

5 section five

Digital Ward - Innovating for the Hospital of the Future



Imagine a future where hospital wards have no paper case-notes or file. Information on a patient's medical condition is automatically captured via intelligent context-aware devices and sent directly to the central computer systems. Information such as X-Ray images, laboratory tests, medication history and drug allergies are also available at one's fingertips on computers located by the patient's bedside. This means less time is spent tracking and documenting patient information, and more time for doctors and nurses to provide better patient care.

The concept of a Digital Ward is basically "an acute care facility incorporating the widespread use of information technology to dramatically improve the processes and outcomes of care". Digital ward, in accordance to many medical informatics experts, is the master plan in realising the dream of the "Hospital of the Future - providing medical excellence and genuine patient care".

(Noah Tay, Grace Ng, Fong Choon Khin,
Alvin Ong, Ong Shao Ying, Yvonne Eng
Singapore Health Services)

1 Introduction

The Digital Ward project is initiated by Singapore Health Services (SingHealth), Singapore's largest healthcare group, with the objective of transforming the way healthcare professionals capture and access clinical information. This pilot project identifies technology-driven point-of-care applications that will help maximise operational efficiency and enhance patient care and safety across SingHealth institutions. It aims to change the entire healthcare system, and set the stage for the creation of the "Hospital of the Future".

The Digital Ward project team is made up of IT professionals from SingHealth's iTAG (Innovative Technology Application Group), who work closely with users such as clinicians, nurses and operations colleagues of various institutions, to innovate and develop systems that will bring value to our patients and improve operational efficiency in the institutions.

Digital Ward innovations adopt proven standards and industry best practices to ensure interoperability between systems.

Within the Digital Ward, various wireless devices are being implemented.

A. Computer on Wheels (COWs)

COWs are wireless notebooks on mobile trolleys, which enable clinicians to retrieve patients' medical records and digital radiology images as well as document patients' progress electronically whilst they are at the patients' bedside (Figure 1).



Figure 1: Computer on Wheels

B. Mobile Electronic X-Ray Computing (MERC)

MERC is a motorised wireless triple LCD x-ray light-box, which enables patients' electronic medical records and digital radiology images to be displayed across three different screens. Clinicians can access these records and images wirelessly at the patients' bedside to explain various therapies and clinical options to them. The back of the MERC is equipped with a traditional analogue x-Ray lightbox that can be used to display hardcopy films, which is especially useful for foreign patients who do not have digital images. This innovation allows clinicians to more effectively assess patients' medical conditions and enriches the face-to-face communication not only with patients but also with their family members (Figure 2).



Figure 2: Mobile Electronic X-Ray Computing

C. VEGA

The integrated wireless VEGA system enables proximity contact tracing, location tracking and remote automated monitoring of patients' vital signs, such as blood pressure, pulse rate, electrocardiogram (ECG), pulse oximetry (SPO2), temperature, and respiration rate (Figure 3).

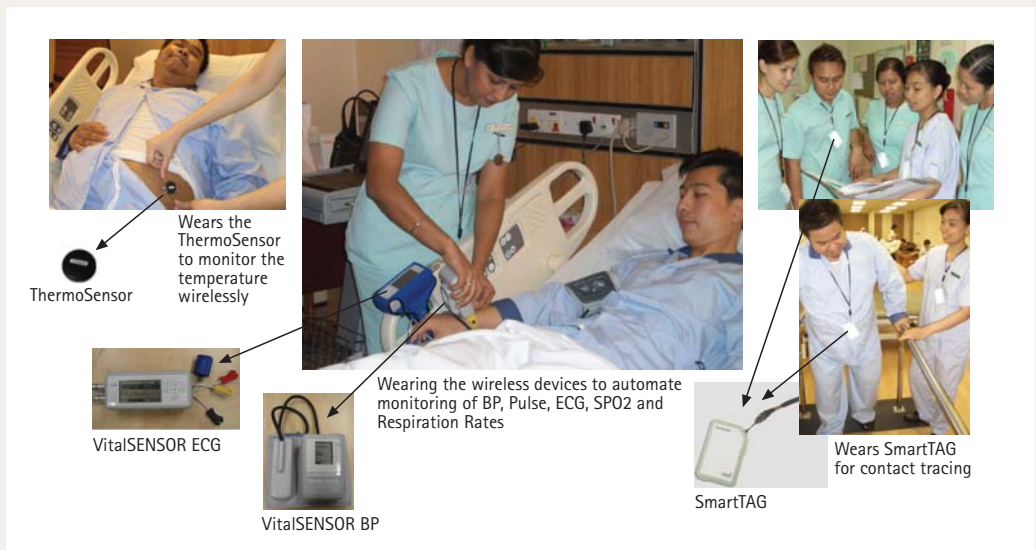


Figure 3: VEGA

To enable proximity contact tracing, SmartTAGs (with both WiFi and Active RFID technologies) are issued to the patients and hospital staff in the ward for the purpose of automatically and wirelessly recording and tracking people they have come into contact with within the ward. The contact data captured in the SmartTAG is then automatically and periodically uploaded into the server via industry standard Wi-Fi access points. Hospital staff will be able to search, view and print records of the contact tracing details online. This system will be especially useful in the handling of infectious disease outbreaks such as SARS and Bird Flu. It will help to contain the disease and prevent it from spreading further (via human interaction) as people who have come into contact with an infected person can be immediately traced and quarantined. In addition, the SmartTAG also has the ability to effectively track staff and patients' locations within the ward.

With VEGA, patients' vital signs can now be captured automatically via customised devices (ThemoSensors, VitalSENSOR-BP and VitalSENSOR-ECG monitor) and clinicians can view the vital signs charts online. This reduces human error and enhances patient safety. With the system, the nurses also spend less time on tedious menial tasks, therefore enabling them to devote more time in delivering patient care. Patients can now rest better without having to be disrupted by the nurses to take their vital signs.

D. Patient Bedside Terminal (PBT)

PBT is an integrated infotainment system that provides both the clinicians and patients an efficient and convenient means to access patients' medical information within the hospital and Internet services globally. With PBT, clinicians can access the patient's medical records and discuss their medical conditions at the bedside. Patients can speak to the nurses on duty through a video nurse call via these terminals. This means that patients can have face-to-face communication with the nurses without having to wait for the nurse to come physically to their bedside for non-urgent requests. Patients can also speak to nurses over the PBT's phone set as well as access the Internet and video-on-demand services. Nurses can also order meals electronically for their patients at the bedside instead of taking manual orders. Access to critical information from the terminals are restricted and authenticated through the use of Smart Card and a 2-factor authentication token (Figure 4).

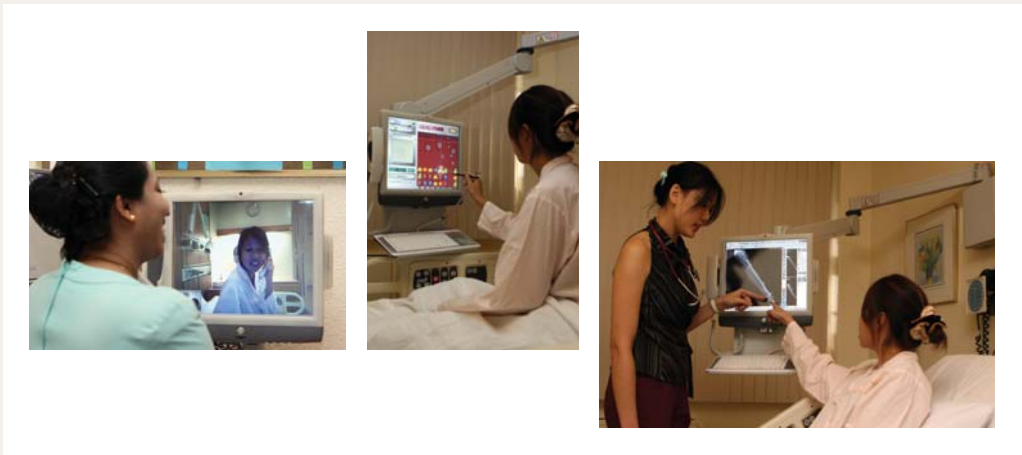


Figure 4: Patient Bedside Terminal

With the set up of a Digital Ward, the adoption of leading-edge technology will gradually replace some of the daily manual and tedious tasks undertaken by clinicians. For example, with automated capturing and storage of the patients' vital signs now, manual intervention and potential human error can be reduced. As a result, doctors and nurses can spend less time tracking and documenting patient information, and devote more time on providing better patient care. Another example is the use of PBTs, which enables doctors and nurses to have access and documentation of patients' information and their progress whilst they are at the patient's bedside. Therefore, the Digital Ward enables greater work efficiency and improves patient care and safety.

2 Case Study Results

Since the implementation of this Digital Ward project in 2004, the team has been gathering results on how the innovations will benefit both our staff and patients. Table 1 shows the expected qualitative and quantitative results.

	COWs	MERCs	VEGA	Patient Bedside Terminal (PBT)
Time Savings	<p>a) Saves > 5 minutes searching for patients' records</p> <p>b) Concurrent viewing of patient's medical record</p>	<p>a) Saves > 5 minutes searching for X-ray films</p> <p>b) Concurrent viewing of patient's medical record</p>	<p>a) Wireless temperature monitoring saves nurses time (~ 3 minutes)</p> <p>b) Online location tracking saves > 50% time taken to track manually</p> <p>c) Contact tracing saves > 5 minutes of nurses time</p>	<p>a) Saves > 5 minutes of nurses time taken to key in order of medications</p> <p>b) Concurrent viewing of patient's record</p>
Patient Safety	<p>a) On the spot and more legible documentation of patient's condition</p> <p>b) Minimise loss of critical information due to misplaced paper records</p>	<p>a) On the spot and more legible documentation of patient's condition</p> <p>b) Minimise loss of critical information due to misplaced X-ray films</p>	<p>a) Detection of abnormalities within a few minutes instead of within an hour or within 4 hours</p> <p>b) Minimise human contact during infectious disease outbreak</p> <p>c) Continuous automated recording of people-to-people contact information</p> <p>d) Reduces human error with real time automatic update of data</p>	<p>a) On the spot and more legible documentation of patient's condition</p> <p>b) Minimise loss of critical information due to misplaced paper records</p>
Patient Service	<p>a) Improves patient-doctor discussions</p>		<p>a) Minimal disruption to patients' rest</p>	<p>a) Improves patient's hospital stay with a variety of entertainment services to choose from</p> <p>b) Improves patient-doctor discussions</p>
Operational Efficiency	<p>a) Immediate access to critical patient information</p> <p>b) Facilitates discussions during ward rounds</p> <p>c) Usage of paper reduced</p>		<p>a) Less time spent on menial tasks, more time can be spent on delivering patient care</p>	<p>a) Immediate access to critical patient information</p> <p>b) Facilitates discussions during ward rounds</p> <p>c) Usage of paper reduced</p>

Table 1: Case study results

3 Lessons Learnt

The team has learnt many valuable lessons and acquired good experiences in the process of implementing the Digital Ward project. It has enabled us to better manage subsequent projects.

The lessons are categorised into two main groups, the stakeholders and the processes.

For Stakeholders:

- a) Perform routine checks to ensure that hospital staff adhere to the new workflow;
- b) Provide sufficient staff training on the usage of the new system;
- c) Secure clinicians' and patients' buy-in to ensure success of the project;
- d) Emphasise the commitment and motivate the staff in adopting and incubating innovations;
- e) Provide strong leadership in managing and supporting the project; and
- f) Solicit funding from the main stakeholders.

For processes:

- a) Need to study, streamline and re-engineer clinical, operational and administrative processes for optimal returns;
- b) Adopt common data standards for a seamless information flow and shared care;
- c) Adopt network security standards and policies to safeguard confidential medical and financial information; and
- d) Abide to policy and regulatory issues in the organisation.

4 Summary

The project team makes continuous and concerted efforts to work closely with the hospital staff and patients in activities such as data verification checks, surveys on the systems, as well as to ensure that the systems are functioning effectively. Hospital staff are also trained to use the new systems and periodically briefed on the benefits and usefulness of the new changes to encourage and motivate them to adopt the changes.

Research has shown that the innovative use of IT not only results in a more efficient and effective operational work flow in hospitals but also brings about enhanced personalised patient care.

SingHealth is one such organisation that paves the way in introducing various IT innovations in its institutions. This innovation culture is continuously nurtured and supported by the management. "In today's world of medicine, we recognise that technology is a critical platform that allows for the delivery of high quality, integrated and multi-disciplinary healthcare. We continually harness technology in innovative ways to improve efficiency and patient care delivery to the level at which we aspire," said Mr Fong Choon Khin, SingHealth's Group Chief Technology Officer.

Finally, creating an innovation culture is an important step in our journey towards embracing innovation as a strategic priority and in bringing the Digital Ward into fruition.