XRIF.

5. The RIF can be printed out, and handed to the patient. The patient's XRIF plus the URL, user's account, and password are also directly sent to the referral service center of the accepting hospital by e-mail over the Internet.

6. The patient must complete his registration at the desk of the referral service center of the accepting hospital. For operating convenience, he/she can hand in his/her RIF to the coordinator of the center for registration.

7. The coordinator confirms the patient by logging into the web server of the referring hospital with the user account and password. He/she can also help the patient to arrange a physician, and forward the patient's chart summary to the physician's workstation.

8. The physician can review the patient's chart summary, which has been sent from the referring hospital, at his/her workstation. He/she can then perform diagnoses, and make appropriate care plans for further treatment.

9. When the patient has been discharged from the accepting hospital, the physician must prepare a chart summary plus outcome of treatment in reply to the referring hospital for that patient. The chart summary is sent to the referral service center. The coordinator of the center can upload the chart summary to the web server of the referring hospital using the provided function as shown in Figs. 6 and 7.

10. The chart summary received from the accepting hospital is tentatively stored in the web server of the referring hospital. After confirmation by the coordinator, the chart summary and RIF can be directed to the physician of the referring hospital for follow up or other purposes.

DISSCUSSION

According to surveys,[3, 13] the average referral rate of primary care organizations in Taiwan is 3%. Moreover, under the insurance payment policy, the BNHI tends to focus on monitoring healthcare delivery processes, and on controlling medical expenses. The referral system in affiliated hospitals between different ranks is enforced. Therefore, communicating patient information from one hospital to another becomes increasingly important.

The Taipei City government established a computer-based emergency medical network system in 1998.[14] The system can provide on-line queries about the number of available ICU (intensive care unit) beds in city hospitals. The transported patients' medical records are usually acquired by telephone. Hence, a referrals' medical records cannot be transported timely, and are unlikely to be complete. The system we developed compensates for these weaknesses. It supports exchange of medical records among healthcare providers.

Sitting and his colleagues developed a computer-based outpatient clinical referral system for the Brigham and Women's Physician Hospital Organization (BWPHO) in Boston, MA[5]. Based on their evaluation, the mean time required to complete a referral initiation form in the paper-based system and computer-based system are 125 and 75 seconds, respectively. The mean number of items entered with paper referral was 12.5 while in the computer system was 31. Although their system can speed up the referral process, users tend to perform more entries. In our system, we reduce the number of manual inputs by automatically collecting the information if it is already available in the hospital systems at the time the physicians compile a referral's RIF.

More importantly, in our approach, each significant piece of the medical record is associated with a tag, and is represented based on the syntax and semantics of the XML. Tagging is a powerful tool that enables a computer to capture the meaning and structure of a document. As such, queries to XML-based medical records can pinpoint specific elements, and filter elements with particular characteristics in documents. For example, if we want to know the referrals whose date of birth is on 1999/11/10, and we also know that the element of date-of-birth is inside the element demography-information, then the query can be formulated as: demography-information [date-of-birth = "1999/11/10"]. Therefore, XML-based medical records can be easily identified, verified, and trans-