



# Infocomm Technology: E-enabling Quality Healthcare Services in Singapore



Healthcare is information intensive and that is where infocomm technology can be a powerful enabler to the process, through automation, knowledge management, business process re-engineering, and even artificial intelligence. Singapore's healthcare providers have been leading infocomm technology adopters to improve healthcare quality, reduce costs, as well

as to meet some of today's challenges such as Singapore's ageing population. The Singapore Health Services (SingHealth) and the National University Hospital (NUH), under the National Healthcare Group (NHG), were merit award winners in the 2004 National Infocomm Awards.

## Infocomm Technology Innovations in Healthcare Delivery

Hospitals can provide a seamless flow of information through point of care applications enabled by wireless communication technologies such as SMS, WiFi and WiMax. Tan Tock Seng Hospital (TTSH) deployed an SMS system to transmit information to doctors whilst both SingHealth and the NHG deployed SMS for patients at its institutions with its appointment reminders and queue management at their Specialist Outpatient Clinics. Singapore General Hospital (SGH) will be deploying intelligent and



environment-sensing devices, which could be used to monitor a patient's temperature continuously, and transmit such data to a central system automatically. This pilot project, termed "Automated Wireless Temperature Surveillance System" earned SGH "The Enterprising Agency Award" in April 2004.

At the National Heart Centre and SGH, a Home Telecare solution aims to integrate the Internet, SMS, Web Portal and mobile phones to monitor the vital signs of patients. The system sends an SMS alert to both the doctor and the patient, whenever the patient's vital signs are beyond set thresholds. The doctor can then decide on a case-by-case basis what course of action to take. The project gives patients an additional peace of mind to know that their vital signs and symptoms are monitored between their scheduled visits to the hospital, and will help to reduce inpatient stay and number of visits in the long run.

NUH developed a doctor-centred, patient-based Computerised Patient Support System (CPSS) to enable an integrated view of patient data from multiple source systems such as X-rays, laboratory results, surgical operating notes, discharge summaries, clinical results and reports. CPSS has resulted in increased effectiveness and collaborative care amongst multi-disciplinary healthcare teams leading to safer and higher quality of patient care. CPSS won the Asian Hospital Management Awards 2003, IT category, in Asia Pacific.

**Parkway's 3 hospitals will be starting the implementation of a group-wide inpatient Electronic Medical Records (EMR) system.**

**Dr Kenneth Thean, Parkway's General Manager**



Parkway Hospitals Singapore's healthcare facilities are linked to a centralised data centre which allows their radiology clinics and centralised laboratory to be connected online to Parkway's 3 local hospitals, East Shore, Gleneagles and Mount Elizabeth. This allows patient's demographic data, orders, results reporting and pharmacy information to be available at all points of care. A new Hospital Information System (HIS), which incorporates workflow optimisation, best practices, bed-management, and biomedical engineering, is in the pipeline. The HIS will also enable information to flow over a distributed network to extend the connectivity to Parkway's group of clinics, which is developing a new computerised clinic management system.

SingHealth also combined textual data from their Electronic Medical Records (EMR) system and the digitised images from the Image Management System (IMS), to deliver significant benefits and value to patients and caregivers. For this, SingHealth was awarded the "Intelligent Enterprise Asia Award 2004". SGH's efforts to build a hospital-wide film-less environment should be realised by September 2005. SingHealth designed a wireless Motorised Mobile Triple LCD X-Ray Light Box to allow doctors to bring digital images and EMR to patients' bedside for a more effective and personal consultation. For the KK Women's and Children's Hospital, their move towards a total film-less environment will be enabled by linking their integrated Picture Archival and Communications System (PACS) to the industry's latest 64-slice CT scan and other imaging equipment. Parkway's radiology arm has already implemented voice recognition, and will be able to distribute images and reports online via the Internet to the referring doctor before the end of the year.

“ SingHealth is reaching out to their partners to facilitate the SingHealth IT Vision of a Digital Health Ecosystem. ”

Mr Fong Choon Khin, SingHealth's Group Chief Technology Officer

Infocomm technology is also empowering patients. The Interactive Patient Guide (IPG) developed by Changi General Hospital (CGH), allows a patient to obtain information on treatments, surgical procedures and aftercare of 25 common medical conditions through videos and printable text online in the comfort of his home. CGH's IPG won the Most Outstanding Project in the IT category of the 2004 Asian Hospital Management Awards.

At TTSH and NUH, robots provide automated handling, preparation steps, movement between different analysers, and storage of laboratory specimens. When ready by the end of this year, NUH and TTSH's laboratories will be the most sophisticated in the region, being the first automation line to integrate chemistry, haematology, immunochemistry and coagulation tests. With automation, turnaround time for laboratory tests in some instances can be twice as fast. Laboratory results delivered to doctors at the quickest time possible also enables them to arrive at diagnosis earlier and provide even more timely intervention and treatment for patients. Parkway also has a total laboratory automation system where virtually every biochemical and immuno-chemical tests can be performed using just a single specimen. Specimens move on rails and robotic arms perform all the automated handling.



NHG is also working on an ePrescribing System with the use of robots to automate the process of picking and packing drugs at the outpatient pharmacy. NHG believes robots at pharmacies can offload up to 50% of the pharmacies' workload, while significantly improving the speed and safety in the picking and packing process.

For the Raffles Medical Group (RMG), devices close to points of healthcare delivery that can retrieve, display and capture information instantaneously helps to streamline and improve the healthcare workflow.

## Future Developments of Infocomm Technology in Healthcare – What's Next?

The healthcare sector worldwide, including Singapore, is undergoing a transformation to redesign its healthcare delivery systems for better patient care with infocomm technology as a key enabler.

SingHealth is reaching out to their partners to facilitate the SingHealth IT Vision of a Digital Health Ecosystem, shared Mr Fong Choon Khin, SingHealth's Group Chief Technology Officer. SingHealth already has an integrated EMR with results reporting, hospital inpatient discharge summaries and e-prescription modules in place. The next-generation of EMR will include enhanced functionalities for electronic ordering of laboratory and radiology tests, process workflows and Inpatient Medication Administration, all designed to enhance patient safety and quality outcomes.

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Mr Linus Tham, NHG's Chief Information Officer

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Choon Khin added that with the rise in chronic diseases, which requires long-term follow-up and medication and the accompanying need for multi-disciplinary clinical management, SingHealth has embarked on a series of Health Management Programs (HMP) for various diseases such as diabetes, cardiovascular and renal disease. The ideals of HMP can be realised efficiently in an infocomm technology-enabled healthcare and clinical decision support system, which is closely linked to the EMR system, integrating medical knowledge and clinical best practices. In the future, it can also facilitate epidemiological modelling of phenotype and genotype information for personalised medical care.

Over at NHG, Mr Linus Tham, Chief Information Officer, shared that moving forward, NHG will be focusing on the Computerised Clinician Order Entry (CCOE) system, which is designed to bring about quality, consistent and safer care for its patients across its group of 4 hospitals, specialist centres and polyclinics. The system allows clinicians to e-order medication, X-ray and laboratory tests for patients. It checks for appropriateness of such tests orders, and suggests other relevant orders if necessary. Doctors are also alerted to repetitive X-ray and/or laboratory tests orders. The e-prescription module checks and alerts doctors to drug allergies, drug-to-drug interactions, and dosage caution for certain medical conditions.

In the long run, when more decision support rules are incorporated into the system, it will be able to participate in and improve patient care by recommending to doctors the best possible treatment based on international best practices and evidence. With CCOE, NHG will be among the first healthcare institutions in the region to go electronic for the entire medication, X-ray and laboratory process – from ordering to dispensing of medication as well as ordering and releasing of X-ray and lab results to doctors – for both inpatients and outpatients. NHG believes that their hospitals will be extensively digital by the next 3 years; every relevant healthcare staff will increasingly leverage electronic information and means in providing care for patients. The entire healthcare loop from the home to primary care, tertiary care and step-down care, will be well integrated within NHG and linked to the entire healthcare ecosystem. Patients can expect seamless, holistic and quality care and services as a result.

Parkway is looking at using RFID to identify patients and equipment, and biometrics to identify staff. Parkway's 3 hospitals will be starting the implementation of a group-wide inpatient EMR system, both on-line and also on an RFID card. Wireless electronic prescriptions, order entry and result reporting will be done next. Clinical and Nursing quality care systems are also currently being piloted. For patients' entertainment, Dr Kenneth Thean, Parkway's General Manager, is looking into providing interactive movies on-demand and games for patients who have to spend time recuperating in the hospital.

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Mr Han Jok Kwang, RMG's Director of Infocomm Technology



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The Infocomm Development Authority of Singapore (IDA) will collaborate with NHG, Parkway, RMG and SingHealth to catalyse the development of innovative healthcare solutions and products through a Healthcare Call-for-Collaboration (CFC). For more details about the CFC or IDA's healthcare initiatives, please email to [Health@ida.gov.sg](mailto:Health@ida.gov.sg)



The Infocomm Development Authority of Singapore (IDA) is committed to growing Singapore into a dynamic global infocomm hub. IDA uses an integrated approach to developing infocommunications in Singapore. This involves nurturing a competitive telecoms market as well as a conducive business environment with programmes and schemes for both local and international companies.

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