (c3) are the problem which can be solved if there is an enough budget. On the other hand, to solve (c1) and (c4), the improvement of the application must be studied in the future.

From the above result, the EHR system implemented at Hiroshima University hospital can be approximately evaluated as the useful tool for the team practice among the concerned medical staff.

4. Discussion

4.1. Problem on the system performance

From the result of the previous section, it was clarified that the medical professionals evaluated well the functionality of the EHR installed of this time at Hiroshima University hospital. However, there are many problem on the response time of the system. For example, it takes from about 30 seconds to 1 minute to display medical and nursing treatment schedule of 50 inpatients onto the screen of the patient schedule (referring to fig. 3). And, the retrieval which covers multiple data classification such as medication history and test result also takes considerable time. In the meantime, input and/or retrieval of the ordering data (clinical examination ordering, injection ordering, etc.) finish in the short time (about 2-3 second).

The cause of the response problem in this time is in the data structure of the HER system. As for the system construction in this time, we were based on the package of the system vender which had data structure optimized by the ordering system. Then, we customized the user interface along the concept of the HNS without changing the data structure of the package.

In the scene of team medical practice, the data processing which covers multiple data classification is the most part, therefore the research of the data structure which can efficiently support the clinical work of the medical staff is one of the future problem.

4.2. How should IT support medical professions?

(a)When an IT system too excessively supports the human being, the medical professions which can not do act without the system may increase in a healthcare field. In this meaning, we reviewed carefully about how should guarantee safety of the injection by the safety-

check system. The point is confirmation work in the mixing stage of the drug. In the reviewing of the system, we received the request from the physician and/or nursing staff that it wanted to confirm individual drug and consistency of the indication at the mixing stage of the injection with the bar code. If the computer checks individual drug, we think that a new-type risk rises on the contrary. That is to say, the worker of injection mixing should work while confirming the instruction contents of the injection, but when a bar code checking system is once introduced, the worker may omit the confirmation stage of the instruction contents. As a result, the ability of medical professions to check the mistake of the instruction contents probably declines. From that reason, a checking system of individual drag was not installed in our EHR.

That is to say, the IT system accounts for providing the latest (the last) version of the injection instruction in the necessary timing, and the medical staff accounts for evaluating correctness of the clinical contents of the injection instruction and correctly preparing the injection. (b)It is necessary that we consider so that an IT system may not inhibit the direct communication of the medical staff concerned with team practice. For example, we discussed how the nursing staff can certainly receive the urgently inputted information by the physician through IT System. The plan was reviewed, in which the nurse's mobile phone automatically rang when a physician inputted urgent data. But it was not adopted, because we thought that the conversation between the physician and all other professionals concerned with team practice decreased when IT system was overdoing. Instead, it should be covered by the operation as displaying the alert of urgent indication on the terminal screen automatically, so that the physician whom it urgently input may had to contact simultaneously, the nursing staff by the oral.

4.3. The problem on the operation

It is necessary that the system operation department would not cause the problem by not expecting system trouble for the EHR system. By the duplication of the system bases such as the disk of the EHR server and the network, we guaranteed a continuous-running to the hardware fault as far as it was possible. As the result, service stop over the whole hospital did not happen by the hardware failure for 3 years since introduction of the system.

If anything, we had another problem: a printer fault (including paper jam, emptying a toner), a mistake concerned with master correction, and so on. These problem occurred frequently. Therefore, we increased about 1.5 employments for the operation of this system.

We consider that the cost decrease by the labor saving of medical staff (see subsection 3.2. (c) in this paper) can sufficiently cover the cost increase by the employment of the operation personnel.





5. Conclusion

We have confirmed the effectiveness of the EHR which was implemented according to the requirement defined in section 2. Actually, it is fixed as the tool which is indispensable for the medical team in healthcare field.

Moreover, in the future, using the accumulated data, we want to carry out evaluation of the quality and the process of medical and nursing care.

References

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