Secure Healthcare IT Solutions Covering Wide Range of Medical Care Information

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1. Introduction

In terms of enhancing the quality and safety of healthcare and building lean hospital management, information technology (IT) has been rapidly introduced into medical information systems with the aim of improving operational efficiency and effectively utilizing healthcare resources. Hospitals are promoting the computerization of every bit of their clinical information and healthcare information. Systems such as the hospital information system (HIS), radiological information system (RIS) and picture archiving and communication system (PACS) are now regarded as core systems that support the hospital operation, as vital to hospitals as the infrastructure for water and electricity.

Ministry of Health, Labour and Welfare envisions the future direction of the healthcare delivery system as follows:

(1) Inpatient treatment
   Functional enhancement of hospital wards for superacute and acute hospitalization
(2) Outpatient treatment
   Highly specialized treatment at large hospitals, functional enhancement of primary care physicians, and promotion of the outpatient referral system
(3) Care at home
   Building of an integrated community care system to link medical care with nursing care.

The functions that can fulfill these requirements should be provided as effective, efficient, safe and high-quality services and solutions.

Traditionally, information sharing was only performed among the systems within a hospital. However, in recent years, it has been performed among hospitals and clinics within the community. To enable each medical institution to efficiently provide healthcare on its home ground, a system for sharing medical information more frequently, securely and smoothly among the participating hospitals and clinics should be established, and solutions that take advantage of the information and communications network and cloud computing technologies are needed.

In this report, we describe what we offer to meet these demands, namely, “healthcare cloud service”, “interhospital medical information sharing solution”, and “hospital accounting solution for integrating a nursing-care insurance billing system with the conventional hospital accounting system.”

Toshiba Medical Systems Corporation offers a cluster of healthcare cloud services called Healthcare@Cloud, incorporating cloud-based information technology (IT) compliant with security requirements in the medical field into its technologies cultivated through 100 years of experience in developing medical devices. Since launching a cloud-based medical image archiving service as the inaugural component, we have been expanding the components of Healthcare@Cloud for both in-hospital and extra-hospital services(*)

These services include a medical image viewing service allowing doctors working at different locations to securely check medical images at any time and a regional medical information sharing service to connect a core hospital with clinics within the community through cloud computing technologies. Furthermore, to facilitate safe, high-quality medical care services as a provider of comprehensive solutions in the healthcare field, we have developed a new hospital accounting system called HAPPY RAPPORT that integrates a nursing-care insurance billing system and a conventional hospital accounting system, along with systems for the sharing of patient information among hospitals using the RapideyeCore medical image archiving and communication system and the RapideyeAgent radiology information system.
2. Healthcare cloud service “Healthcare@Cloud”

Toshiba Medical Systems Corporation introduced a healthcare cloud service called Healthcare@Cloud. The service utilizes cloud computing technologies to promote the communication of medical information within a medical institution or within the community, to enhance the quality of healthcare. We have been expanding the components of this service. After launching a cloud-based medical image archiving service as the inaugural component in 2012, we started to offer a medical image viewing service in 2014. In fiscal year 2015, we will offer a regional medical information sharing service (Figure 1).

2.1 Medical image viewing service

In recent years, highly portable smart devices, for which various applications are available, have been spreading rapidly, and there is an increasing demand in medical institutions to build an environment where these devices can be used to view medical images. However, while smart devices are highly portable, they can be lost or stolen, and may cause security problems such as the risk of unauthorized access to medical information. Also, in conventional systems, since a dedicated server must be provided in a hospital for direct access from smart devices to images stored in the hospital, introduction of the system is a daunting task due to the cost and management difficulties.

As a new service provided by Healthcare@Cloud, we have developed technologies for securely viewing medical images with smart devices at any time and any location. Medical images acquired in a hospital are encrypted and anonymized for tight security before being stored in a data center outside the hospital. These images can be viewed safely with smart devices at any time and any location.

As medical images can also be viewed from outside the hospital, a physician can give advice in his area of specialty even if he is away from the hospital during night hours or on holidays, or attending to professional matters elsewhere. In addition, a physician visiting his patient can show medical images while giving an explanation.

2.2 Regional medical image sharing service

In view of rapid population aging in Japan, as well as the current shortage and uneven distribution of physicians, efficient delivery of high-quality medical services is needed. One of the measures to realize this is a transition from the conventional healthcare framework, where a single hospital covers all stages of medical care from diagnosis to treatment, to a regional healthcare framework where medical institutions in the community work together in providing healthcare.

As a new service of Healthcare@Cloud, we are going to offer a regional medical image sharing service to connect a core hospital with clinics within the community. In this service, a schedule at the core hospital can be viewed by a clinic to make an appointment all year round. Through the cloud service, the core hospital can return the result image and diagnostic report of the study performed according to the appointment, to the primary care clinic. A physician in the clinic can view the study results immediately after the study was performed. The patient can also receive an examination using advanced equipment at the core hospital when necessary, while seeking medical advice from his primary care doctor.
2.3 Security measures

The utmost consideration is accorded to assuring the security of medical information in Healthcare@Cloud. In order to ensure safe use of medical information through the cloud service, Healthcare@Cloud complies with the guidelines of Ministry of Health, Labour and Welfare, Ministry of Economy, Trade and Industry, and Ministry of Internal Affairs and Communications. The service also uses an extremely robust data center in Japan, and employs various technologies as security measures, such as superencryption of information, data manipulation detection, two-factor authentication, and a function to stop remote access. In addition, dedicated staff of an organization that holds information security management system (ISMS)\(^{(2)}\) certification manages the operation of the cloud service to provide a safe and secure service.

2.4 Contribution to the environment

We have been aiming to provide environmentally conscious products (ECPs). Based on Toshiba’s Green Procurement Guidelines, our products for Healthcare@Cloud use parts that do not contain substances subject to regulation. In addition, use of the image viewing function outside the hospital eliminates the necessity of recording media (such as CD) used to report the study results to the clinic, as well as the necessity to visit the hospital just to see images (energy consumed for production and transportation of recording media and transportation of physicians can be saved). Shared use of facilities in the data center can reduce the power consumed by electronic equipment. By reducing CO\(_2\) emissions and the total amount of waste, these measures contribute to the reduction of environmental impacts.

2.5 Contribution to patients, medical institutions and communities

Through Healthcare@Cloud, we are aiming to provide new value, as well as new functions, to patients, medical institutions and communities. For patients, Healthcare@Cloud can provide an environment where they can easily access high-quality medical services. For medical institutions, it helps improving the workflow through the provision of remote support for emergency cases, while it helps improve hospital management through the acceptance of study appointments from local clinics to increase the utilization of diagnostic equipment. For the communities, utilization of Healthcare@Cloud enhances the efficiency of regional healthcare services, and promotes the active use of these services. By providing this new value, we are committed to contributing to the realization of an integrated community care system.

We will continue to offer new cloud services in order to improve the quality of healthcare and provide new value.

3. Interhospital medical information sharing solution

As described in the previous section on the regional medical image sharing service, through the review of the healthcare delivery system, functional differentiation of large hospitals from medium and small hospitals and clinics is being promoted as part of medical service reform, and high-quality specialized medical treatment is being sought in large hospitals in order to improve the quality of healthcare. From the viewpoint of hospital management, hospitals wish to increase the utilization of the diagnostic imaging systems they have purchased, and there are expectations that interhospital sharing of appointment information for each imaging system could increase the utilization ratio.

The interhospital medical information sharing function can be realized by an interdepartmental medical image and information system RapideyeCore, an information system for medical imaging departments RapideyeAgent, and Healthcare@Cloud. It connects affiliated hospitals, such as university group hospitals and general group hospitals, more closely, thus allowing provision of high-quality specialized medical treatment while ensuring patient security and enhancing hospital benefits (Figure 2).

3.1 Integration of patient information

Integration of patient information is one of the keywords for realizing the interhospital medical information sharing function.

As a patient ID is often issued by each hospital, a patient typically has multiple patient IDs. As in the case of regional information sharing using other conventional systems, in addition to the patient name and date of birth, the address, telephone number, and health insurance card number should be used to link different patient IDs so that interhospital access to the same patient information can be possible. Also, agreement to the disclosure of medical information to other hospitals for the purpose of mutual use should be obtained from the patient in a written form, so that only the information of patients who have provided written consent is disclosed. Integration of patient information is only possible after these two measures have been implemented. There are expectations concerning future utilization of a national identification number to introduce an integrated ID in the field of medicine, so that patient information can be easily linked. However, in order to achieve sharing of patient information not just within group hospitals but also among all other hospitals, in addition

\(^{(2)}\) ISMS is a system to manage information security within an organization. The criteria for certification are defined in the standards of International Organization for Standardization (ISO) and Japanese Industrial Standards (JIS).
to linking of medical information for the same patient, the adoption of standard disease names and symptom descriptions and the improvement of infrastructure, including the network, should be accomplished, which may take considerable time.

3.2 Providing advanced medical care through interhospital medical image sharing and ubiquitous image interpretation

When different patient IDs are linked, medical images and reports generated in each hospital can be managed by the interhospital image sharing function of RapideyeCore for mutual utilization. Even if the patient is transferred to a different group hospital, a physician at the new hospital can easily understand the patient's previous disease condition, and can avoid examinations that have already been performed.

Also, radiologists who are asked to interpret images acquired in other hospitals can prepare diagnostic reports without visiting the hospitals. Thus, ubiquitous image interpretation (ubiquitous preparation of a diagnostic report based on medical images) is possible. Images of cardiac computed tomography (CT), CT colonography and mammography generated in each group hospital can be immediately interpreted by a specialist in each field, so that diagnosis can be performed with higher accuracy (Figure 3).

3.3 System that provides more safety to the patient

The interhospital medical information sharing function of RapideyeAgent not only allows hospitals to share study appointments and study results in order to prevent duplicating the same medical care or examination. It also allows them to share the patient's history of adverse effects from contrast media, various contraindications, and information on the patient exposure dose, in order to ensure more safety for the patient. For example, by managing and sharing information on adverse effects that occurred in group hospitals, the patient's history of adverse effects from contrast media, which was traditionally self-declared by the patient, can now be checked before performing a study even without the report from the patient, and a warning can be displayed if attention is needed.

Also, by sharing information on the patient exposure dose, the total medical exposure dose of the patient can be managed, allowing physicians to plan a study depending on the situation for each patient. It is expect-
ed that the management of the total exposure dose for each region examined will be possible in the future for better planning of studies.

3.4 Security measures

The interhospital medical information sharing function allows exchange of important patient information among hospitals. However, if data leakage were to occur, it would impose irreversible harm to the patients and hospitals. Thus, security must be ensured in this function as well as in the healthcare cloud service, and it is important to provide the interhospital medical information sharing solution by combining various security measures.

4. Hospital accounting solution “HAPPY RAPPORT” for integrating a nursing-care insurance billing system with the conventional hospital accounting system

Fifteen years have passed since the implementation of the nursing-care insurance system in 2000. Although functional differentiation between healthcare and nursing care was initially emphasized, in recent years, establishing a link between these services has been regarded as an important challenge toward the construction of an integrated community care system (Figure 4).

In view of that background, in order to promote coordination between home care and nursing care, medical institutions dedicated to home care (home care supporting clinics and hospitals) have been established to meet the growing demands for medical professionals to provide nursing-care services such as home-visit nursing and rehabilitation.

In 2014, we started to offer a new hospital accounting system, HAPPY RAPPORT, that integrates the conventional hospital accounting system (for billing based on the medical insurance system) with a nursing-care insurance billing system (for billing based on the nursing-care insurance system).

4.1 Providing more comfort for the patient

Integration of these two systems eliminates the necessity for elderly patients who seek both medical care and nursing care at a hospital to apply for these services separately, thus resulting in a shorter waiting time.

The new system also provides new approaches for billing of patient charges, which is often troublesome for patients. For patients who received both healthcare and nursing care, it is possible to issue a summary bill, instead of a separate bill for each service. It is also possible to issue a bill of patient charges for the month. These approaches reduce the possibility of trouble with billing and are more convenient for elderly patients.

4.2 Providing more comfort for the hospital staff

Although healthcare and nursing care are based on different insurance systems, these services are often provided together, without being differentiated, in a series of medical practices. For such practices, there are limits on the medical treatment fees and nursing-care benefits a hospital can receive. Thus, hospital staff usually have to use both the hospital accounting system and the nursing-care insurance billing system to check the data of medical practices performed and confirm the calculation of medical treatment fees and nursing-care benefits, which is very cumbersome. In HAPPY RAPPORT where healthcare and nursing-care information
is consolidated, the calculation check function of the hospital accounting system has been enhanced to cover both of the insurance systems. This can ease the burden on the hospital staff by providing a one-stop platform to check the calculation of medical treatment fees and nursing-care benefits.

4.3 Contribution to hospital management

As healthcare costs increase, accounts receivable from the patients have a greater impact on the hospital management. For hospitals providing both healthcare and nursing care, managing these accounts for each service involves longer and extra labor. HAPPY RAPPORT performs integrated management and collection of the accounts due in both healthcare and nursing care, contributing to more efficient hospital management (Figure 5).

4.4 Contribution to the community

By utilizing the information/data sharing function of the hospital accounting system, HAPPY RAPPORT allows a hospital to link electronic medical records with nursing-care information stored in the hospital, and share patient information with their affiliated geriatric health service facilities (GHSFs). We are going to implement sharing of information with the institutions for long-term care within the community, and continue to further develop the system so that it can play a role in an integrated community care system.

5. Conclusion

In the future, great amounts of medical data will be stored and managed by using vendor neutral archive (VNA), and big-data analysis technologies will be used to analyze such data from various aspects. As a result, the “quality of healthcare” and the “current status of hospital management” will be visualized in addition to healthcare itself, clarifying various issues. As a healthcare IT solution provider, we will continue to offer various solutions to help solve these emerging issues.

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