OUR VISION
To be the trusted technology partner in healthcare

OUR MISSION
To lead and deliver technology for excellence in healthcare

OUR VALUES
Trust & Respect
We value everyone’s talents, support and care for one another

Integrity
We are honest and open with one another

Passion
We strive for excellence in all we do

Dynamism
We embrace change and innovation

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ABOUT IHiS

Integrated Health Information Systems (IHiS) is a healthcare-IT leader, transforming patient care through excellence in technology. Managing highly integrated systems and IT expertise across Singapore’s public healthcare sector, its over 700 IT professionals support more than 30,000 healthcare users at all public hospitals, national specialty centres and polyclinics.

IHiS architects and oversees the performance of the institutions’ clinical, business and healthcare analytics systems. It played a key role in four Singapore hospitals becoming the first public institutions in the Asia Pacific to achieve the HIMSS EMR Adoption Model Stage 6, an international benchmark for advanced technology used in patient-care.

A wholly-owned subsidiary of MOH Holdings, IHiS is at the forefront of innovation, driving new standards in quality care.

IHiS focuses and synergises the IT resources of Singapore’s six healthcare clusters to transform healthcare delivery across the country, for better patient outcomes and cost-effective care.

IHiS’ goals are to use technology to:

- **Drive Service Excellence and Value** at the public healthcare institutions
- **Integrate Care Delivery** across the healthcare continuum, so patients can benefit from the continuity of care
- **Innovate** to transform healthcare delivery
IHiS has been recognised with numerous top IT international and local awards for its outstanding and transformational work. The recognitions highlight IHiS’ deep expertise in healthcare–IT.

2011 AWARDS
HIMSS EMR Adoption Model Stage 6 Award
- KK Women’s & Children’s Hospital
- National University Hospital
- Singapore General Hospital
- Tan Tock Seng Hospital
  (project executed by IHiS) for advanced Electronic Medical Records systems

Microsoft Health Users Group, Innovation Award Winner – Best Use of Clinical Records (Inpatient)
- Singapore General Hospital & IHiS for Bed Management System

CIO Summit, IDC Enterprise Innovation Award – IT/Business Excellence In Singapore
- Singapore General Hospital
  (project executed by IHiS) for Bed Management System

SAP Awards of Customer Excellence – Best Upgrade Project (Public Sector)
- IHiS
  for Enterprise Resource Planning System Upgrade for National Healthcare Group and Singapore Health Services

Zebra Technologies Asia Pacific – Certificate of Achievement, Competitive Win in Healthcare Solutions
- IHiS
  for Knowledge Based Medication Administration

Hitachi Data Systems Asia Pacific IT Inspiration – Diamond Award, Most Innovative Use of Technology
- Singapore Health Services & IHiS for Best Virtualisation Strategy For Storage Area Network

Hitachi Inspire The Next Award – Best Storage Management Strategy
- IHiS for Storage Area Network

Asian Hospital Management Awards – Excellence Award, Departmental Service Improvement Project
- KK Women’s & Children’s Hospital
  (project executed by IHiS) for SMS service for patients with ‘No Evidence of Cancer’ results

Asian Hospital Management Awards 2010 – Excellence Award, Internal Customer Service Project
- Changi General Hospital
  (project executed by IHiS) for Hospital Risk Management System

- Singapore General Hospital
  (project executed by IHiS) for e-HR Initiatives
This yearbook marks IHiS’ third anniversary. Three years ago, with IHiS’ creation as an integrated IT enabler, our task was to help the healthcare institutions use technology to achieve service excellence and value, integrate care delivery across the healthcare continuum, and transform patient care delivery.

Since our inception, many major projects have reached significant milestones and have been successfully implemented. The net effect is that IHiS’ value as the trusted healthcare IT partner has become more evident to the various public healthcare institutions that we serve.

Our efforts have been worthwhile, as doctors and other healthcare staff now have comprehensive and timely patient information to make treatment decisions. By implementing IT appropriately to optimise workflows and processes, our people have ensured that unnecessary administrative tasks have been reduced. This has translated into more time for patient care and enhanced patient safety. Our colleagues in the healthcare institutions can clearly appreciate the efforts that IHiS has put in to transform care for the better, in the service of patients, healthcare staff and the public.

IHiS continues to help the hospitals win many top IT accolades. The Closed Loop Medication Management systems that we implemented, clinched the 2011 Singapore Infocomm Technology Federation award for E-Government, 2011 Best PS21 Project - Gold award, and 2010 National Infocomm award for Most Innovative Use of Infocomm Technology (Public). We also helped Khoo Teck Puat Hospital win the regional 2011 FutureGov – Healthcare Organisation Of The Year award.

Stronger Relationships

Today, our staff’s professional skills in healthcare-IT are recognised, and our relationships with our stakeholders have grown stronger. Such ties have resulted from the impact of our work on patient-centric IT solutions and in the enhancement of administrative functions in the institutions that we serve. Such synergies and efficiencies came about as we standardised, harmonised and optimised IT resources both within IHiS as well as across the healthcare clusters.

These achievements are the result of our staff’s passion and commitment through the many challenges the major projects posed. Such passion and commitment are infectious, as they pilot new technologies and innovative solutions in the service of the institutions to take patient care to new heights.

I would also like to take this opportunity to thank my fellow Board Directors for their commitment to our vision, and guidance in nurturing this organisation so that in just three years, significant impact on healthcare delivery in Singapore has been enabled.

Going forward, we can look to IHiS’ continued transformative role in supporting the healthcare clusters, as a key enabler to power the delivery of outstanding care for Singaporeans.

Associate Professor Benjamin Ong
CHAIRMAN, IHiS
November 2011
The creation of IHiS in 2008 marked a milestone in the continuing transformation of the healthcare landscape in Singapore. Over 600 IT staff came together to seed the formation of IHiS, committed to driving greater synergies and high performing systems through a strengthened and consolidated IT workforce that could help power the healthcare clusters towards their goals.

Benefits such as aggregating demand for hardware, software and projects; interoperable EMR systems for exchanging records and images across clusters; specialised capabilities and career paths for IT staff; and a critical mass of skills to meet the changing IT needs in both the clinical and administrative areas; have been realised through the strategic move of consolidating public healthcare-IT in IHiS.

The four hospitals’ achievement of HIMSS EMR Adoption Model Stage 6 award highlights IHiS’ pivotal role as architect and manager, in helping the clusters implement highly integrated platforms and interoperable Electronic Medical Records systems.

At KK Women’s and Children’s Hospital, National University Hospital, Tan Tock Seng Hospital and Singapore General Hospital, we had simultaneously rolled out a series of systems which are important to enhance patient safety and hospital efficiencies, and to implement the HIMSS Stage 6 EMR Model.

Our teams had to help healthcare staff streamline and optimise processes, working around their busy schedules. The strong commitment of the hospitals’ leadership and staff to achieve the best possible patient outcomes was a critical factor in speeding the adoption of the new processes and tools.

In the next few years, we will continue our drive towards facilitating ‘paperless’ institutions, and help all the public hospitals achieve HIMSS Stage 6, and several to attain Stage 7.

The journey to Stage 7 EMR Adoption is important as it provides a proven, structured and cost effective process that will lead to better patient outcomes, better information at healthcare staff’s fingertips, and better healthcare analytics to improve patient care.

Going forward, we will provide better healthcare analytics from the data that is already in the systems. We will harness their usefulness to extract the right information to facilitate improved patient outcomes and healthcare service management.

In addition, we will help the clusters enhance the patient experience through employing mobile technologies and enabling easier information access for patients, clinicians and administrators at all points of care.

Focusing Talent
We have now structured IHiS into four teams comprising the Clinical, Business Systems, Technology Management and Enterprise Architecture/Development Centre divisions. They are supported by a Corporate Office comprising Finance, Human Capital Management and Corporate Planning sections to accelerate unified processes across our business.

Each healthcare cluster is supported by a Chief Information Officer, whose office focuses on governance and managing the IT services provided for the cluster.

“...The journey to Stage 7 EMR adoption is important as it provides a proven, structured and cost effective process that will lead to better patient outcomes, better information at healthcare staff’s fingertips, and better healthcare analytics to improve patient care.”

Dr Chong Yoke Sin

EMR Adoption Model

Stage 7
- Complete EMR; C2D transactions to share data; Data warehousing; Data continuity with ED, ambulatory, OP

Stage 6
- Physician documentation (structured templates), full CDSS (valiance & compliance), Closed loop medication administration

Stage 5
- Full R-FACS

Stage 4
- CPOE, Clinical Decision Support (clinical protocols)

Stage 3
- Nursing/clinical documentation (flow sheets), CDSS (error checking), PACS available outside Radiology

Stage 2
- CDR, Controlled Medical Vocabulary, CDSS may have Document Imaging; HIM capable

Stage 1
- Ancillaries – Lab, Rad, Pharmacy - All Installed

Stage 0
- All Three Ancillaries Not Installed

CEO’S MESSAGE
This dual stratification according to expertise and customers allows us to develop deeper skills in areas such as EMR, radiology and laboratory systems, standards, healthcare analytics, finance, billing and human resource, underpinned by our customer focus to ensure the right solutions for them.

This deep healthcare-IT knowledge and close collaboration with our clinical users were critical to the delivery of the Central Clinical Data Repository database system, Computerised Physician Order Entry, Radiology Information System, Results Reporting, Closed Loop Medication Management and Clinical Decision Support systems for the various clusters and their institutions.

We also supported the opening of new facilities to relieve the bed crunch at public hospitals, with accelerated system deliveries for Khoo Teck Puat Hospital, Jurong Health Services’ operations cutover at Alexandra Hospital, and Singapore General Hospital’s satellite ward at Alexandra Hospital.

In addition, we developed solutions to interface patient data from the Electronic Medical Records systems of five clusters - SingHealth, Eastern Health Alliance, National Healthcare Group, National University Health System and Jurong Health Services – with the National Electronic Health Record (NEHR) system. Within the next one year, medical records from Alexandra Health System will also be interfaced with the NEHR system.

NEHR is part of the planned national integrated healthcare system which will enable patients to move seamlessly among medical facilities to receive care in the most appropriate setting.

Virtualisation And Cloud Computing

We continue to drive synergies through consolidating data centres, procurement and functional teams.

Virtualisation and cloud computing technologies have been leveraged to optimise the healthcare clusters’ IT infrastructure, expand data centre capacities, reduce costs and harness the full benefits of consolidation.

In addition, IHIS has helped to aggregate the purchases of hardware and software and derived significant savings from economies of scale. Many of the software and equipment can now be ordered through a product list available to all clusters.

As IT is critical to the clinical and business operations of public healthcare, we have invested substantial efforts to align our network and systems to new levels of resilience and performance standards to better support the clusters and patients.

Deepening IT Expertise

Today, we have in IHIS one of the largest concentrations of healthcare-IT talents in the Asia Pacific region. We will grow further our teams’ capabilities to innovate healthcare-IT solutions to benefit patients.

To facilitate this, we have adopted the National Infocomm Competency Framework (NICF) to ensure a focused and systematic development of our staff’s skills.
We have also introduced a professional career track, in addition to the management career path, to motivate our employees to develop specialised domain knowledge.

**Federated Architecture**
We continue to work with the senior management of the six healthcare clusters to hone their enterprise architecture to better align IT efforts with their business goals, and to drive towards a federated architecture.

Today, the enterprise architecture journey has progressed to cover more business areas. A federated architecture will enable the clusters to implement more standardised and interoperable IT systems, in a coherent and non-disruptive manner.

This will reduce duplicative investments, generate significant synergies, and facilitate the development of further high performing systems to meet their expanding business needs.

**Beyond The Hospital Walls**
The Singapore healthcare landscape is changing rapidly, with patient care expanding beyond the hospital walls into homes, and ‘anytime, anywhere’ mobile environments.

We will support patient focused care by enabling seamless patient flow and processes, beyond the hospitals, to the primary and step-down care providers such as general practitioners, polyclinics and community hospitals.

The advanced Electronic Medical Records environment we have put in place, provides a solid foundation for the next stage of this healthcare transformation.

Our staff are already piloting tele-health hubs, tele-consultations, remote monitoring devices, mobile web applications and smartphone health diaries with various hospitals. We are also converting many e-services into mobile services.

Today, IHiS is at the hub of meaningful and transformational change for the hospitals. As change agents, we will continue to synergise and innovate new solutions to help the clusters achieve healthcare excellence and deliver integrated care for every patient.

Finally, I would like to take this opportunity to thank our Board, Clusters, MOH, MOH Holdings and IHiS staff for their commitment and dedication in bringing the various institutions’ healthcare-IT to the new levels today.

Dr Chong Yoke Sin
CHIEF EXECUTIVE OFFICER, IHiS

November 2011
OUR LEADERSHIP

Board of Directors

ASSOCIATE PROFESSOR BENJAMIN ONG
Chairman, IHiS
Chief Executive, National University Health System

MR GOH AIK GUAN
Managing Director
MOH Holdings

PROFESSOR IVY NG
Group Chief Executive Officer
Singapore Health Services (wef 22 Jan 2012)
Deputy CEO, SingHealth; and CEO, KK Women’s & Children’s Hospital (till 21 Jan 2012)

PROFESSOR PHILIP CHOO
Chief Executive Officer
Tan Tock Seng Hospital

MR T K UDAIMAM
Chief Executive Officer
Eastern Health Alliance

PROFESSOR ANG CHONG LYE
Chief Executive Officer
Singapore General Hospital
Deputy CEO (Clinical Services & Informatics), SingHealth

RADM (NS) RONNIE TAY
Chief Executive Officer
IDA Singapore

MR PAUL CHAN
IT Committee Chairman
National Healthcare Group

MR WILLIE CHENG
IT Committee Chairman
Singapore Health Services

MR ROBERT CHEW
IT Committee Chairman
Alexandra Health System

MR BARNEY LAU
IT Committee Chairman
Jurong Health Services

MR LIM CHIN HU
IT Committee Chairman
Eastern Health Alliance

Senior Management

Chief Executive Officer

Operations Division

Business Systems, Group Director
Clinical Systems, Group Director
Enterprise Architecture / Development Centre, Chief Architect & Director
Technology Management, Group Director

Corporate Services

Finance, Legal & Procurement, Director
Human Capital Management, Director

DR CHONG YOKE SIN

Chief Information Officer Division

Alexandra Health System CIO
Eastern Health Alliance CIO
Jurong Health Services CIO
National Healthcare Group CIO
National University Health System CIO
Singapore Health Services GCIO

MR ALVIN ONG

MRS CHEONG PIK MAY
MR HO KHAI LENG
MR ONG LEONG SENG
MR FRANCIS FAN

MRS CHNG WONG YIN
MR LIM SOO TONG
MS TAN MING CHU
MR HO KHAI LENG
MR BENEDICT TAN

MS SHIRLEY LIM
MS MARGARET TAN
IHIS’ strategy for healthcare IT has been to interface, standardise, interoperate and optimise pre-existing systems, and to ensure that any new system after 2009 is considered for the ultimate goal of the unification of systems.

This ensures a smooth transition to the new unified environment with as little disruption as possible.

The clusters’ aspirations and operating models are translated into the business architecture aspect of the Enterprise Architecture.

IHIS has adopted a federated approach to the Public Healthcare Enterprise Architecture. The federated approach allows for better adoption of the strategies since this takes into account the aspirations of the clusters aligned towards national goals.

Similarly, the strategy to align the application systems to the vision articulated in the business architecture is to consider the requirements for business process integration vs business process standardisation.

The EA team’s goal is to help all the clusters draw up IT roadmaps that clearly define and prioritise what is important, and how to transform the current IT state to the desired future state. Within IHIS, this will also help to focus the competency levels and consolidate the IT platform and assets.

Roadmap Reviews
IHIS teams have guided the clusters’ senior management through successive reviews of their IT roadmaps to ensure the plans are effective and strategic to their businesses, despite the changing healthcare environment. This also ensures the EA is business-driven rather than technology-driven.

The success of each cluster’s EA journey relies on the support of its senior executives who can enforce effective governance to drive compliance and standardisation, and enlist the rest of the organisation to work with the IT team.

We will thus continue to hold briefing sessions and work closely with the clusters’ management to promote greater understanding of the EA approach.

STRATEGIES GOING FORWARD
Federated Architecture
We are working towards achieving a federated architecture for the healthcare

Enterprise Architecture Governance
- IHIS collaborative approach

<table>
<thead>
<tr>
<th>Layers</th>
<th>Control &amp; Ownership</th>
<th>Impact</th>
<th>Key Stakeholders</th>
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<tr>
<td>Business Architecture</td>
<td>Business Owners</td>
<td>Strategic Outcomes</td>
<td>Clusters</td>
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<td>Application Architecture</td>
<td>Users &amp; Project Team</td>
<td>Business Outcomes</td>
<td>Clusters &amp; IHIS</td>
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<td>Information Architecture</td>
<td>Technical Team</td>
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<td>Clusters &amp; IHIS</td>
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<td>Technical Architecture</td>
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clusters, as this will enable greater interoperability and sharing of platforms.

At the same time, the various clusters will have the flexibility to differentiate with unique business applications, and enjoy high performing systems to support their business and operational needs.

The federated structure will also allow IHIS to focus resources on delivering consistent quality work and speedy services to the clusters by strengthening our in-house competencies on a few platforms. In the long term, this would be more cost-effective and sustainable than supporting many different platforms and toolsets, with heavy reliance on a variety of vendors.

**Four Hierarchy Levels**

The hierarchical federated architecture would have four levels – the technical architecture comprising utility-based computing resources and managed operations such as a private cloud, information architecture such as the Health Information Exchange coding and interface standardisation, applications architecture and business architecture.

The core technical architecture would be common to all. The information and applications architecture require standardisation, integration and consolidation.

However, the business architecture would be unique to each healthcare cluster, and the cluster would have the flexibility to make architectural decisions appropriate to its business needs.

Going forward, we will facilitate inter-cluster EA collaboration into more areas, as the federated architecture requires the various clusters’ agreement on governance, standards for interoperability, harmonising and integrating the different processes and technologies.

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**Strategy for Alignment: Business Integration vs Business Standardisation**

- Considerations for strategies of various types of systems

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<thead>
<tr>
<th>BUSINESS PROCESS STANDARDISATION</th>
<th>LOW</th>
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<tr>
<td>Coordination</td>
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<tr>
<td>• Shared patients or services</td>
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<td>• Impact on other business unit transactions</td>
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<td>• Operationally unique business units or functions</td>
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<td>• Autonomous business management</td>
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<td>• Business unit control over business process design</td>
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<td>• Shared patient and services data</td>
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<tr>
<td>• Consensus processes for designing IT infrastructure services</td>
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<td>• IT application decisions made in business units</td>
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| Unification                      |     |      |
| • Patient and services may be institutional or cluster-wide |     |      |
| • Cluster-wide integrated business processes often with support of enterprise systems |     |      |
| • Business units with similar or overlapping operations |     |      |
| • Centralised management often applying functional / processes / business unit matrices |     |      |
| • High level process owners design standardised processes |     |      |
| • Centrally mandated databases |     |      |
| • IT decisions made centrally |     |      |

| Diversification                  |     |      |
| • Few, if any, shared patients or services |     |      |
| • Independent transactions across business units |     |      |
| • Operationally unique business units |     |      |
| • Autonomous business management |     |      |
| • Business unit control over business process design |     |      |
| • Few data standards across business units |     |      |
| • Most IT decisions made within business units |     |      |

| Replication                      |     |      |
| • Few, if any, shared data |     |      |
| • Independent transactions aggregated at a high level |     |      |
| • Operationally similar business units |     |      |
| • Autonomous business unit leaders with limited discretion over processes |     |      |
| • Centralised (or federal) control over business process design |     |      |
| • Standardised data definitions but data locally owned with some aggregation at corporate level |     |      |
Clinical Systems division rolled out a series of successive clinical and ancillary solutions at the healthcare institutions in the last 22 months, as part of efforts to implement highly integrated Electronic Medical Records (EMR) systems to drive patient-centric care.

The programs reflect the institutions’ advanced healthcare-IT capabilities that are benchmarked against the HIMSS EMR Adoption Model Stage 6 processes.

Today, major functions such as the Central Clinical Data Repository (CCDR) database, Computerised Physician Order Entry (CPOE) for medication, radiology and laboratory orders, Closed Loop Medication Management (CLMM), online Results Reporting for radiology and laboratory results, and Electronic Clinical Documentation have been or are being implemented.

**Award Winning Solutions**

The CLMM system, which helps ensure correct medication administration to patients, is already in place at most acute care hospitals.

The program incorporates and interfaces the Electronic Inpatient Medication Records (eIMR) system for medication ordering, Clinical Decision Support System (CDSS), Inpatient Pharmacy Automation System (iPAS) for medication packaging, and Electronic Medication Administration Recording System (eMARS) for medication administration.

**Tangible Benefits**

Data analysed from the CLMM implementation at KKH, NUH and TTSH in 2010 and 2011 show the system has successfully helped to avert potential drug allergies and inappropriate medication servings. As a result, drug allergy cases dropped significantly at TTSH, and there were no reported cases at NUH for the first half of 2011.

The data also shows substantial increases in healthcare staff’s productivity. With CLMM, pharmacists can now do nine times more timely drug reviews at NUH and TTSH.

At KKH, turnaround time for pharmacists’ verification of prescriptions has dropped from 51 minutes to 7 minutes, and pharmacy staff spend 90 per cent less time doing billings. Today, 97 per cent of patients receive their first medication within 30 minutes of being warded.

**Better, Safer Patient Care**

With the CLMM system, doctors enter prescriptions directly into computers via eIMR, aided by the Clinical Decision Support System (CDSS) which helps ensure correct doses, and avoid drug interactions and allergies.

Pharmacists no longer need to decipher doctors’ handwriting and can instead focus on providing timely prescription reviews. The iPAS system then dispenses and packs the medication into unit-dose, barcoded sachets, eliminating human errors in dispensing.

In NUH and TTSH, the sachets are stored in the wards in secure ‘intelligent cabinets’ that are linked to the hospitals’ Electronic Medical Records system.

To integrate the CLMM into the different IT systems at KK Women’s and Children’s Hospital (KKH), Singapore General Hospital (SGH), Changi General Hospital (CGH), National University Hospital (NUH), and Tan Tock Seng Hospital (TTSH), our teams had to provide two different programs.

We custom-built and used ready solutions for the CLMM system for NUH and TTSH, but implemented ready products for CGH, KKH and SGH’s CLMM.

Our CLMM systems implementation has garnered the 2011 Singapore Infocomm Technology Federation E-Government award, 2011 Best PS21 Project – Gold award, and 2010 National Infocomm (Public Sector) award.

**Sensors**

Sensors on the ‘intelligent cabinets’ allow pharmacy staff to automatically track real-time drug consumption levels, ensure 24-hour supply of 86 per cent of medicine needed, and reduce wastage from excess stock.

**The cabinets emit guiding lights when a nurse enters a patient’s data, to help the staff quickly pick up the right medication. When serving medicine, the nurse scans the barcodes on the patient’s wristband and on the drugs using eMARs, to ensure correct medication administration.**

**Intelligent Cabinets**

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At NUH, the high availability of drugs in the wards, due to the CLMM system, has led to manpower savings of 22 FTEs (full-time equivalent employees). The automated processes have also saved each ward up to 30 minutes per medication administration session, or 90 minutes daily.

A 2010 NUH survey shows nursing staff are pleased that the CLMM system has relieved them of administrative tasks, freeing up more time for patient care. In addition, 89 per cent of the nurses feel that matching barcodes on the patient’s wristband and on the drugs has improved patient safety, and 98 per cent feel the ‘intelligent cabinets’ help them locate medicine more quickly.

Electronic Clinical Documentation
The clinical documentation system, which enables doctors and nurses to record patient notes electronically, has been implemented at all polyclinics, which are now largely ‘paperless’.

We have also implemented the program in selected units of the acute care hospitals, such as at the intensive care and emergency departments.

In 2010, we worked with Khoo Teck Puat Hospital to ensure all clinical and ancillary systems were ready for the institution’s opening. At Alexandra Hospital, we deployed common systems to ensure the IT capabilities were levelled up when the new Jurong Health Services team took over the hospital in August 2010.

STRATEGIES GOING FORWARD
For the next few years, we forecast increasing demand for IT as key enablers to support clinical and business process transformations within and beyond the healthcare clusters, and to facilitate integration across the continuum of care settings.

The following are our strategies to meet these challenges.

- Complete Major Program Roll Outs
  We will complete implementation of major systems such as CPOE, CLMM, online Results Reporting and Electronic Clinical Documentation across all the major institutions over the next two years.

  We will also increasingly focus on developing clinical decision support and healthcare analytics systems to improve patient outcomes.

  Our teams aim to help the hospitals transform into ‘paperless’ environments where clinical documentation is widely deployed, outcomes are documented, and clinical decision support is used pervasively. This will position the hospitals to achieve the HIMSS EMR Adoption Model Stage 7.

- Implement A Federated System
  While we currently have different Electronic Medical Records systems at the various clusters, we need to ensure data can be federated so caregivers will have a holistic view of patients’ records.

  Clinical Systems division’s consolidation of our teams for the various clusters into one common team will enable us to more effectively drive federated data and cost-effective solutions. Our staff will have improved capabilities to ensure systems are highly integrated and standards are adopted across institutions.

  - Enable Care For Healthcare Continuum
    The integrated care system must enable caregivers to manage patients and access relevant data across various settings – from acute care hospitals to community hospitals, nursing homes, polyclinics and general practitioners.

    To facilitate these, we will assist with the implementation of national IT data and terminology standards, as well as governance and controls.

  - Facilitate Care Beyond Hospitals
    Our teams will enable patients’ use of home monitoring devices that can feed data to the institutions’ systems. Online services and patient portals will also be set up to increase patients’ access to information. In addition, we will develop mobile applications so patients can use smartphones and other devices to access their health records or care services.

  - Ensure Robust Systems
    To ensure robust, high performing clinical and ancillary systems to meet the institutions’ expanding needs, we will continue to upgrade the clusters’ infrastructure and applications.
KEY ACHIEVEMENTS

Over the past year, we accelerated Business Systems’ transformation by integrating our teams for the six healthcare clusters into a single unit. This optimises resources, technology and platform synergies, and the sharing of best practices.

Today, the division comprises three focused teams with deep capabilities - Patient Systems, Enterprise Management Systems and Healthcare Analytics.

Process Improvements
At National Healthcare Group (NHG) Polyclinics, we launched the Electronic Polyclinic Outpatient System (ePOS) across all nine polyclinics, five Dental Services facilities and Singapore Footcare Centre in August 2011.

The solution integrates patient administration, billing and accounts receivable functions into one common platform. This speeds up workflows and enables patient self-service in registration, appointments and billing.

At the National University Health System (NUHS), National Healthcare Group (NHG), Jurong Health Services (Jurong-Health) and Alexandra Health System (Alexandra Health) clusters, we also customised solutions to help hospital staff simplify MediFund processes and improve the overall patient experience.

We also aligned the human resource systems at five clusters to the SAP HCM platform. The new solution rolled out for SingHealth in May this year has speeded up personnel administration, medical benefits, payroll and time management processes, and improved productivity with employee self-services.

At NHG, JurongHealth and Alexandra Health clusters, the SAP HCM is targeted for launch in the first half of next year, while NUHS’ system will go-live in the first quarter 2012.

To support the opening of new facilities, we implemented SAP solutions at Khoo Teck Puat Hospital, as well as at Alexandra Hospital for the hospital operations of Jurong-Health and satellite ward of Singapore General Hospital (SGH).

Healthcare Analytics
Today, we are driving analytics to empower the clusters to unlock valuable insights from the massive data in our systems.

At SingHealth, we have implemented the first phase of the Enterprise Health Intelligence System (eHIntS) for SGH. This is an enterprise business intelligence repository integrating business workload, finance and clinical information for reporting and analysis.

We are currently developing the eHIntS extension to National Heart Centre and Singapore National Eye Centre, enhancing the application with additional data sources. This is scheduled for roll out in March 2012.

At SingHealth and Eastern Health Alliance (EH Alliance), we are leveraging the Oracle Business Intelligence platform to migrate and enhance our data marts and repositories. In March this year, we migrated six applications at SGH, and completed KK Women’s and Children’s Hospital and Changi General Hospital’s first phase projects. The remaining repositories will be migrated by March 2012.
At NHG, NUHS and JurongHealth clusters, we implemented the Enterprise Data Warehouse project in 2010 as an enterprise repository to support reporting, analytics and data marts.

The first data mart, the Patient Affordability Simulation System for Institute of Mental Health, Tan Tock Seng Hospital, Alexandra Hospital and National University Hospital, was launched in July 2011.

The system provides financial analytics and simulation capabilities to track patient medical costs, payment profiles and affordability.

In addition, dashboards for hospital management to quickly monitor and track performance in key areas are now being developed.

A new NHG Polyclinics data mart is in progress and targeted to roll out in June 2012.

**Award Winning Business Systems**

In 2010, IHIS and the hospitals won several awards for business systems initiatives. We clinched the SAP Customer Excellence award for the SAP ECC 6.0 upgrade, while SGH won a Leading HR Practices Award for the SAP HCM project.

SGH’s Bed Management System, which has substantially improved bed utilisation efficiency and reduced patient waiting times, won awards from Computerworld, IDC Enterprise and Microsoft.

**STRATEGIES GOING FORWARD**

Business Systems division’s strategies to reap the full benefits of synergies include the following.

- **Right Sourcing and Deepening Business Skills**
  The Finance, Human Resource and Billing systems across all the clusters are primarily platformed on SAP. This has provided significant economies of scale in terms of technical and business expertise. Going forward, we will adopt a co-sourcing approach where IHIS will focus on critical business skills with sufficient depth in SAP, while outsourcing the IT upgrades and maintenance to vendors.

- **Standardising For Synergies**
  We will continue to review applications portfolios across the healthcare clusters for opportunities to further harmonise and standardise solutions and common platforms to realise greater economies of scale for our stakeholders.

- **Achieving Higher Resilience**
  We are driving for higher resilience and availability in mission critical applications, such as the administration and accounting modules SAP-ISH, OAS and ePOS, and are working with the partners to achieve this. We will also review the healthcare clusters’ applications portfolios to prioritise investments for higher resilience and availability.

- **Aligning With National Initiatives**
  Business Systems’ teams have delivered on major national healthcare priorities. These include supporting the National Electronic Health Record (NEHR) system’s go-live in June 2011 with data integration from the business systems of all the six healthcare clusters.

  The upgrade and migration of all our systems to the ICD 10 (International Classification of Diseases) standard will be a major national milestone that will facilitate better use of the structured data provided across our care settings.

  Major initiatives in mobile technologies funded by the iGOV 2010 scheme have also been implemented across the clusters. An example is the miHealthCare application on the apps store.

  Developed on the iPhone iOS platform, miHealthCare mobile app provides a quick guide to the various public hospitals, healthcare institutions and polyclinics.

  It brings information on the hospitals’ consultation charges, clinical services, directions, contact details and admission procedures - to users’ fingertips. Subsequent enhancements will include appointment information, calendar of events and way-finding.

  Business Systems will continue to proactively align with national and e-Government healthcare initiatives to help the clusters streamline and advance their capabilities.
KEY ACHIEVEMENTS

Virtualisation
IHIS uses virtualisation technologies to provide more efficient, flexible and cost effective IT systems. By maximising the power of individual servers with virtualisation, we were able to eliminate over 150 servers with significant savings.

Last year, IHIS and SingHealth won the Hitachi Asia Pacific IT Inspiration award for ‘Most Innovative Use of Technology’ for the virtualisation of storage area networks.

The project involved improving business agility across SingHealth Group by consolidating storage capacity and centralising patient information access through virtualisation. Today, we have some of the region’s most robust and speedy systems for collecting and protecting medical records.

Collaborating On The Cloud
A significant milestone since the formation of IHIS is the delivery of a common email system across the entire public healthcare network.

The Unified Messaging System for Healthcare (H-mail), which is hosted on a private cloud, provides healthcare staff with ‘anytime anywhere’ access from many mobile devices, and easier collaboration and sharing of documents across institutions.

The H-Mail allows a staff to locate and access other staff across the entire public healthcare network, a first for public healthcare since its inception.

Secure Remote Access
In 2011, we enabled for IHIS staff, secure ‘anytime anywhere’ remote access to resources on our Intranet, project management and department shared files. This is in line with our efforts to support our staff in their increasingly mobile work patterns, as they execute projects across the healthcare clusters.

The secure remote access uses SSL VPN (Secure Sockets Layer Virtual Private Network) and SMS as the second remote authentication.

STRATEGIES GOING FORWARD

Healthcare Cloud
IHIS is using cloud computing strategies to meet the healthcare institutions’ growing demand for data centre facilities. We are building a virtualised data centre by consolidating and standardising the technical architecture.

Cloud computing offers elastic provisioning of IT resources through a standardised, scalable and secure infrastructure that is virtualised. Key benefits include the dynamic availability of computing resources, virtualisation for lower costs, better resilience and faster implementation of applications.

We will use private clouds for highly secure applications such as patient records, and public clouds for general applications that do not require high security.

IHIS plans to build and operate a private healthcare cloud as a single IT shared service entity. This will enable greater pooling of computing resources across clusters, for better economies of scale.
Singapore Health Services (SingHealth) is the country’s largest healthcare cluster with two tertiary hospitals, five national specialty centres and a network of nine polyclinics. It offers the complete range of multi-disciplinary and integrated healthcare to meet the needs of Singapore’s population today and in the future.

In its pursuit of Academic Medicine, SingHealth focuses on delivering quality patient care; continuing its tradition of teaching, lifelong learning and grooming future generations of healthcare professionals; and fostering new discoveries and innovation – all centred on improving the lives of patients.

**KEY ACHIEVEMENTS**

IHiS has rolled out a host of systems to support new services, Electronic Medical Records (EMR) program implementation, and enhance operational efficiency.

**New Services**

**Ancillary**

*Cluster Pharmacy System*

Inpatient pharmacy systems across SingHealth Group came closer to standardisation with the launch of the Sunrise Medication Management (SMM) inpatient pharmacy system at KK Women’s and Children’s Hospital (KKH) in November 2009 and Singapore General Hospital (SGH) in March 2011.

The program seeks to improve patient care through standardising inpatient pharmacy systems, support inpatient medication ordering and administration, and facilitate medication review and verification by pharmacists.

**Tele-Health**

*Diabetic Retinopathy Program*

In July 2010, we provided IT support for the progressive roll out of Singapore Eye Research Institute’s faster diabetic retinopathy pilot screening service at Bukit Merah, Outram and Pasir Ris polyclinics.

The initiative allowed for eye images of diabetic patients captured at the polyclinics to be sent electronically, via an IT platform, for assessment by a centralised team of trained accredited graders from the Institute. The graded results are then transmitted back to the polyclinics within an hour.

This replaces the previous practice where polyclinic doctors graded retinal photographs after clinic hours. The turnaround time then was three to four weeks.

**Tele-Stroked Service**

The Tele-Stroked Service allows National Neuroscience Institute (NNI) specialists to remotely provide advice to Changi General Hospital’s Accident & Emergency Department doctors for stroke cases.

This reduces the time taken to diagnose stroke cases, and enables early treatment to improve patient outcomes. It was piloted in October 2010.

**Tele-Radiology**

This tele-care solution facilitates workload balancing among SingHealth institutions. A radiologist with high workload can send images to his colleague at another institution to read and report. He can also outsource the reading of certain images to a third party.

**Mobile Applications**

*Health Diary*

In October 2010, SGH introduced MobileCare@SGH, a mobile phone application with a health diary for rheumatoid arthritis patients to enter information on their condition.

Developed by IHiS with SGH specialists’ input, the application collates data and generates charts that patients and doctors can easily view on the phone. This facilitates tracking of progress by doctors and patients, and improves patients’ adherence to prescribed care regimes.

The health diary also gives the physician more information on the patient’s condition between clinic visits to facilitate better decisions. The application enables better disease management and improved patient outcomes,
without increasing operational costs for hospitals or clinics.

**Mobile Antibiotics Guide**

In May 2011, SGH piloted the Antibiotics Guideline mobile phone application for doctors ‘on the move’. Developed by IHiS with input from SGH clinicians and pharmacists, the application provides busy doctors with a quick ‘anytime anywhere’ reference to make effective antibiotic prescriptions that comply with the hospital’s guidelines. This enhances doctor efficiency and patient outcomes.

**mobile@SGH**

With this application, patients can quickly view through their smartphones, payment modes, the queue length at SGH’s Emergency department, amenities and street map. The system went live in November 2010.

**Pregnancy Health**

KKH launched the unique Woman& Child HealthPedia mobile application in May 2011. It features pregnancy health and medical care for pregnant women in the Asian context, and was developed with input from KKH specialists.

**Electronic Medical Records Systems**

**HIMSS EMRAM Stage 6 Award**

In June 2011, SGH and KKH achieved the HIMSS EMR Adoption Model Stage 6 for their advanced Electronic Medical Records systems. This is just one level away from Stage 7, the pinnacle of the seven-stage international benchmark model, and is a significant achievement for both hospitals and SingHealth. Currently, only 5.5 per cent of hospitals in US have attained Stage 6 and 7.

**Medication System**

We completed full implementation of the Knowledge Based Medication Administration system at KKH in January 2011. The program helps minimise medication errors and uses barcoding to ensure medication administration of the Right Drug to the Right Patient at the Right Time.

**Electronic Nurse Charting System**

The program at SGH converts basic charting functions in nursing to electronic charts to complement the Computerised Physician Order Entry (CPOE) and Closed Loop Medication Management (CLMM) systems. Doctors and nurses can readily view the charts online to provide effective patient care.

**Closed Loop Medication Management**

The CLMM system was implemented in all SGH wards by March 2011. CPOE was rolled out in SGH, National Heart Centre Singapore (NHCS), SingHealth Polyclinics and National Dental Centre (NDC) of Singapore by July, and at KKH by October 2011.

**Polyclinic Clinical Documentation**

In September 2010, we launched the electronic medical records Sunrise Clinical Manager (SCM) clinical documentation service in all SingHealth polyclinics. Doctors and nurses now enter patient notes electronically, and patient information can be accessed and shared online. The notes include history-taking, physical examination, diagnosis, patient education and care plans.

**Electronic Dental Records System**

NDC rolled out its Electronic Dental Records (EDR) system in February 2011. Clinicians can now electronically chart all general and specialty dental records, and document their diagnosis, findings and treatment.

This is the first custom-built solution in the country to seamlessly integrate all major aspects of patient management in a large-scale dental institution.

**Digital Dental Models**

In June 2011, NDC began pilots for a digitisation process to convert plaster dental models to digitised models. The digital dental models enable doctors to achieve more accurate analysis, using analysis software, for their treatment plans.

**Chronic Disease Management**

Clinical documentation on the electronic medical record SCM platform for diabetes, hypertension and hyperlipidaemia went live in March 2010.

We rolled out the Delivering On Target (DOT) web-based system for chronic disease patients at NHCS and SGH Diabetes Centre in December 2010. The program facilitates the efficient management and monitoring of chronic diseases.
of patients discharged from specialist outpatient clinics to the care of general practitioners and polyclinics.

**Paediatric Cardiology Imaging**
With the Paediatric Cardiology Imaging and Information Management System (CIIMS), echocardiogram images are digitised for instant access, eliminating the analog video degradation problem. The system went live at KKH in July 2010.

**Operational Efficiency**

**Population Care Management**
The Procare Polyclinic Information System (PPIS) seeks to improve the health of the population by helping doctors enhance the patient's quality of life and delay complications. Patient registries are set up with data on patients with similar conditions to be managed proactively. For example, patients with abnormal HbA1c are enrolled into an insulin initiation program. We delivered the system in October 2010.

**Inpatient Pharmacy Automation**
The Inpatient Pharmacy Automation System (iPAS) improves the pharmacy dispensing process by picking and packing drugs in unit dose using robotics and barcoding. Rolled out at KKH in January 2011, it also facilitates medication administration checks at patients’ bedside with barcode scanning capability. This enhances pharmacy operational efficiency and patient safety.

**Outpatient Pharmacy System**
The SGH Outpatient Pharmacy Automation System (OPAS) automates the picking, packing and labelling of drugs for outpatients, with a robot machine that eliminates human errors in dispensing. The program integrates with the pharmacy system for outpatient prescription orders.

OPAS enhances patient safety and improves pharmacy staff’s productivity. The solution was piloted in April 2011 with the commissioning of SGH’s first outpatient medication dispensing machine. A second machine was added in August 2011.

**Enterprise Healthcare Analytics**
We launched the Electronic Health Intelligence System (eHIntS) Phase One at SGH in October 2010 to serve the analysis and reporting needs of Business, Finance and Clinical users.

We are now implementing the system at NHCS and SNEC with four additional clinical data sources.

**SGH eWorkPlan System**
The program facilitates the online submission and automatic collation of work plans, capital expenditure and manpower budget into a system shared throughout SGH. It went live in July 2010.

**Roster For Medical Social Workers**
In December 2010, we launched the NCCS appointment system for medical social workers to meet patients. The program enables reviews of daily or weekly schedules and patients’ appointment histories.

**Cluster Human Resource System**
We have completed implementation of the first phase of the Human Resource Information System (HRIS) across the cluster.

The program speeds up organisation management, personnel administration, medical benefits, payroll and time management processes.

**PLANNED FUTURE PROJECTS**

We have planned the following activities to support SingHealth’s vision and operations.

**Clinical Systems**

- To achieve HIMSS EMR Adoption Model Stage 7 for SingHealth Group in three years’ time.
- Roll out Clinical Documentation such as doctors, nurses and allied health electronic clinical notes via a phased approach in institutions throughout the cluster.
- Roll out Computerised Order Entry at all institutions including cardiac and nursing orders.
• Continually review clinical processes and extend the support of the EMR system to improve patient safety and workflow. These include the Clinical Viewer, Facility Board, and Handover Documentation modules.

• Implement a medical records scanning system to scan existing hard-copies of patients’ medical notes to complement the Clinical Documentation system. This will enable SingHealth institutions to go ‘paper-lite’, and eventually ‘paperless’.

• Launch Clinical Decision Support for doctors prescribing antibiotics using the SCM Electronic Medical Records system.

• Implement the Anaesthesia Information System (AIS) in SGH operating theatres and recovery rooms. This will help the anaesthetists chart and monitor patients’ vital signs before, during and after operations.

• Launch mobile applications to monitor, track and co-manage patients’ medical conditions for better outcomes.

• Enhance operational efficiency by
  – Extending the Theatre Sterile Supplies Unit (TSSU) Instrument Management System (TIMS) to the Major Operating Theatres and Central Sterile Supplies Department (CSSD).
  – Implementing solutions to facilitate ‘paperless’ and electronic forms.
  – The epilepsy caregivers’ portal will enable family members or caregivers of epilepsy patients to record epilepsy episodes. This will provide doctors with more information on patients’ conditions between clinic visits for better treatment decisions.
  – The dementia caregivers’ portal will enable family members of dementia patients to e-consult NNI staff, as they struggle with the patients’ changing behaviours. It is often difficult to bring patients with advanced dementia to the institute.
  – The portals will be linked to the national Personal Health Management Portal which is planned for launch next year.

Business Systems

• Improve the patient experience and public services by implementing the ‘One queue, one bill’ system at NHCS and Automated Visitor Management System at SGH.

• Extend and improve wireless access for the public at the institutions including at the wards and public areas.

• Extend human resource (HRIS) modules to cover competency management, talent management and e-Appraisal.

• Enhance healthcare informatics by extending and rolling out eHIntS to all SingHealth institutions, and implementing dashboards for executive decision support.

• Support research by
  – Extending analytics and facilitating the set-up of research databases.
  – Implementing a Clinical Research Forms Database for SGH’s Clinical Research department to maximise research data capture capabilities.
  – Implementing the web-based SGH Integrated Research Automated System (SIRAS) to help the Research / Clinical Trials Resource Centre teams manage research funds, track research progress and streamline processes.
  – Developing the cluster’s Centralised Institutional Review Board (CIRB) system to streamline processes across the institutions’ review boards, such as the electronic submission of documents by researchers. The program will support current and future regulatory compliance by integrating documentation and audit-trails.

• Enhance further the IT infrastructure to support SingHealth Group’s expanding operations, and improve resiliency and applications availability.
**National Healthcare Group (NHG)** provides care through an integrated network of primary healthcare polyclinics, acute care and tertiary hospitals, national specialty centres, innovative virtual specialty centres and business divisions. Together, they bring a rich legacy of more than 340 years of medical expertise to their philosophy of patient-centric care.

By designing accessible and seamless healthcare services around patient needs, NHG ensures that patient care is fully coordinated within the cluster and is also extended to high level collaboration with other healthcare providers at home and abroad.

**National University Health System (NUHS)** groups National University Hospital, NUS Yong Loo Lin School of Medicine, NUS Faculty of Dentistry and NUS Saw Swee Hock School of Public Health under a common governance structure to create synergies to advance health by integrating clinical care, research and education.

The enhanced capabilities and capacity will enable NUHS to deliver better patient care, train future generations of doctors more effectively and bring innovative treatments to patients through groundbreaking research.

**KEY ACHIEVEMENTS**

NHG and NUHS share a similar IT architecture as both clusters collaborate on and use common systems. This enables programs successfully piloted in one cluster to be cost effectively and speedily replicated in the other cluster.

**HIMSS EMRAM Stage 6 Award**

In June 2011, NUH and TTSH achieved the HIMSS EMR Adoption Model Stage 6 for their advanced Electronic Medical Records systems.

The international benchmark ranks them among the first hospitals in Asia Pacific to implement such advanced healthcare-IT systems to benefit patients. The significant achievement also places NUH and TTSH among the top 5.5 per cent of hospitals in US to achieve Stage 6 or 7.

**Medication Management**

The Closed Loop Medication Management (CLMM) system was fully implemented at National University Hospital (NUH) in October 2009 and Tan Tock Seng Hospital (TTSH) in May 2010.


Joint Commission International, part of the standards setting and accreditation body, The Joint Commission, also published an in-depth article on the hospitals’ CLMM system in its quarterly newsletter JCInsight in April 2011.

The CLMM system minimises risks of adverse effects by facilitating appropriate medication prescription and correct medication administration. It utilises drug unit doses which are machine-packed, barcoded and stored in automated dispensing cabinets at the wards.

Nurses use hand-held Personal Digital Assistants (PDA) to match the barcodes on the patients’ wristbands and on the drugs before giving medicine. This ensures the right dose of the right medicine is given to the right patient at the right time.

Wastage is minimised as unconsumed and undamaged medicine remain in their packaging and can be returned and reused.
Central Clinical Data Repository
As part of our Electronic Medical Records (EMR) journey to help improve patient outcomes and support caregivers’ work, we have implemented Phase One of the Central Clinical Data Repository (CCDR). This common repository contains patient medical records of NHG, NUHS and Jurong Health Services (JurongHealth) clusters.

The system provides a ‘single source of information’ for patients’ medical records, and is being used to link the healthcare clusters to the National Electronic Health Record (NEHR) system. The CCDR will also integrate with our other clinical systems in clinical decision support and care management.

Anaesthesia Information
A new Anaesthesia Information System (AIS) was rolled out at TTSH’s 24 operating theatres in November 2010. This was the first large scale electronic anaesthesia charting system implemented in Singapore.

AIS electronically captures anaesthesia related information and bedside clinical data generated during surgery and anaesthesia onto a single platform, and is part of our roadmap towards electronic clinical documentation.

Key patient parameters, which were previously recorded manually on various equipment, are now automatically charted onto one system, helping anaesthetists make better informed decisions.

eNotes Enhancements
We have made further enhancements to the Electronic Clinical Documentation (eNotes) system for NHG.

The Significant History section captures information on the patients’ lifestyles relevant to their medical conditions, while the Important Notes section alerts the healthcare team to important care messages.

The Diabetic Retinal Photography eNotes template was refined to include a work list to better coordinate workflow and follow-up of patients under the Diabetic Eye Screening program.

The new eReferral template helps doctors create referral letters more quickly with IT-assisted population of relevant clinical information.

A health education module, added in March 2011, helps coordinate education activities and goal setting to encourage patient empowerment.

Surgical Set Tracking System
A new RFID-based Surgical Set Tracking System was rolled out at TTSH in August 2010.

The system enables faster and more efficient location of surgical sets, whether they are in sterilisation stage or in the operating theatres, eliminating the need for manual tracking and documentation.

With the system, patient safety and infectious disease management are enhanced, as action can be taken quickly during an infection outbreak.

Patient Discharge Summary
The upgraded electronic Hospital Inpatient Discharge Summary (eHIDS) and medical certificate systems were rolled out in May 2011. The new web-based solutions enable better continuity of care as patient discharge records are made available across institutions.
Visitor Facilitation System
TTSH implemented a new Visitor Facilitation System in April 2010 to manage the number of visitors in the wards more effectively and ensure patients get sufficient rest. The system uses self-service kiosks for visitors to register, and gantries at the lift lobbies to manage people entering the wards to visit patients.

More Bandwidth For Polyclinic Doctors
Doctor workstations in the consulting rooms at NHG polyclinics have been upgraded with second monitors and higher network bandwidths.

This enables them to view more clinical information at the same time, such as the Electronic Clinical Documentation (eNotes), ePrescription, imaging, chronic disease management or patient records systems.

We are also developing a doctors’ portal for remote monitoring. This will be linked to the national Personal Health Management Portal which is scheduled for launch next year.

PLANNED FUTURE PROJECTS

- **Paperless Medical Centre**
  NUH Medical Centre is targeting to be ‘paperless’ when it opens in 2013. Besides the Electronic Clinical Documentation (eNotes) program, we are planning to implement systems to convert patient paper records into electronic copies, and harmonise processes and forms.

- **Medication Records At IMH**
  At the Institute of Mental Health, we will launch the Electronic Inpatient Medication Record (eIMR) system by end 2011 to give doctors ‘anytime anywhere’ access for medication ordering.

The integration of eIMR with the Critical Medical Information System (CMIS) for drug allergies, adverse drug events and medical alerts will further enhance patient safety.

- **Outpatient Prescription System**
  Over the next two to three years, we will roll out an upgraded electronic outpatient prescription system (eRx) for doctors at NHG, NUHs and JurongHealth outpatient clinics and polyclinics.

  The program has a built-in drug dictionary and other useful features compatible with the inpatient medication system, and will pave the way for more advanced clinical decision support modules.

- **Clinical Documentation System**
  Over the next three years, we will roll out the Clinical Documentation system (cDoc), which will allow doctors to enter electronic patient consultation notes more efficiently, and eliminate paper files.

  The program will enable the doctor to quickly record the patient’s description of his/her condition, the doctor's observations and diagnosis, and prescribed medication and treatment.

- **Desktop Portal For Doctors**
  In 2012, we will launch a Clinical Desktop Portal (cDesk) for doctors in NHG and NUHs clusters. The portal will give doctors quick, easy access to all Electronic Medical Records modules and functions they may need to use.
Jurong Health Services (JurongHealth) is the new regional healthcare hub in western Singapore, facilitating the integration of care services and processes within the hospital and across the community.

The cluster currently manages Alexandra Hospital (AH) which provides a comprehensive range of clinical services. Its anchor regional hospital, the 700-bed acute care Ng Teng Fong General Hospital (NTFGH), will be twinned with the 280-bed Jurong Community Hospital (JCH) to provide holistic integrated care when it opens in late 2014.

**KEY ACHIEVEMENTS**

JurongHealth assumed full management of AH in August 2010, while planning the building of NTFGH and JCH. The IT work stream in JurongHealth is made up of three phases – Transition, Elevation and Transformation.

**Transition Stage**
The focus of this phase was to ensure a smooth transition into AH in 2010.

JurongHealth adopted AH’s and National Healthcare Group’s (NHG) IT systems, where possible, to minimise downtime. Our major tasks then included replacing ageing computing devices and network equipment, and expanding network capacity to support planned applications.

We rolled out 34 projects in quick succession to facilitate the transition. IHiS’ experience with starting up other institutions enabled us to jump-start AH’s IT systems in record time.

Key projects implemented include:
- JurongHealth’s websites
- Emergency Unit System (EDWeb)
- Results Reporting system
- Primary Data Centre (PDC) firewall migration
- Switch over to upgraded AH network firewall
- Outpatient & discharge medication request (CPSS-eRX) system
- Various SAP business and Financial Counselling (eFC) modules
- Cardiology system (4D CIS).

**Elevation Stage**
In the Elevation Stage, we begin to level up IT capabilities and start our journey towards a ‘paperless’ hospital.

We will continue to collaborate with NHG and National University Health System (NUHS) on new clinical solutions such as Clinical Documentation (cDoc), Central Clinical Data Repository (CCDR) and Drug Knowledge Management System (DKMS). We will also adopt NHG’s upgrades of its Human Resource, Outpatient and Discharge Medication Prescription, and Clinician Desktop systems.

To improve system resiliency and reduce disruptions to operations, AH will participate in NHG’s implementation of disaster recovery capabilities for the Computerised Clinician Order Entry (CCOE) and electronic inpatient prescription (eIMR) systems.

We will also install AH specific Document Management, Enterprise Messaging and Electronic Meal Ordering systems.

Projects rolled out include:
- Patient Affordability & Simulation System (PASS) enhancements
- CCDR – Phase One

**Transformation Stage**
For the Transformation phase, we will develop further the IT strategy to achieve a ‘paperless’ hospital, and implement systems that will support the integration of care between NTFGH, JCH, Jurong Medical Centre and health partners in the western region.

We have begun work on the Enterprise Architecture, and are defining the IT future state and implementation roadmap to achieve JurongHealth’s vision of OneCARE.

The IT blueprint covers NTFGH, JCH, and integrated care partners such as polyclinics, general practitioners, nursing homes and care providers. We are also preparing the IT budget and action plans for the OneCARE project.

Our key goal for the Transformation Stage is to be ‘five-less’ when we move into the new facilities – ‘film-less’, ‘chart-less’, ‘script-less’, ‘paperless’ and ‘cash-less’. To achieve this, we will implement highly integrated systems across the continuum of care provision.

With the Results Reporting system, doctors can view X-Rays faster. A doctor enters orders into the CCOE.
Eastern Health Alliance (EH Alliance), the regional health system for the people of eastern Singapore, includes Changi General Hospital, St Andrew’s Community Hospital, SingHealth Polyclinics and Salvation Army Peacehaven Nursing Home.

EH Alliance is aligned with the national direction to make healthcare on-going, rather than episodic, especially for people with long-term chronic conditions.

EH Alliance members are focused on delivering integrated healthcare services, from disease prevention, early detection and treatment, through to on-going care, providing the right quality care at the right time for each patient. Information technology is playing a key role in achieving the vision.

KEY ACHIEVEMENTS

Integrated Care Initiatives
In 2011, CGH and other EH Alliance members launched several innovative integrated care initiatives.

These included the Health Management Unit (formerly Disease Management Unit) for patients with poorly controlled chronic conditions, and the Eastern Community Health Outreach (ECHO), which focuses on community-based chronic disease prevention.

To support these initiatives, IHiS has successfully implemented the following systems.

Patient Relationship Management (PRM)
The solution was launched in January 2011 to help the Health Management Unit’s nurse tele-carers implement a coordinated and sustainable follow-up care plan for patients at home.

The PRM system displays data as an integrated view of patients’ status for the tele-carers to monitor easily. It enables them to access their assigned patients’ past test results and interaction history, and activates an alert when selected clinical indicators worsen.

It also captures the tele-carers’ communications with their patients and family members. This helps sustain their relationships with the patients and caregivers, to better support patient care.

ECHO System
Rolled out in January 2011, the ECHO system allows for data capture and management, and online registration for ECHO activities. It enables healthcare staff to efficiently identify ECHO participants with, or at risk of, chronic disease for follow-up.

Hospital Operations
CGH has implemented various systems to strengthen hospital operations and enhance patient care.

Nurse Charting
The nurse charting system rolled out in December 2010 provides an online capability for nurses to record patients’ vital signs, hourly intake and output. This gives a more complete view of patients’ conditions, and the information is readily available online for doctors to plan effective patient care.

Medication Management
Implemented in September 2011, the Closed Loop Medication Management (CLMM) system provides online ordering, verification and recording of drug administration to the patient, enabling doctors, pharmacists and nurses to work closely to better manage patient medication. The quick access to accurate information also helps enhance patient safety.

Faster Radiology Services
Launched in September 2011, the Radiology Integrated Systems (RIS-PACS) application streamlines radiology operations and reporting workflows. It improves patient reception, image acquisition and reporting processes, and enables the capturing, communicating and storing of X-Ray images. Radiology images are distributed hospital-wide through the Image Management System.

Cardiac Information System
We enabled the online distribution of Cardiac Image and Information Management System (CIIMS) reports through integration with the Electronic Medical Records system in January 2011, and extended the function to the second catheterisation laboratory in March 2011.

The system streamlines reporting workflow by integrating catheterisation X-ray images with haemodynamics measurements into a single report.
ECG Management System
Rolled out in July 2011, the system enables cardiologists and clinicians to view from their computers, patients’ ECGs performed from ECG Carts.

Tele-Stroke Service
The Tele-Stroke program was piloted by CGH and National Neuroscience Institute (NNI) in October 2010. It enables remote diagnosis and assessment of acute stroke patients through video conferencing. With Tele-Stroke, acute stroke patients at CGH can be treated with the help of NNI neurologists remotely at any time of day. The timely treatment has helped improve patient outcomes.

Intranet Portal
In April 2011, the CGH Intranet was migrated to Sharepoint 2010. The solution provides a unified platform for accessing enterprise information and applications, and advanced content management capabilities.

Searching for and sharing of documents are now more intuitive, and the solution’s collaborative features such as Blog and Facebook have provided an improved internal communications environment for staff to be better informed, share information and work together more effectively.

Website Enhancement
We upgraded CGH’s website to the Sharepoint 2010 content management system in February 2011 to speed up content publishing and provide a single, flexible platform, in anticipation of expanding needs. As a result, creating interactive content is easier and users can search more easily for healthcare information.

eClaims System
The revamped eClaims system streamlines the financial claims process for transport claims, reimbursements and cheque requisitions. It features a new and scalable workflow engine that will support other Intranet applications, and will go live in December 2011.

Virtual Servers
Server virtualisation has enabled us to migrate physical servers to a virtual environment, significantly reducing the number of physical servers at CGH’s data centre. The virtualisation exercise in July 2011 helped save valuable space and energy.

We also implemented the Central Tape Backup solution in August 2011 to consolidate different tape solutions. This has improved backup performance, standardised tape solutions and reduced costs.

PLANNED FUTURE PROJECTS
IHİS will support EH Alliance’ innovative efforts in enhancing, coordinating and delivering integrated care for the people of eastern Singapore. To achieve this, we will continually explore new systems and improve existing solutions to provide more effective capabilities.

Here are some planned initiatives:

Clinical Systems
- Upgrade the EMR system to SCM 5.5 with enhanced functions to provide healthcare staff with more effective tools for patient care.
- Implement the inpatient medication management solution (iPAS) to enhance patient safety. The system includes a bedside barcode medication administration system, automated unit-dose packaging machines, and electronic automated medication cabinets in the wards.

- Implement a medical records scanning system to make patient case notes available online for doctors’ instant access. This will facilitate faster, better and safer patient care.
- Develop innovative solutions to support EH Alliance’ proactive and integrated approach to disease management.
- Enhance the PRM system to receive and integrate readings from blood glucose remote monitoring devices. Diabetic patients will then be able to use their blood glucose monitors to transmit readings for CGH staff to monitor. The solution will be linked to the national Personal Health Management system.

Business Systems
- Develop a ‘patient information hub’ with single-point access for tracking and updating bed status and patient movements, and facilitate processes such as elective admissions.
- Install an automated visitor tracking system for more efficient management of visitors to the wards.
- Develop a harmonised human resource management system for more efficient talent management, manpower and succession planning.
- Provide remote access capability for an increasing population of doctors and healthcare staff so they can provide services to patients without having to physically be at the hospital.
- Install a more resilient corporate network system to minimise downtime and support the growing bandwidth needs from new applications.
- Upgrade wireless network bandwidths to give healthcare staff higher connection speeds for faster applications and better network performance.
The opening of Khoo Teck Puat Hospital in 2010 marked the beginning of the Alexandra Health System (Alexandra Health) integrated regional healthcare hub which serves more than 700,000 people in the north of Singapore.

The 550-bed acute care Khoo Teck Puat Hospital (KTPH) provides a comprehensive range of medical services and specialist care. Future plans for the cluster include the establishment of a new community hospital and a medical centre.

**KEY ACHIEVEMENTS**

KTPH opened its Outpatient and Day Surgery services in March 2010, and Inpatient and Acute & Emergency Care (A&E) services in June 2010, three months ahead of schedule. The workload at KTPH quickly exceeded that of Alexandra Hospital but this did not impact the institution’s smooth operations. More importantly, KTPH’s opening helped ease the high patient load at other public hospitals.

The series of innovative IT capabilities IHiS implemented at KTPH facilitated a faster, safer and more hassle-free experience for patients.

These initiatives also resulted in KTPH’s winning the 2011 FutureGov - Healthcare Organisation of the Year award. The top regional recognition is an international benchmark for public sector IT innovation.

Some of the systems implemented include the following.

**Electronics Medical Records**
The integrated Electronic Medical Records (EMR) system, which combines inpatient and ambulatory care on a common platform, enables care providers to view and share online patients’ complete medical information. This helps facilitate quality care and patient safety.

The system’s Computerised Physician Order Entry (CPOE) and Results Reporting modules enable accurate capturing of physicians’ orders and faster results notification.

The IHiS-developed vital signs device interface to the EMR allows the auto-loading of vital signs onto the electronic nursing chart. This frees nurses from manual recording, giving them more time for patient care.

The Andon electronic signal board at the Radiology department enables clinicians to quickly view and schedule radiology orders. At the wards, the signal boards allow nurses to more speedily view and execute treatment orders.

**Critical Care Systems**
At the Intensive Care Unit, the critical care system automatically measures and charts many key patient parameters. Nurses no longer need to manually record patients’ vital signs and can instead focus on patient care. The system also facilitates the monitoring of quality indicators for continuous improvement to enhance patient safety.

**Emergency Care System**
At the busy A&E, the CareLine solution features an electronic signal board that gives staff real-time visualisation of the department’s activity level, treatment progress and waiting times.

This facilitates care coordination at the centre, which treats over 300 people daily, resulting in a faster and more pleasant experience for patients and their families.

**Bed Management System**
The Bed Management System, which allows healthcare staff to visually manage together online, beds and patient movements, enables beds to be assigned to patients more quickly. The program reduces staff’s manual coordination efforts, giving them more time for patient care.
Tele-Geriatrics
A video conferencing and telemedicine system facilitates KTPH’s provisioning of geriatric care to nursing homes via remote consultation. This helps with the early detection and management of illnesses, reducing hospital readmissions and specialist outpatient clinic reviews. KTPH began tele-consultation with St Joseph Nursing Home in December 2010.

PLANNED FUTURE PROJECTS
IHIS’ teams will work with Alexandra Health’s management, clinicians and staff to enhance further the IT systems and embed new organisational capabilities.

These will include the following initiatives.

- **Roll Out Advanced EMR System**
  We will further strengthen the hospital’s clinical systems capabilities by implementing the SCM 5.5 upgrade, Closed Loop Medication Management (CLMM) and A&E Systems upgrade.

  The SCM 5.5 Electronic Medical Records system will provide enhanced clinical documentation functions, and give healthcare staff more time for patient care. The upgraded tools will also allow IHIS teams to configure systems more quickly.

  We are working with the hospital staff to put in place various CLMM modules. The closed-loop approach to ordering, dispensing, delivering and administering medication will enhance patient safety and staff efficiency.

  The A&E System upgrade and integration of clinical notes on the EMR platform will give doctors a more complete view of patients’ medical data.

- **Enhance Human Resource Systems**
  The integrated SAP HRIS human resource system will enable more efficient management of people while the higher process automation will provide more timely and consistent information to support business decisions.

  The Talent Management & Succession Planning function will help Alexandra Health proactively develop its talent pool and leadership bench strength, while the Competency Management feature will facilitate staff training.

  The Computerised Integrated View of Customer (CIVOC) system will be piloted to fine-tune the patient dashboard. It will also pave the way for KTPH to have a comprehensive view of its patients to facilitate a hassle-free care experience.

- **Support Service Innovations**
  We are providing IT support as KTPH pilots innovative services and facilities in a ‘Dream Ward’ to enhance the patient experience. This includes enabling the patient to use a bedside control panel to surf the internet, send emails and Skype; and remotely adjust the room lights, curtains, television and air-conditioning.

- **Fortify IT Infrastructure**
  We are working to strengthen the hospital’s disaster recovery capabilities and are planning network expansion to achieve a resilient network infrastructure and a zero unplanned downtime environment.

  At KTPH Data Centre, the IHIS team is refining processes to further optimise energy efficiency. We have helped design the centre to be highly energy efficient and are now working towards the Green Data Centre certification.
OUR PEOPLE

We aim to develop a high performing team to power IHiS’ vision to become a trusted technology partner, to help the clusters transform healthcare delivery. Underpinning our ability to excel are our staff’s skills, knowledge and passion.

KEY ACHIEVEMENTS

Training & Development

A key focus over the next few years is to deepen our staff’s healthcare-IT expertise to implement, manage and continually improve the advanced systems at the healthcare institutions in support of their business objectives.

We have adopted the National Infocomm Competency Framework (NICF) to ensure a focused and systematic development of our staff’s expertise in healthcare-IT, as well as in the soft skill areas necessary for good project management and customer servicing.

The NICF framework provides IHiS supervisors with a systematic way of measuring skills for transparent job progression. It also guides them in planning appropriate on-the-job training to give staff opportunities to develop hands-on experience at each career level.

In addition, the framework empowers each employee to self manage his/her professional upgrading with clear guidelines on the skills and knowledge that need to be acquired at each career stage, for various key infocomm job roles.

The restructuring of our divisions from cluster to specialty based teams provides more flexibility in assigning staff on projects at the various institutions. This also helps our employees build skill levels and deepen their domain knowledge more quickly.

At the same time, participating in the divisions’ system roll outs at more healthcare institutions, and seeing their work benefit thousands of healthcare staff and patients, have increased our employees’ job satisfaction levels.

New training schemes recently rolled out include the NICF-PMP certification in Project Management, NICF-Project Management for Information Systems, and NICF-ITIL V3 Foundation for IT Service Management conducted with Institute of Systems Science, National University of Singapore; as well as the Certified Professional in Healthcare Information and Management Systems (CPHIMS) certification. We also conducted numerous communications, presentation and leadership modules with various partners.

Employee Engagement

In April 2011, our first employee survey ‘Our IHiS Our Voice’ saw a healthy 86 per cent response rate. Following
the staff feedback, team heads and task forces are working to enhance schemes to make IHiS an even more meaningful and satisfying company to work in.

During the financial year, we also improved our employee benefits, health and wellness plans. Today, staff can choose benefits to suit their lifestyles from options such as holiday expenses, cost for childcare or elderly parent care, and optical equipment.

In April 2011, we partnered MHC Asia Group to give staff access to 350 general practitioner clinics, 40 dental clinics, 200 specialists, as well as 22 clinics in Malaysia. Medical claims are now easier as staff just need to pay their co-share of fees at the clinics, and no longer need to submit receipts for reimbursements. We have also increased coverage for medical outpatient visits, health screenings and vaccinations.

**Strategic Advance**
IHiS’ annual Strategic Advance exercise saw department leaders coming together in a series of meetings to evaluate past performance and plan the company’s strategies and targets.

The priorities and goals were then discussed with employees at the annual Staff Conference and at subsequent team sessions.

Regular cross functional team heads’ meetings during the year, such as the Post Strategic Advance and Project Quality Management sessions, ensure problem areas are addressed promptly, action plans are improved, and targets are achieved on schedule.

**Increased Communications**
During the year, we increased communications activities to help nurture the IHiS culture and forge staff’s sense of belonging to one team.

The CEO writes a monthly newsletter to keep all staff informed of IHiS’ major activities and achievements, and project milestones at the various healthcare institutions. This is supplemented with frequent emails, and monthly informal conversations over coffee with groups of staff on their birthday month and during management walkabouts at the site offices.

The Recreation Club is a hub of activity with staff participating in various sports and interest groups. The Club also regularly organises festive celebrations and informal social events to bring employees together. These include Movie Day, Dinner and Dance, lunchtime sharing talks, health-fitness workshops, and gift and health food fairs.

The Family Day at Resorts World Sentosa in April 2011 was a resounding success in helping IHiS’ extended family connect, as staff and their families turned out to enjoy the attractions.

**Orientation for New Staff**
In 2011, the employee orientation scheme was strengthened. During the first 90 days, new staff learn about our major projects at the clusters, and participate in workshops to internalise IHiS core values and methodologies such as the project management, governance, time and budget management processes.

The new eHCM system rolled out by our development centre team in August 2011 has enabled faster administration processes and confirmation appraisals for new staff.

**PLANNED FUTURE PROJECTS**

**Platform for Increased Staff Collaboration**
We are currently migrating our Intranet to SharePoint 2010 content management system to facilitate staff collaboration. The system will help team members work together more quickly on shared documents, by enabling simultaneous real-time edits.

Staff can also use the social media tools and blogs within SharePoint to share their learning experiences at the various healthcare institutions, and tap their colleagues’ expertise to seek best solutions.