

# New Electronic Transmission System in Health Care Using the K-MIX; Kagawa Medical Internet eXchange

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## Introduction

Kagawa Prefecture is located in the northeastern part of Shikoku Island, bordering Tokushima Prefecture southward and Ehime Prefecture westward, and has the smallest land area (1,876 km<sup>2</sup>) of any Japanese prefecture. The population is 1,006,329 (483,142 men and 523,187 women as of October 1, 2007). According to the statistics of the Public Health Center, there are 99 hospitals and 814 clinics (164 with beds and 650 without beds) in Kagawa Prefecture as of October 1, 2006.

Kagawa Medical Association has a membership of 1,877 physicians, organized in 10 municipal medical associations. It celebrated its 60th anniversary in 2007 and held a ceremony on November 18. Moreover, the Association completed the construction of the new building before the end of 2006, and started operation in the new building from January 2007 with a refreshed mind. While the Association is engaged in diverse activities, this article focuses on Kagawa Medical Internet eXchange (K-MIX), which is the telemedicine network operated jointly by the Department of Medical Informatics, Kagawa University Hospital; the Prefectural Government of Kagawa; and Kagawa Medical Association.

## Kagawa Medical Internet eXchange (K-MIX)

K-MIX was developed as the system for the Internet transmission of patient data, including



X-ray, CT, MRI, digitally captured images of skin lesions, fundus photography, referral documents, and laboratory test results, to support the diagnosis, treatment, and the process of informed consent with the aid of specialists. Although the system started operation in June 2003 as a network of medical institutions in Kagawa Prefecture, it was constructed with the expectation of access from facilities outside the Prefecture. As of February 29, 2008, the participants of the system include 59 medical institutions in Kagawa Prefecture, 2 in Okayama Prefecture, 1 in Hyogo Prefecture, and 1 in Hiroshima Prefecture.

Because K-MIX is an Internet-based transmission system, it can be accessed from any facility in any place, provided that there is a personal computer with an Internet connection. In contrast with this advantage, the use of the Internet raises security concerns. In this respect, the network has been designed carefully with elaborate protective measures including multiple barriers to achieve a high level of security. As the minimum system requirements, users need to

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have an ISDN or faster Internet connection and a PC with a 600 MHz or better CPU and 128 MB or more of memory. However, it is desirable to have an ADSL or faster broadband connection for sending and receiving large images, and a PC with a 1 GHz or better CPU and 256 MB or more of memory for processing high-quality images. At this time, only Windows PCs are supported, and the system for Macintosh support has not been developed yet. Please see the K-MIX website (<http://www.m-ix.jp/>) (in Japanese) for details of system requirements and specifications.

### Functions of K-MIX

The primary functions of K-MIX are diagnostic imaging support and the electronic transmission of referral documents. In diagnostic imaging support, the medical institution requesting image reading produces CT, MRI, and other images, and sends the image files to K-MIX for delivery to the physician at the supporting institution. The transmitted data are stored in the data center, and the system sends an email notice of the request to the supporting institution. The specialist at the supporting institution accesses the system, interprets the images, and sends the result of diagnosis to the requesting physician. Similarly to the process of making a request, the diagnostic report is sent to the center, and the requesting physician receives an email notification of the delivery of the report. The requesting physician accesses the center and receives the diagnostic report. This system enables the physicians at the requesting institution to use this report as a guide and provide more standardized, high-quality medical care to patients.

In the electronic transmission of referral documents, the system can deliver these documents with image files as attachments, eliminating the need for patients to carry films. Another advantage is that physicians may prepare referral documents unhurriedly when they have time to spare during or after a day's work, and these documents can be transmitted any time 24 hours a day. A limitation at the present is the inability to handle audio and video files. Because all transmitted data, including the requests for image reading and referral documents are stored at the center, physicians can access the center and view them at any time.

In view of the increasingly common use of information technology in medical institutions, we believe that K-MIX is a system that can be introduced without resistance, and its benefits and attractive points can readily be understood. In particular, the medical institutions that already have this system consider it indispensable.

As mentioned above, the system is designed to accept the use by medical institutions outside Kagawa Prefecture, and we are looking forward to receiving proposals from outside the Prefecture. Proposals for participation are all the more welcome if they are combined with the participation of supporting institutions.

### Community-integrated care pathways

As a new attempt in the development of K-MIX, we are now constructing a system to address the community-integrated care pathway, which is expected to start operation in fiscal year 2008. In this system, the care pathway prepared at the acute-phase hospital (the program-managing hospital) is transmitted to the recovery-phase institution via K-MIX at the time of discharge from the hospital, and is used as the basis for rehabilitation management. When the patient moves to a maintenance-phase institution, the care pathway is similarly transmitted via K-MIX to the maintenance-phase institution. This realizes the seamless utilization of electronically formatted community-integrated care pathways.

Apart from the handling of fees for community-integrated care pathways, the largest advantage of this system lies in that the program-managing hospital, making use of the exchange of electronic care pathways, can analyze the data derived from the system and feed back the results to members so that further improvement may be made to the community-integrated care pathway sheet. We plan to expand the coverage of this system from femoral neck fractures to stroke, swallowing disorder and NST, home care, etc.

We encourage physicians at institutions in and outside Kagawa Prefecture to use this community-integrated care pathway system, as well as the existing K-MIX system mentioned above. Please direct any inquiries about K-MIX to Kagawa Medical Association (facsimile: 087-823-0266, email: [k-mix@kagawa.med.or.jp](mailto:k-mix@kagawa.med.or.jp)).