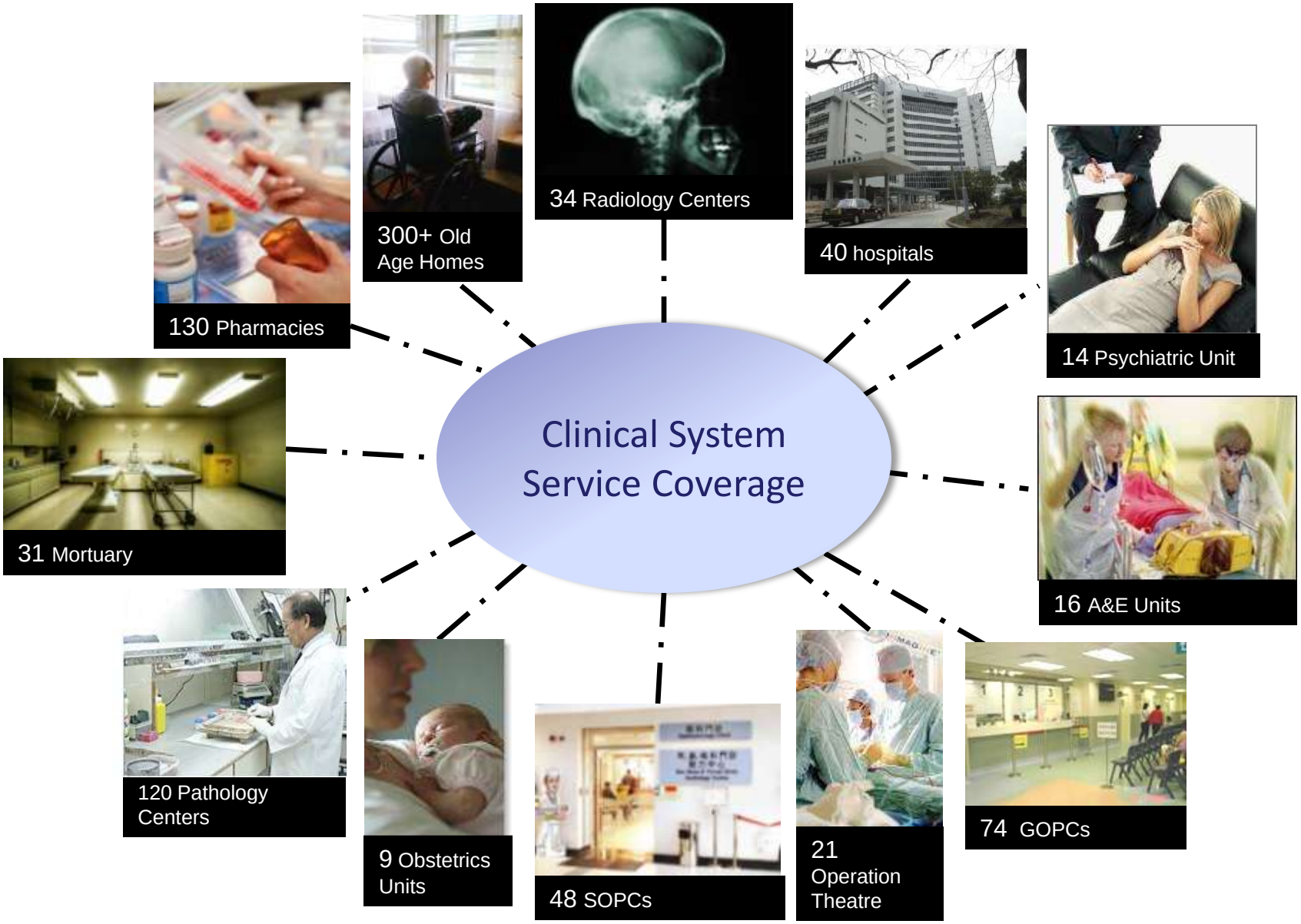
The CMS development history for 20 years (1991 – 2010)

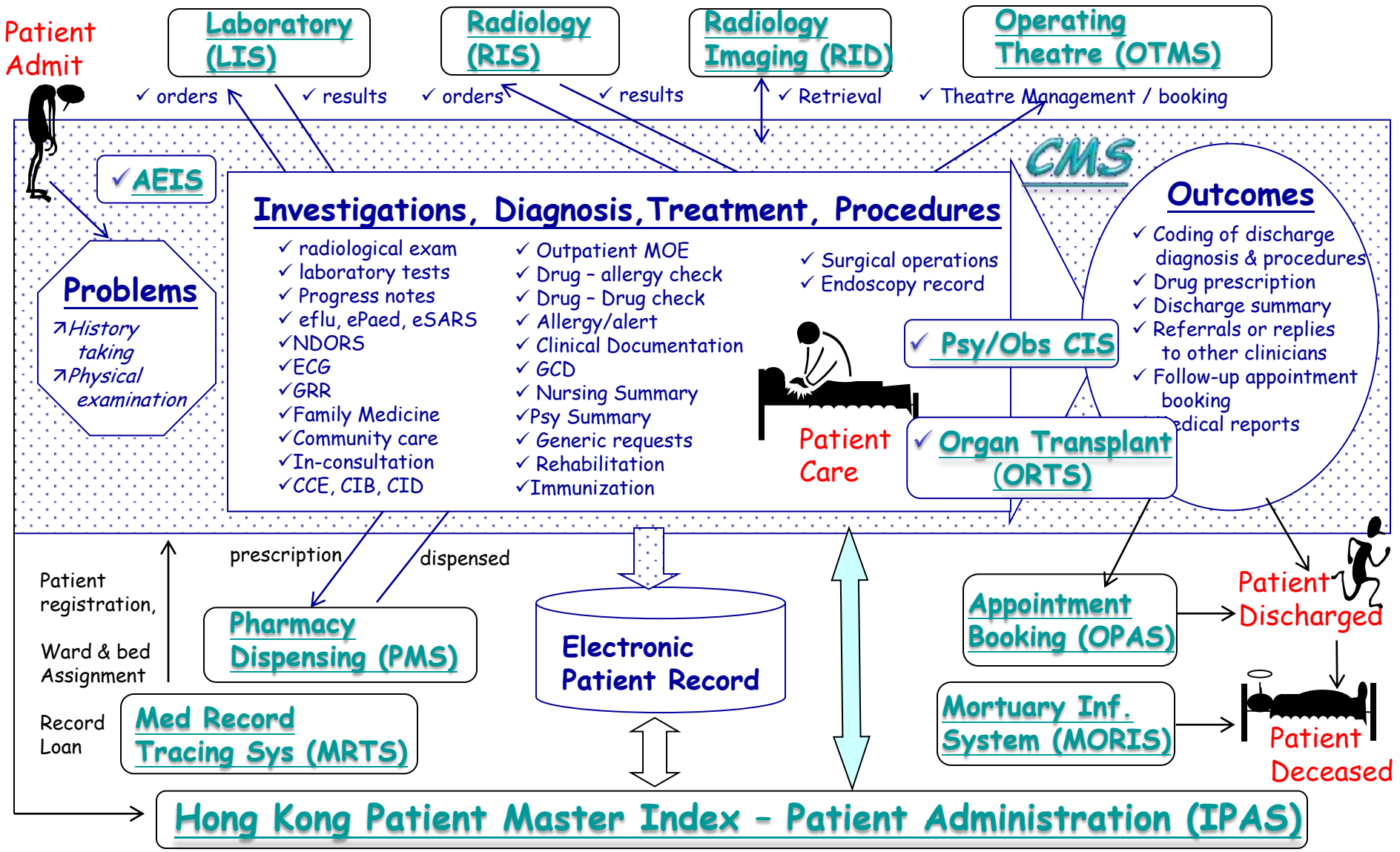
Anthony CHEUNG
CSM(CS)

November 2010

Clinical Systems - Service Coverage



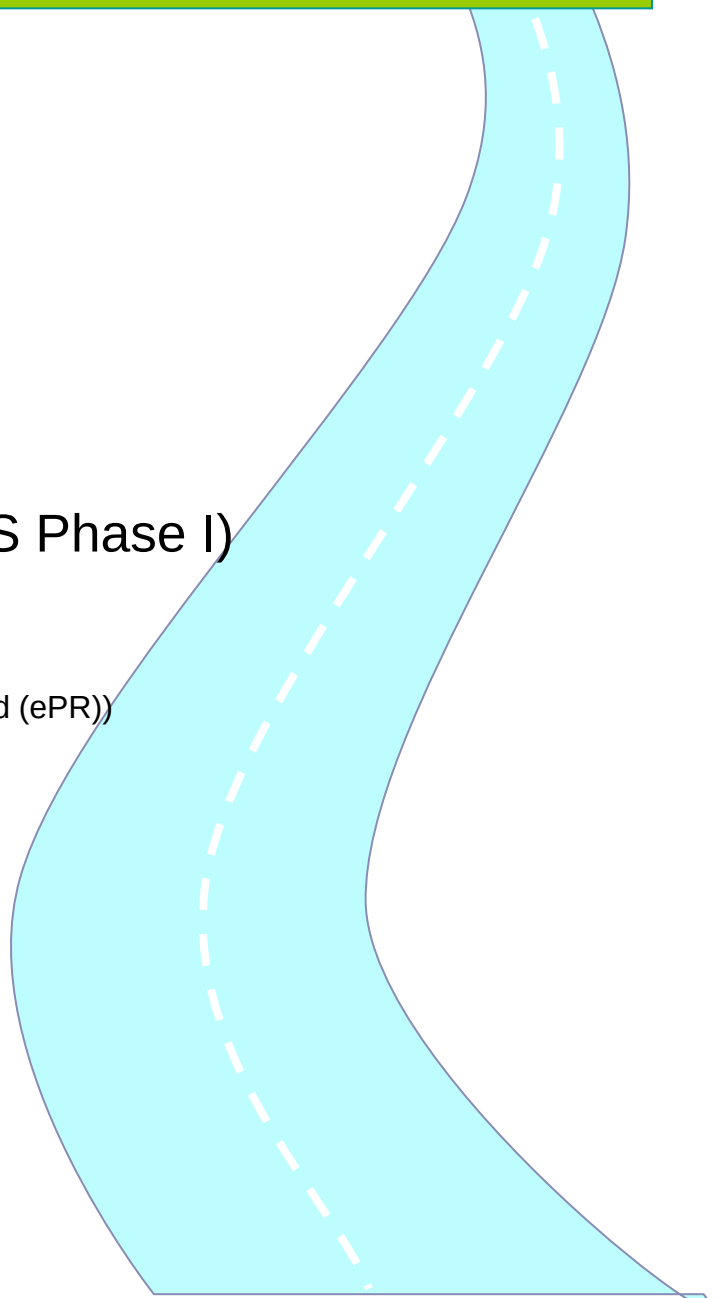
Clinical Systems – Patient Care Delivery Journey



Clinical Systems Development In HA

- **1990** – “Green fields”
- **1991** – Patient Administration
- **1992** – Pharmacy system
- **1993** – Lab results online
- **1994** – Radiology information system
- **1995** – Clinical Management System (CMS Phase I)

  Clinician documentation and order entry
- **2000** – CMS Phase II (incl. Electronic Patient Record (ePR))
- **2003** – eSARS
- **2004** – ePR Image Distribution
- **2006** – ePR sharing with private sector
- **2008+** – CMS Phase III
- **2009+** – Filmless Hospital
- **2010+** - IPMOE project



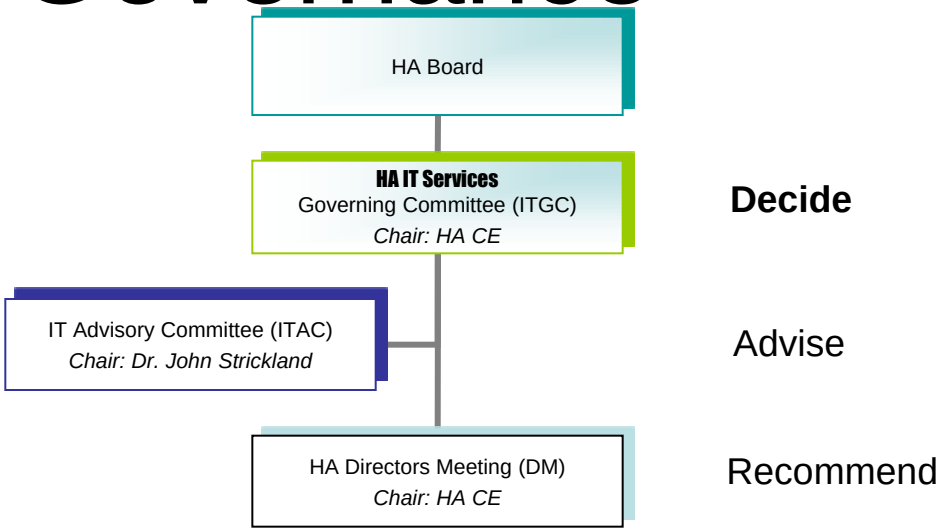
Critical Success Factors

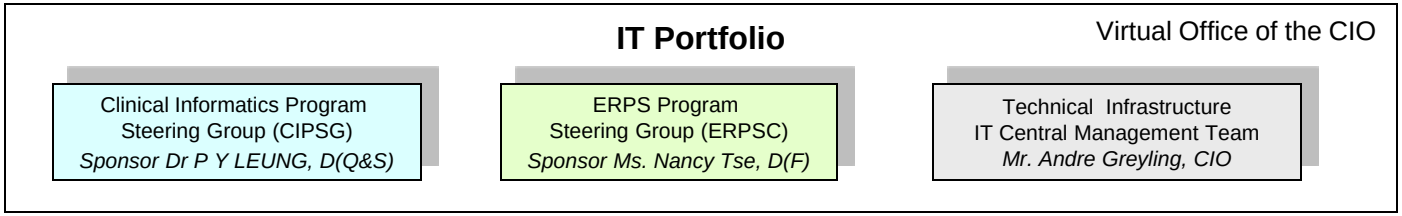
- Proper Governance Structure
- Strategic Planning
- Clinician Engagement
  - Driven by clinician
  - Designed by clinician
  - Used by clinician
- Dedicated IT development team with mature technology
- Develop and Roll approach

IT Governance

Governance Domains

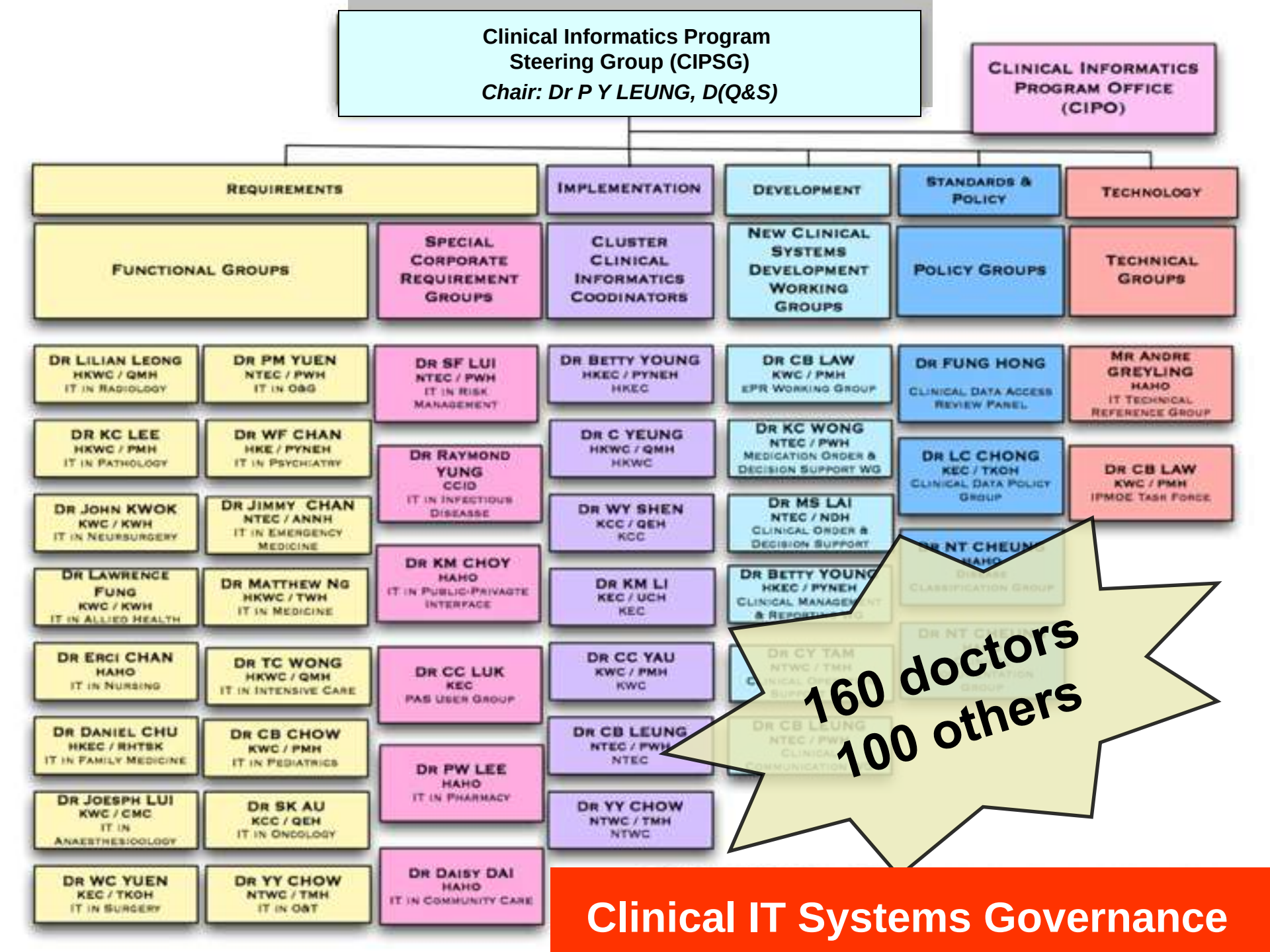
IT Principles
IT Infrastructure Strategies
IT Architecture
IT Investment Priorities
Business Application Needs





Performance Reporting/KPI's

Financial Management Performance
Meeting Agreed Service Levels
Delivering Projects on Time and Within Budget
Residual Risk Matrix
Progress on Strategic Change Initiatives
Benefit Realisation


Clinical Informatics Program Steering Group (CIPSG)
Chair: Dr P Y LEUNG, D(Q&S)
Clinical Informatics Program Office (CIPO)
Requirements
Implementation
Development
Standards & Policy
Technology
Functional Groups
Special Corporate Requirement Groups
Cluster Clinical Informatics Coodinators
New Clinical Systems Development Working Groups
Policy Groups
Technical Groups
Dr Lilian Leong HKWC / QMH IT in Radiology
Dr PM Yuen NTEC / PWH IT in O&G
Dr KC Lee HKWC / PMH IT in Pathology
Dr WF Chan HKE / PYNEH IT in Psychiatry
Dr John Kwok KWC / KWH IT in Neursurgery
Dr Jimmy Chan NTEC / ANNH IT in Emergency Medicine
Dr Lawrence Fung KWC / KWH IT in Allied Health
Dr Matthew Ng HKWC / TWH IT in Medicine
Dr Erci Chan HAHO IT in Nursing
Dr TC Wong HKWC / QMH IT in Intensive Care
Dr Daniel Chu HKEC / RHTSK IT in Family Medicine
Dr CB Chow KWC / PMH IT in Pediatrics
Dr Joesph Lui KWC / CMC IT in Anaesthesiology
Dr SK Au KCC / QEH IT in Oncology
Dr WC Yuen KEC / TKOH IT in Surgery
Dr YY Chow NTWC / TMH IT in O&T
Dr SF Lui NTEC / PWH IT in Risk Management
Dr Raymond Yung CCID IT in Infectious Diseasse
Dr KM Choy HAHO IT in Public-Privagte Interface
Dr CC Luk KEC PAS User Group
Dr PW Lee HAHO IT in Pharmacy
Dr Daisy Dai HAHO IT in Community Care
Dr Betty Young HKEC / PYNEH HKEC
Dr C Yeung HKWC / QMH HKWC
Dr WY Shen KCC / QEH KCC
Dr KM Li KEC / UCH KEC
Dr CC Yau KWC / PMH KWC
Dr CB Leung NTEC / PWH NTEC
Dr YY Chow NTWC / TMH NTWC
Dr CB Law KWC / PMH EPR Working Group
Dr KC Wong NTEC / PWH Medication Order & Decision Support WG
Dr MS Lai NTEC / NDH Clinical Order & Decision Support
Dr Betty Young HKEC / PYNEH
Dr Fung Hong Clinical Data Access Review Panel
Dr LC Chong KEC / TKOH Clinical Data Policy Group
Mr Andre Greyling HAHO IT Technical Reference Group
Dr CB Law KWC / PMH IPMOE Task Force
160 doctors
100 others
Clinical IT Systems Governance

The HK Patient Master Index

- Using Hong Kong Identity Number (HKID #)
- HKPMI, Admissions/Discharges and Appointments Booking implemented across all HA hospitals and clinics
- HA HKPMI contains 8 million records

Uniquely identify all patients and can facilitate linking together episodes of care

Evolution of CMS

Phase I - Functions

- Discharge summary
- Clinician coding of diagnosis & procedure codes
- Ordering of medications and laboratory tests
- Retrieving laboratory and radiology results
- Medication history
- Electronic booking of appointments
- Generate referral or reply letters and reports
- Cross hospital information enquiry

Phase II - Modules

- Generic Clinical Requests (Order Entry)
- Generic Results Reporting (Forms)
- Clinical Data Framework
- Outcome Documentation
- Medication Decision Support
- Clinical Data Analysis and Reporting

- *Electronic Patient Record (ePR)*

Electronic Patient Record - ePR

- Web-based lifelong longitudinal record of all healthcare transactions for all Hong Kong citizens
- Many data formats (textual, numerical and digital images)
- Patient privacy protected with access controls and full audit logs
- Available at all 162 facilities in the HA
  - Now extending to external providers

Clinical Systems are essential in HA

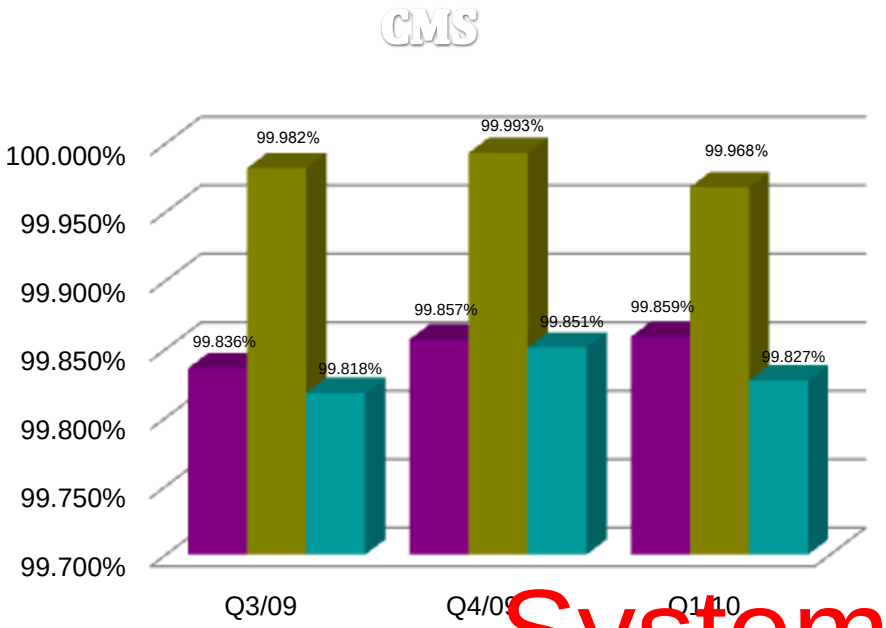
Each Day...

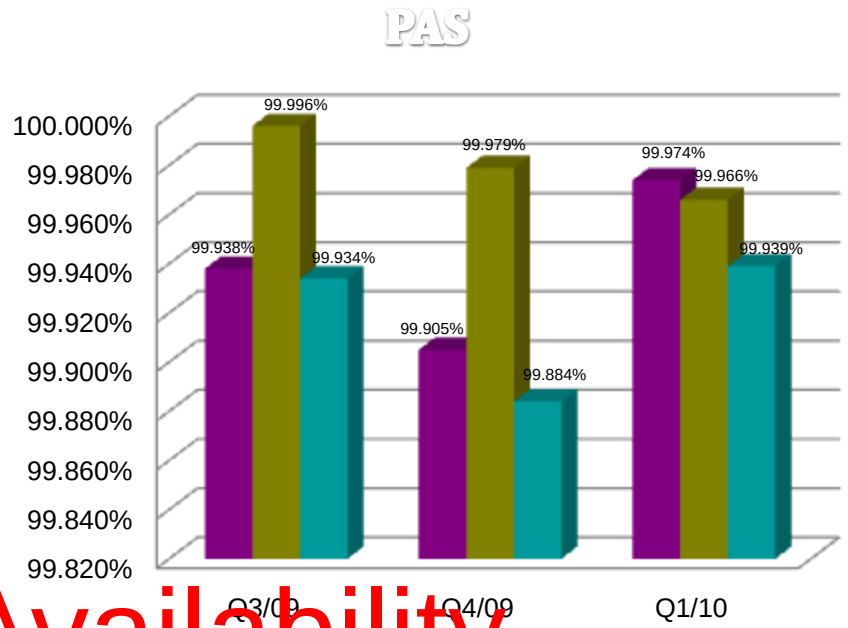
- 35,000+ clinician users
  (Doctors, Nurses, Pathology, Pharmacists, Radiology,...)
- 100,000 patients
- 10,000,000 on line transactions (clinical)
  - Peak usage: 30,000 tran / min
    or 500 tran / sec
- 700,000 ePR transactions
- 18,000 clinical workstations

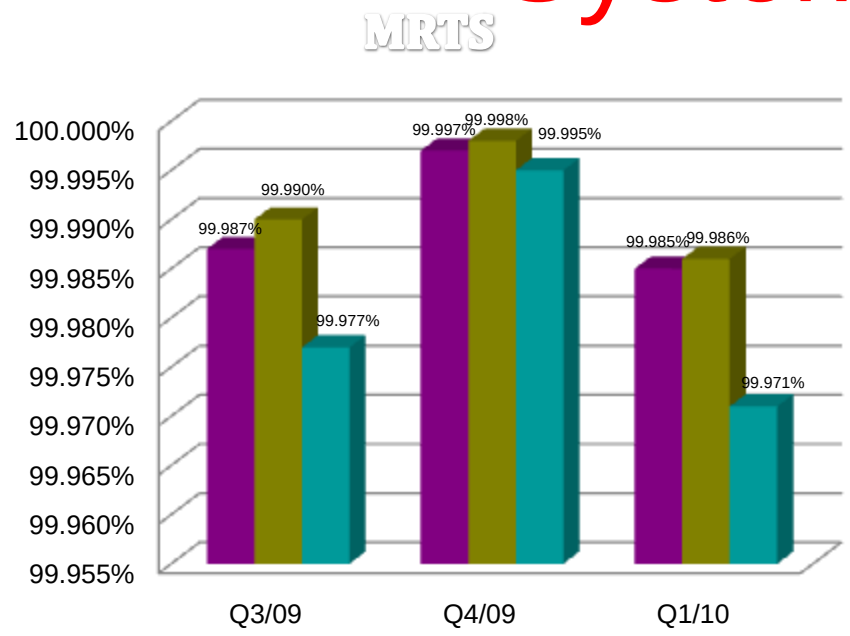
To Date...

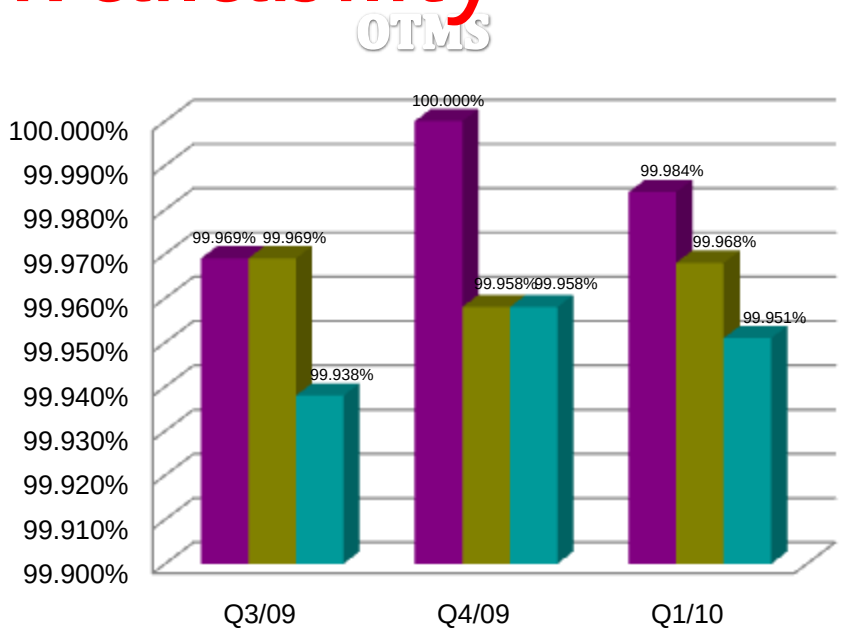
- 8,800,000 patient records
- 500,000,000 ePR Lab records
- 1.5 Terra Bytes ePR data volume
- 3 Terra Bytes ePR Images

System Availability



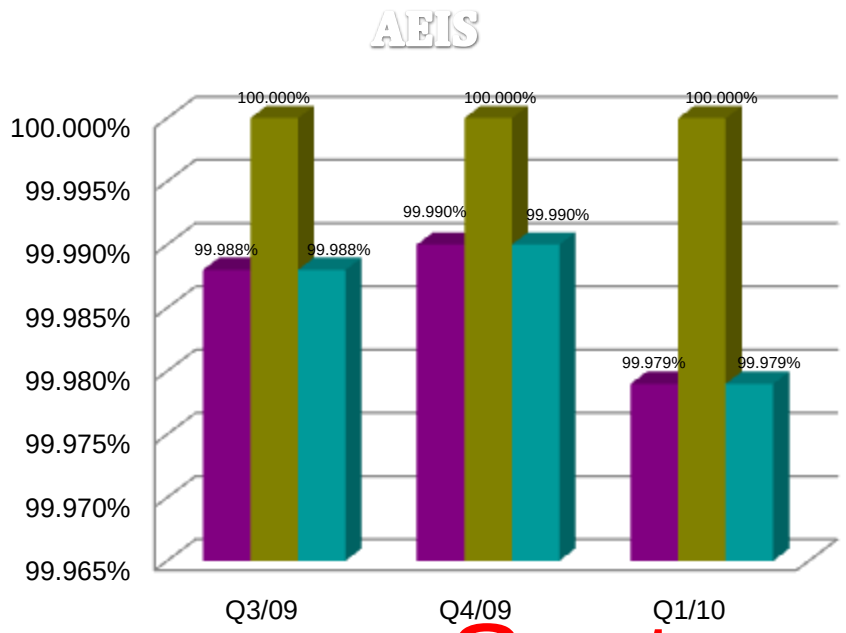


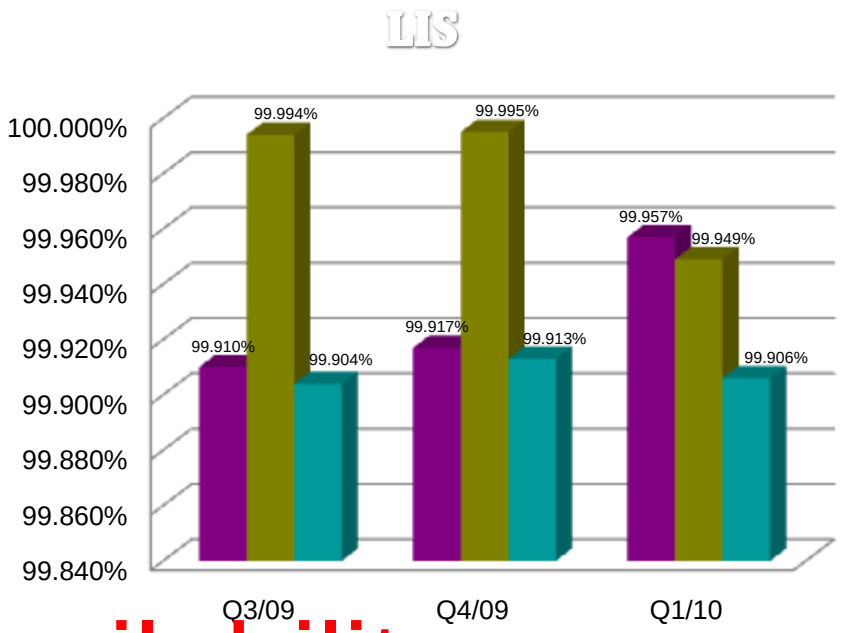


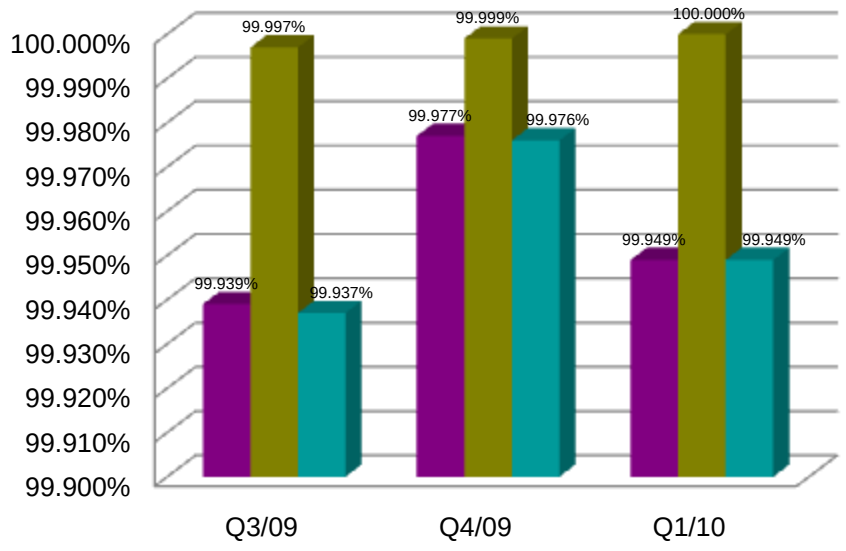


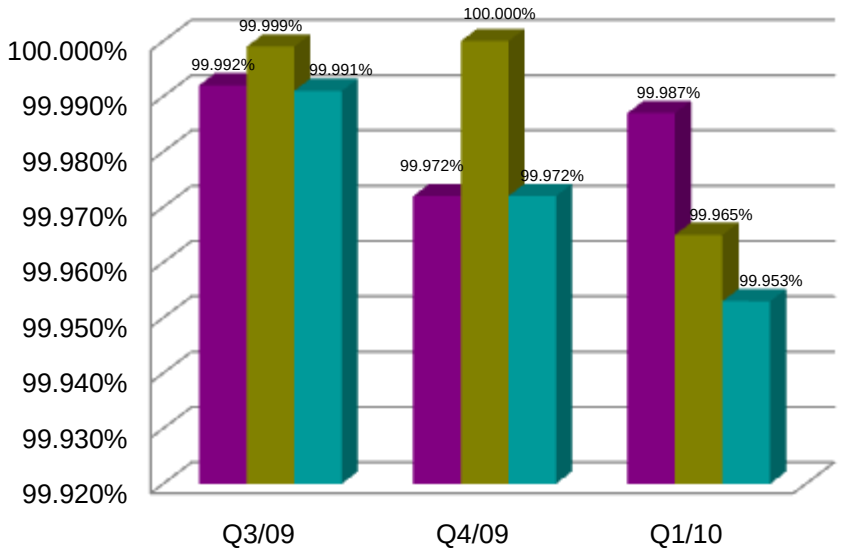
Scheduled Downtime Unscheduled Downtime Total

System Availability









Scheduled Downtime Unscheduled Downtime Total

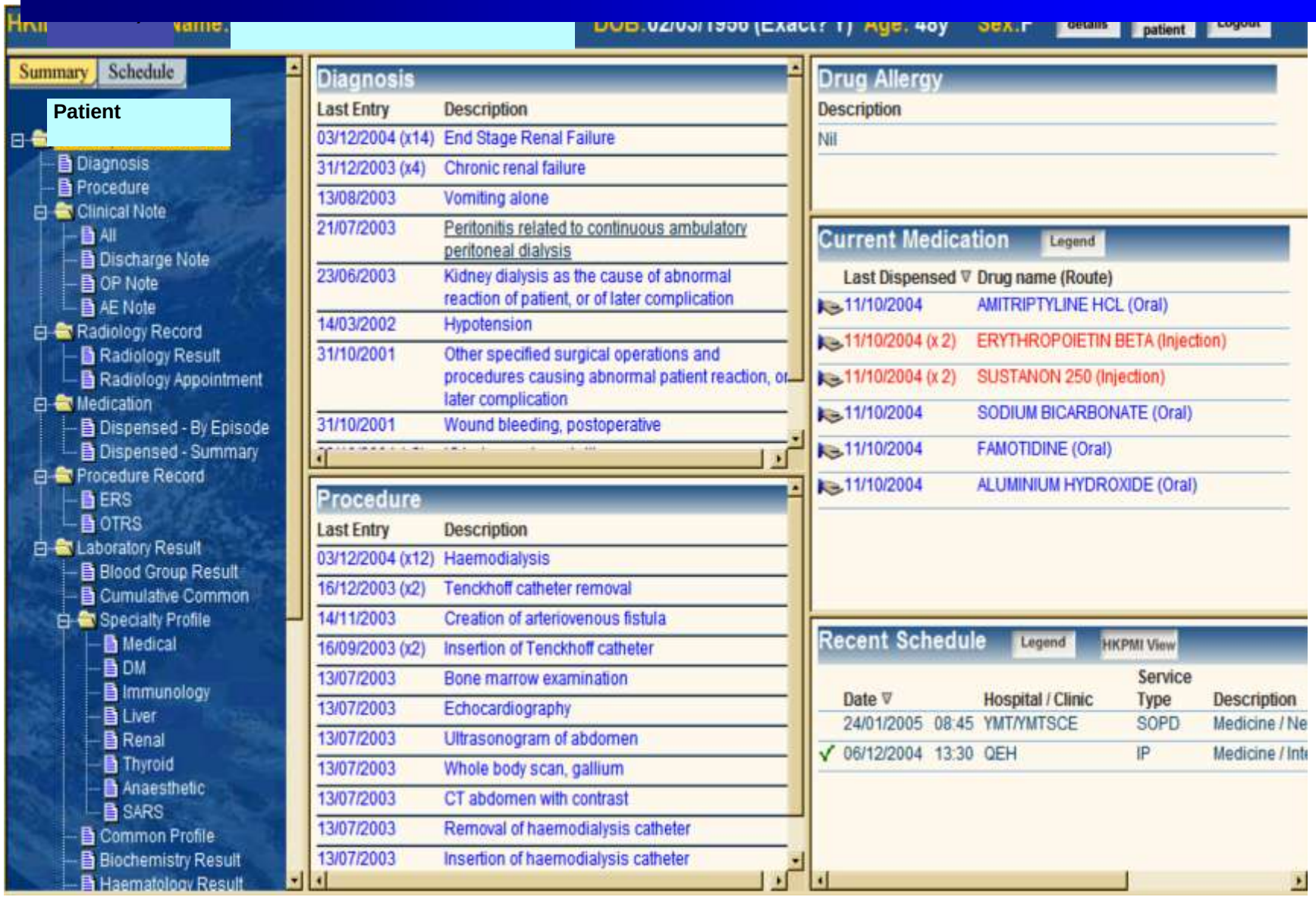
Patient Administration Systems

- Patient Master Index (PMI)
- Inpatient Admission
- Outpatient Appointment Booking

Patient Administration Data Interfaced to Equipment

- **Facilitate patient administration process :**

ePR - Patient Summary



Laboratory Results

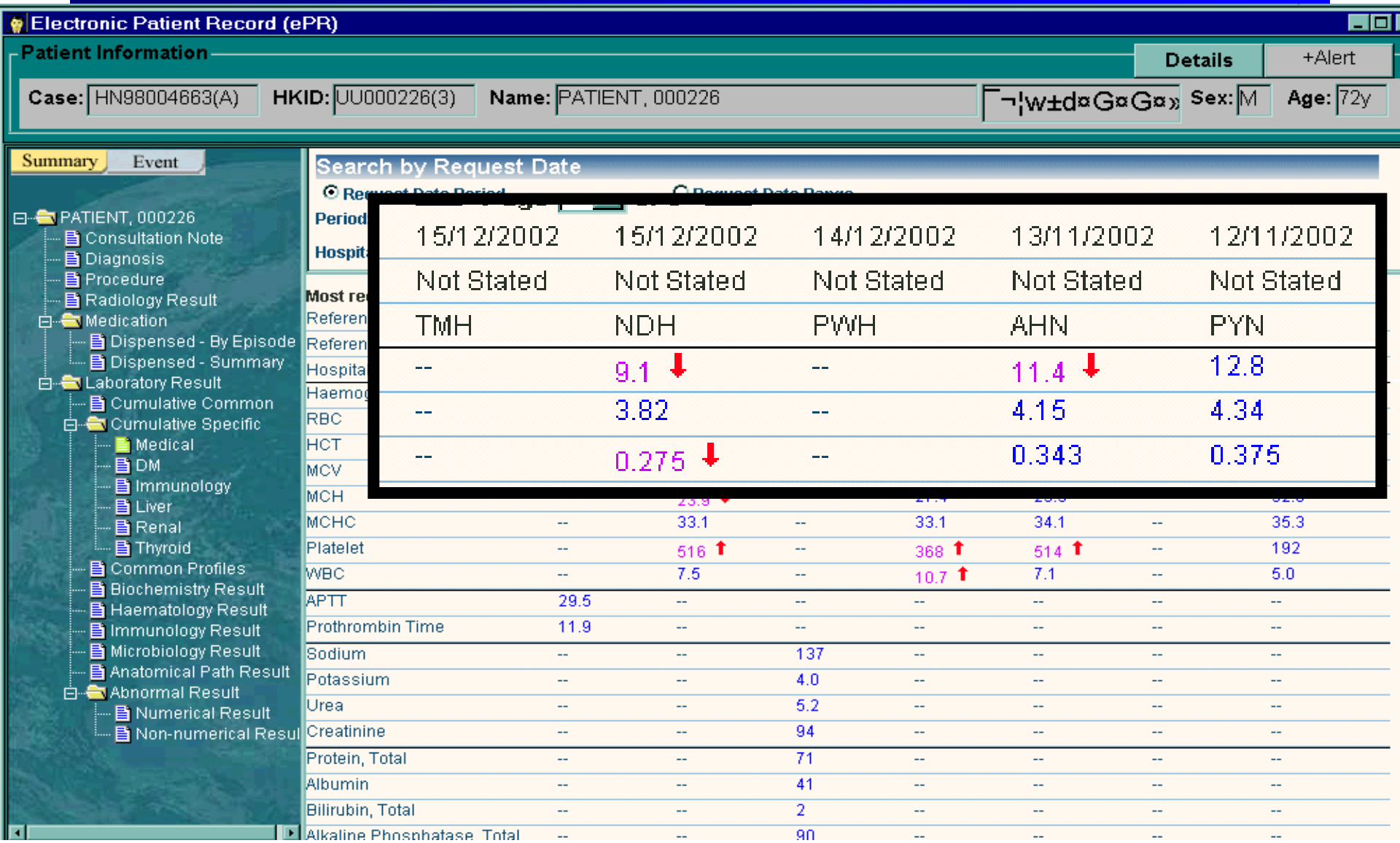


Image Distribution via ePR

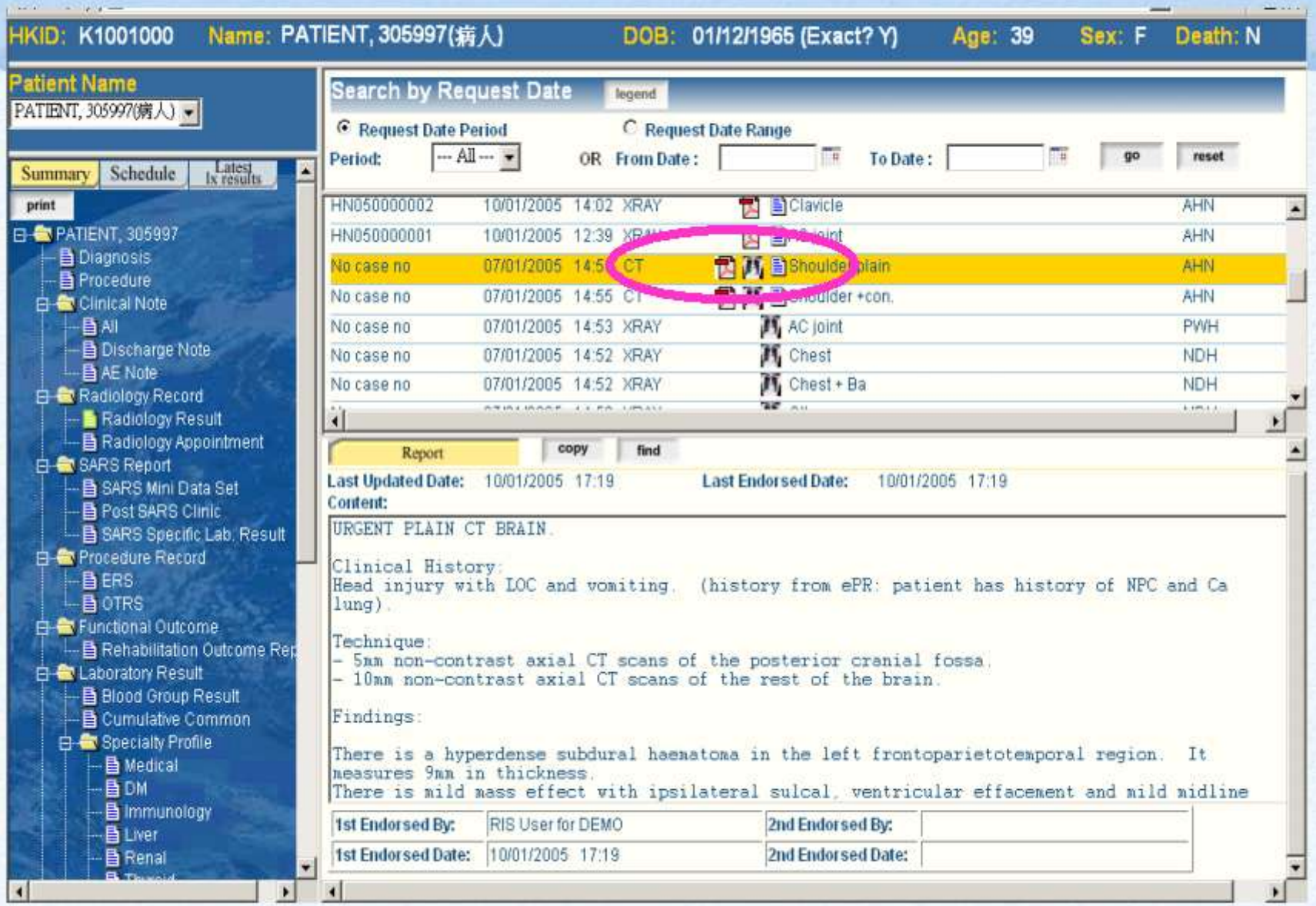
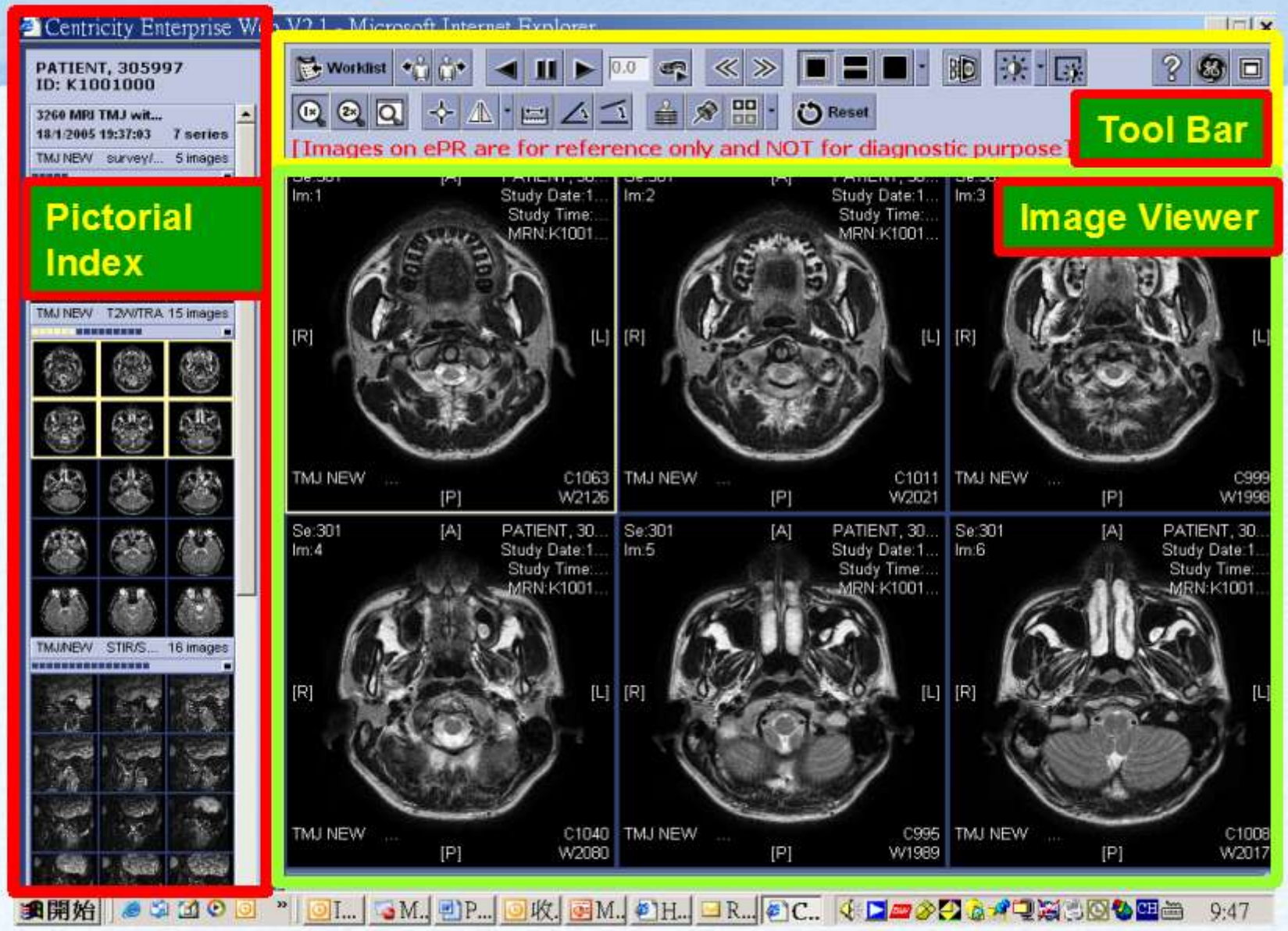
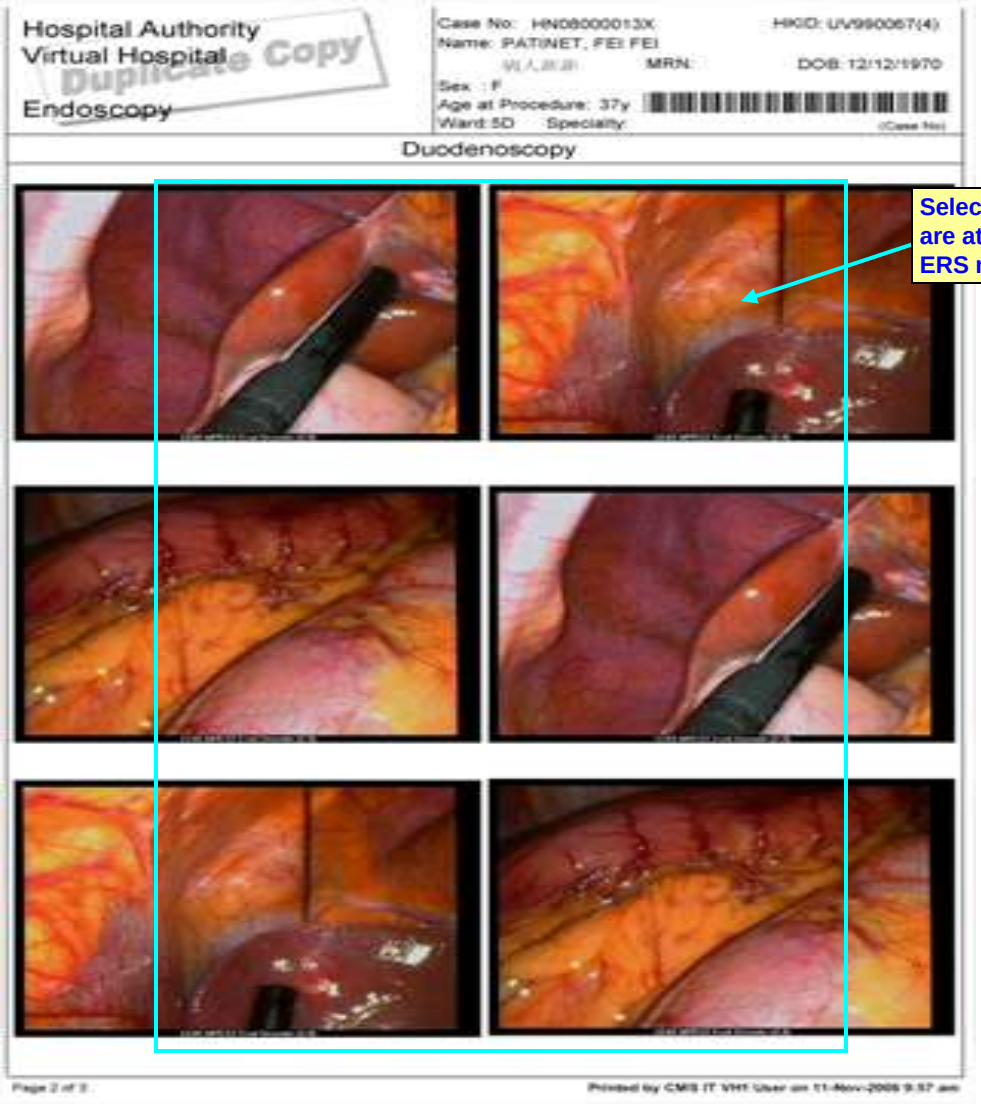
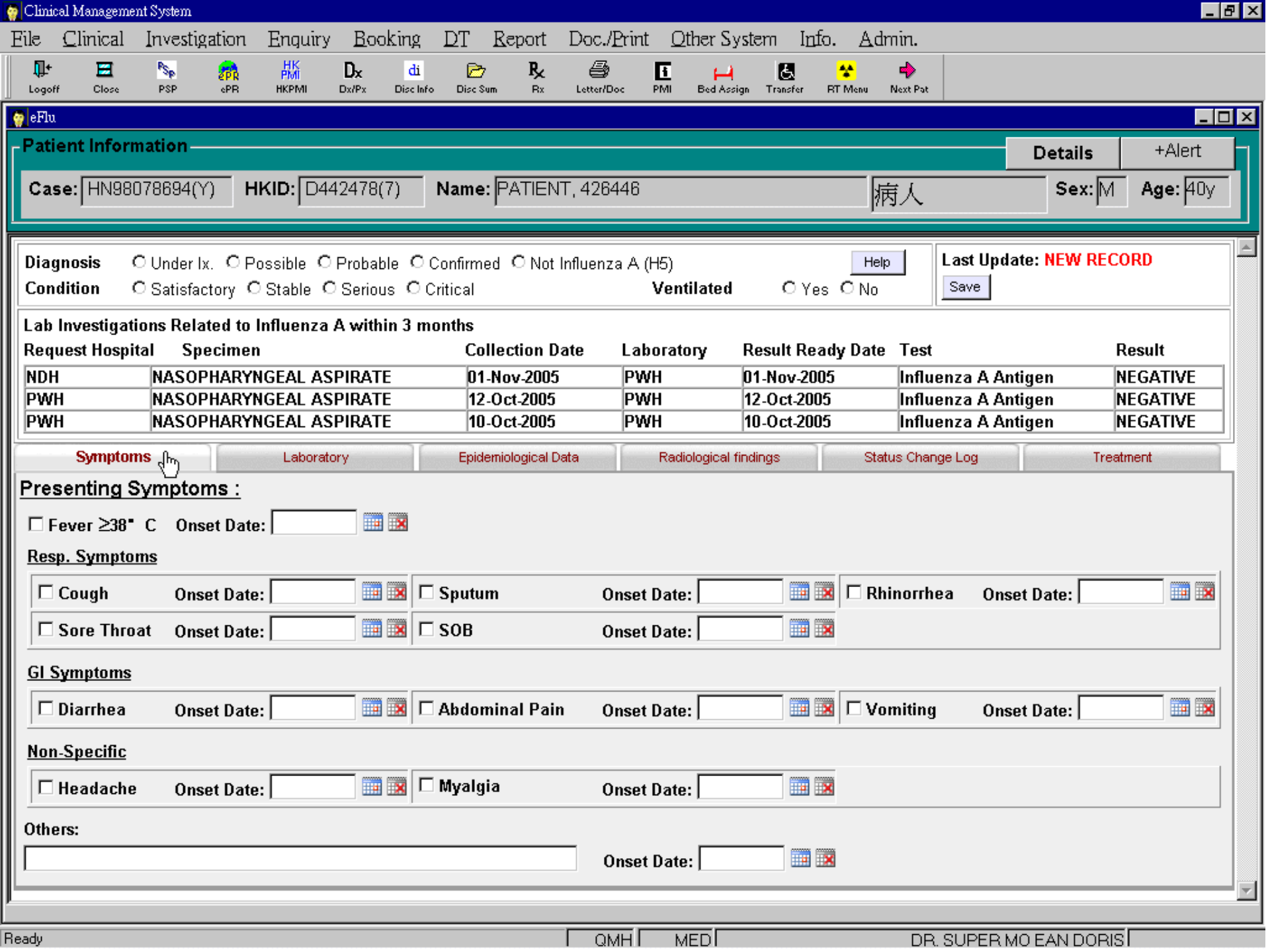


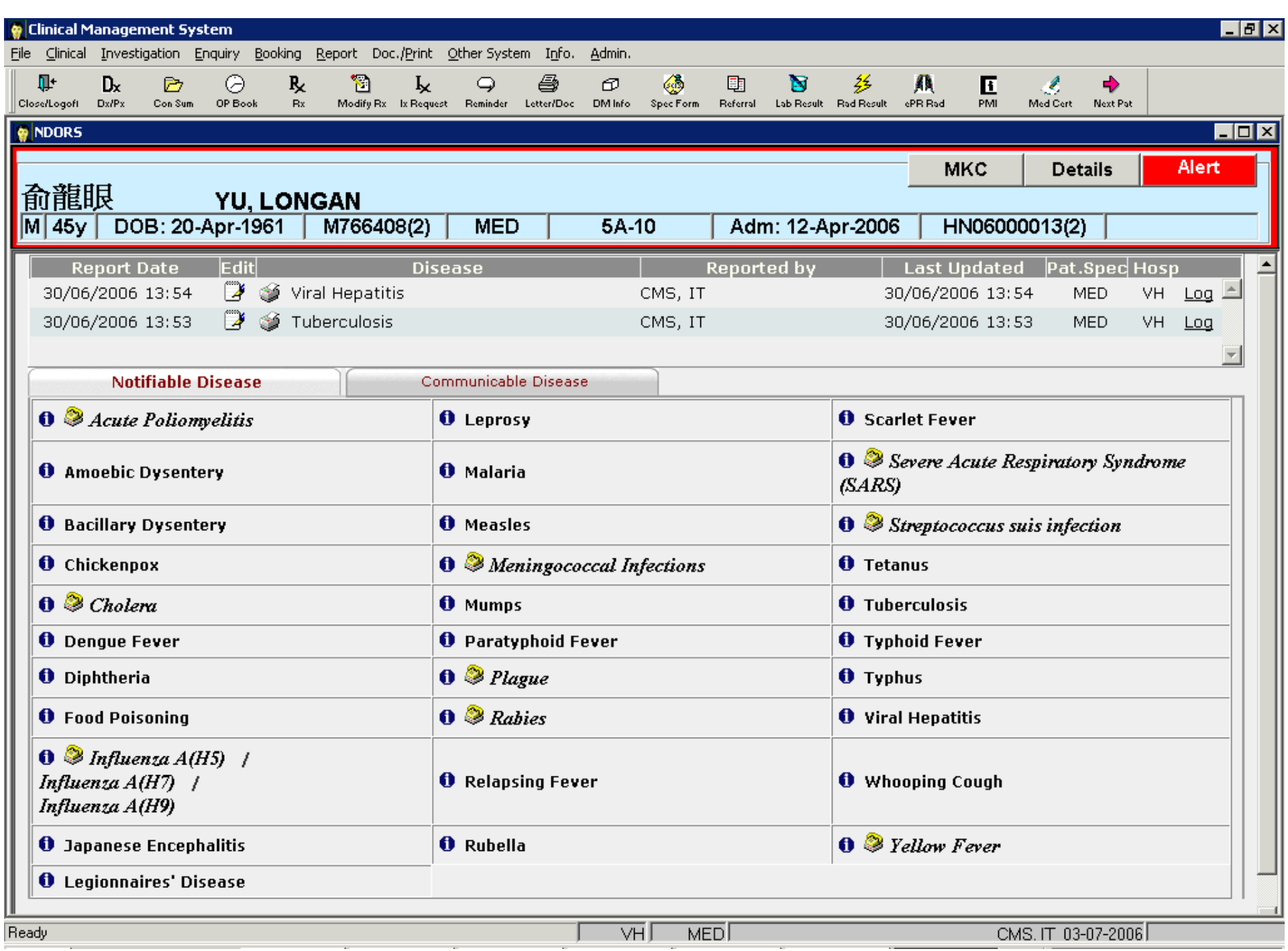
Image Distribution via ePR



ERS / OTRS Record

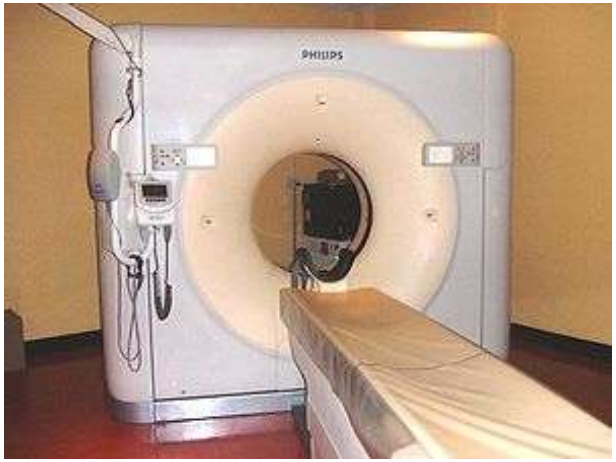


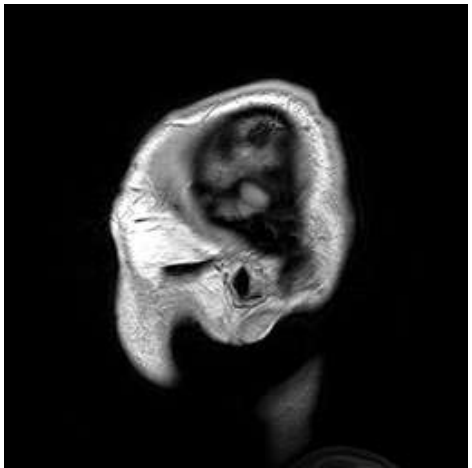

Clinical Management System
File Clinical Investigation Enquiry Booking DT Report Doc./Print Other System Info. Admin.
Logoff Close PSP ePR HKPMI Dx/Px Disc Info Disc Sum Rx Letter/Doc PMI Bed Assign Transfer RT Menu Next Pat
eFlu
Patient Information
Details
+Alert
Case: HN98078694(Y) HKID: D442478(7) Name: PATIENT, 426446 病人 Sex: M Age: 40y
Diagnosis Under Ix. Possible Probable Confirmed Not Influenza A (H5)
Help
Last Update: NEW RECORD
Condition Satisfactory Stable Serious Critical
Ventilated Yes No
Save
Lab Investigations Related to Influenza A within 3 months
Request Hospital | Specimen | Collection Date | Laboratory | Result Ready Date | Test | Result
NDH | NASOPHARYNGEAL ASPIRATE | 01-Nov-2005 | PWH | 01-Nov-2005 | Influenza A Antigen | NEGATIVE
PWH | NASOPHARYNGEAL ASPIRATE | 12-Oct-2005 | PWH | 12-Oct-2005 | Influenza A Antigen | NEGATIVE
PWH | NASOPHARYNGEAL ASPIRATE | 10-Oct-2005 | PWH | 10-Oct-2005 | Influenza A Antigen | NEGATIVE
Symptoms
Laboratory
Epidemiological Data
Radiological findings
Status Change Log
Treatment
Presenting Symptoms :
Fever ≥38° C Onset Date:
Resp. Symptoms
Cough Onset Date:
Sputum Onset Date:
Rhinorrhea Onset Date:
Sore Throat Onset Date:
SOB Onset Date:
GI Symptoms
Diarrhea Onset Date:
Abdominal Pain Onset Date:
Vomiting Onset Date:
Non-Specific
Headache Onset Date:
Myalgia Onset Date:
Others:
Onset Date:
Ready
QMH
MED
DR. SUPER MO EAN DORIS


Clinical Management System
File Clinical Investigation Enquiry Booking Report Doc./Print Other System Info. Admin.
Close/Logoff Dx/Px Con Sum OP Book Rx Modify Rx Ix Request Reminder Letter/Doc DM Info Spec Form Referral Lab Result Rad Result ePR Rad PMI Med Cert Next Pat
NDORS
MKC Details Alert
俞龍眼 YU, LONGAN
M 45y DOB: 20-Apr-1961 M766408(2) MED 5A-10 Adm: 12-Apr-2006 HN06000013(2)
Report Date Edit Disease Reported by Last Updated Pat.Spec Hosp
30/06/2006 13:54 Viral Hepatitis CMS, IT 30/06/2006 13:54 MED VH Log
30/06/2006 13:53 Tuberculosis CMS, IT 30/06/2006 13:53 MED VH Log
Notifiable Disease
Communicable Disease
Acute Poliomyelitis
Amoebic Dysentery
Bacillary Dysentery
Chickenpox
Cholera
Dengue Fever
Diphtheria
Food Poisoning
Influenza A(H5) / Influenza A(H7) / Influenza A(H9)
Japanese Encephalitis
Legionnaires' Disease
Leprosy
Malaria
Measles
Meningococcal Infections
Mumps
Paratyphoid Fever
Plague
Rabies
Relapsing Fever
Rubella
Scarlet Fever
Severe Acute Respiratory Syndrome (SARS)
Streptococcus suis infection
Tetanus
Tuberculosis
Typhoid Fever
Typhus
Viral Hepatitis
Whooping Cough
Yellow Fever
Ready VH MED CMS, IT 03-07-2006

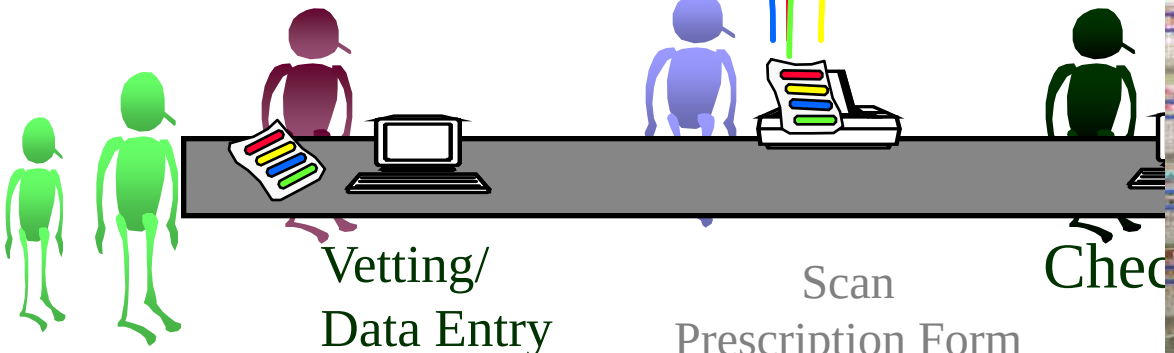
Radiology & Imaging

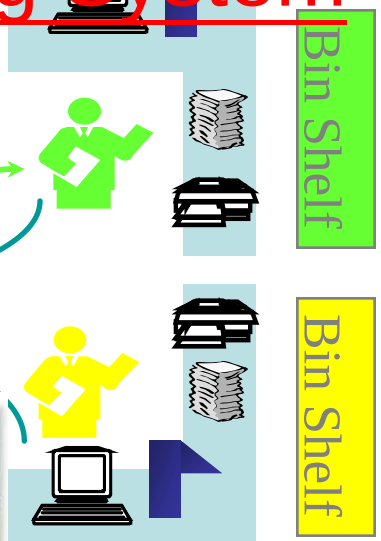
- Radiology Information System (RIS)
- Picture Archiving & Communications Systems (PACS)
- Imaging distribution and filmless operation
- Others
  - Radiology sharing
  - Support of Olympics





Express Dispensing System





eyer Belt

Assembly Line

Pigeon Hole

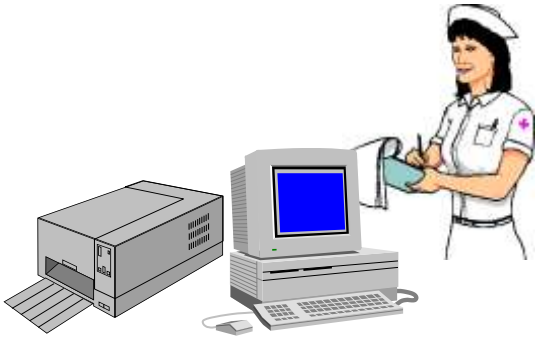
Vetting/
Data Entry

Scan
Prescription Form

Chec

The workflow in Laboratories

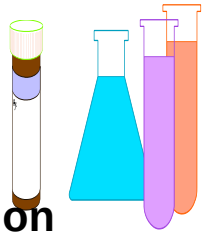
Request registration



Report printing and result enquiry

Analyzer interface server(s)

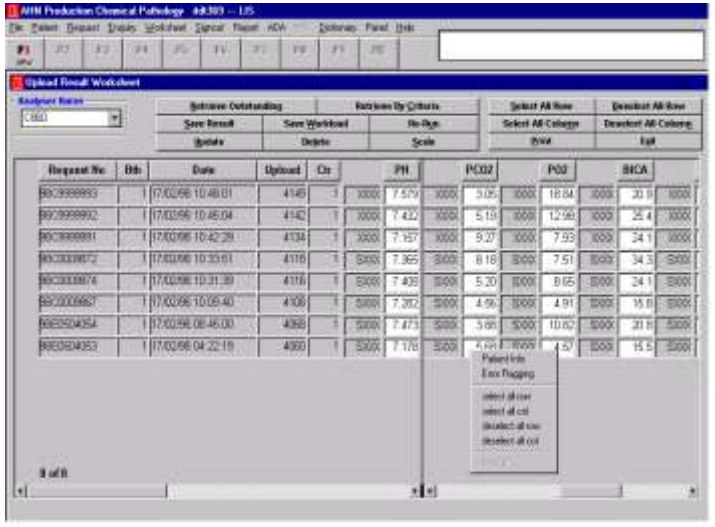
LIS



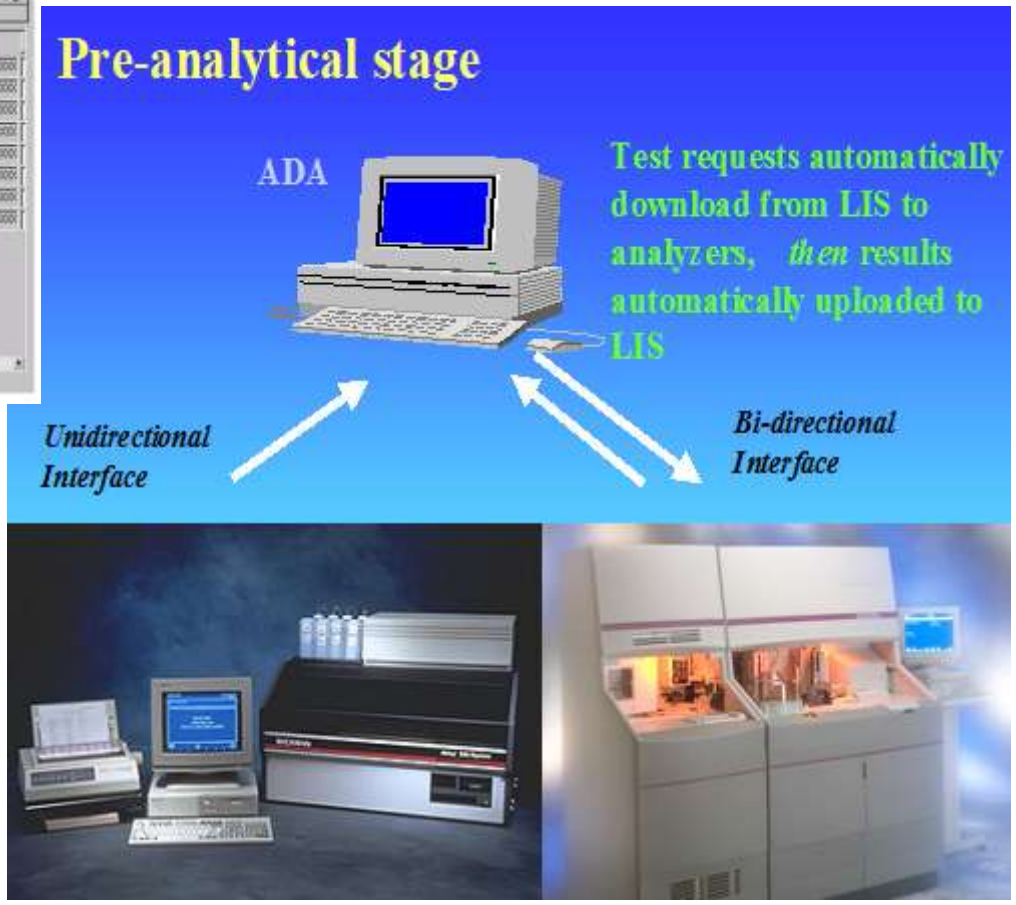
Result entry and authorization

Sign-out

Automation by Interfacing LIS with Analyzers

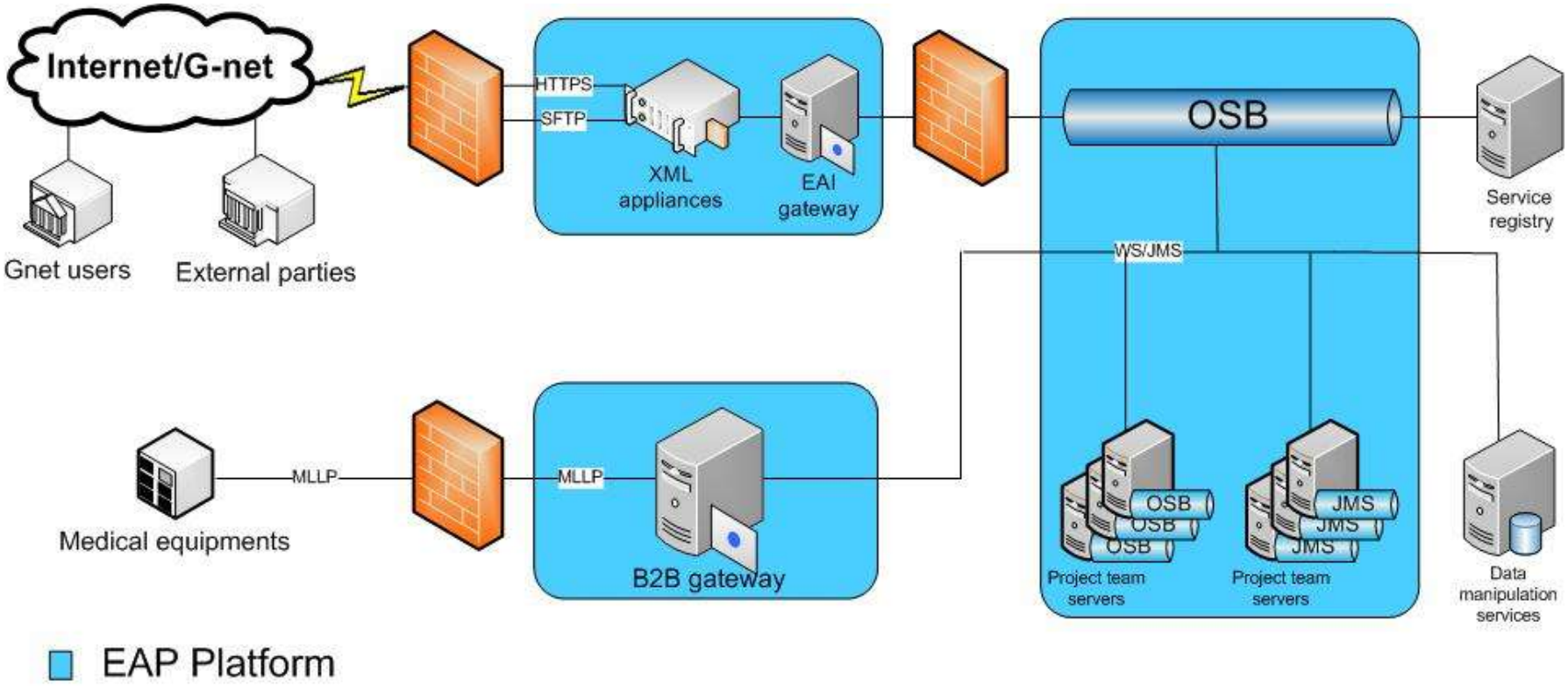


Much work automated by analyzer interface



EAI Gateway with Vendor CIS

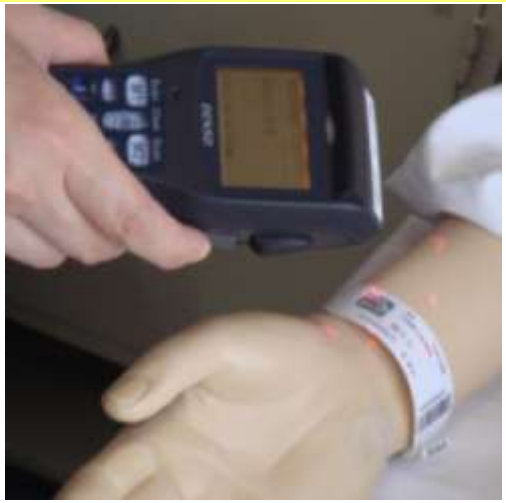
- EAI gateway interfaced with Vendor CIS via HL7 message
- Integration service is SOA compliable
- Sophisticate security provider and powerful data manipulation tools are used for integration services



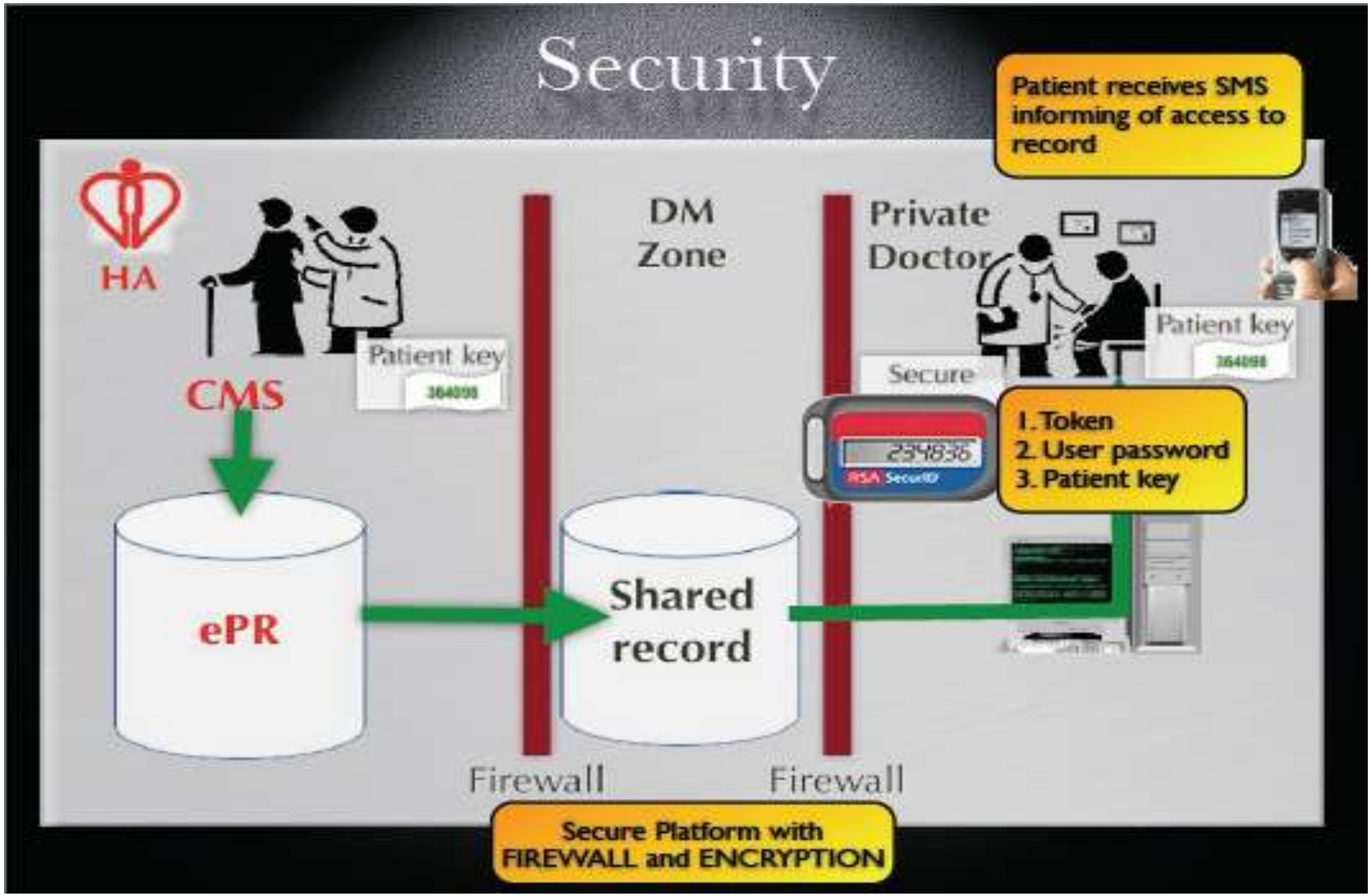
Extensive Use of Barcoding

Adult

Paediatric



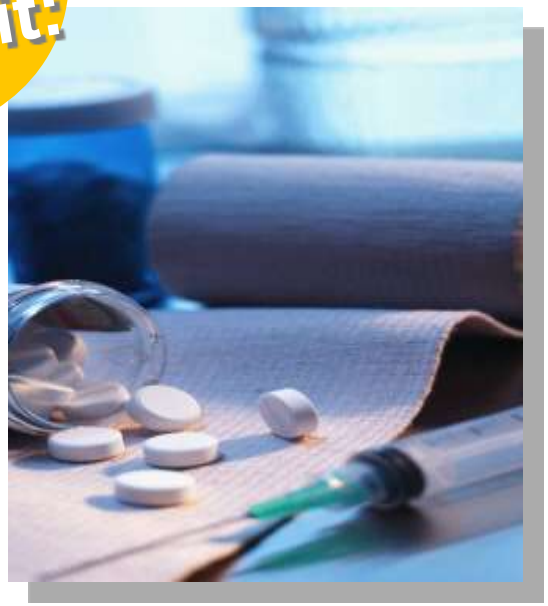
Sharing HA's ePR with Private Sector Clinicians



1st Benefit:

System Efficiency from Speeding up the Process

2nd Benefit: Contribution to Patient Safety



Drug Allergy Checking	
Drug Allergy Alerts Raised	69,000
Alert Accepted	32,000 (47%)
Alert Overridden	37,000 (53%)
Drug Drug Interaction Checking	
DDI Alerts Raised	11,000
Alert Accepted	4,000 (35%)
Alert Overridden	7,000 (65%)

Incidents of Misidentifications in Laboratory Tests

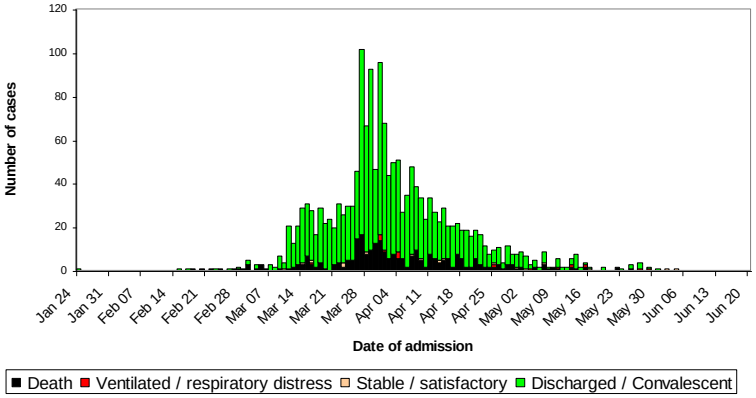
	Hospital A	Hospital B	Hospital C	Hospital D	All hospitals
Before introduction of 2D barcode system					
No. of cases	132	4	59	42	697
After introduction of 2D barcode system					
No. of cases	2	1	2	0	

3rd Benefit: Manage Emergencies (e.g. eSARS >> eFLU)

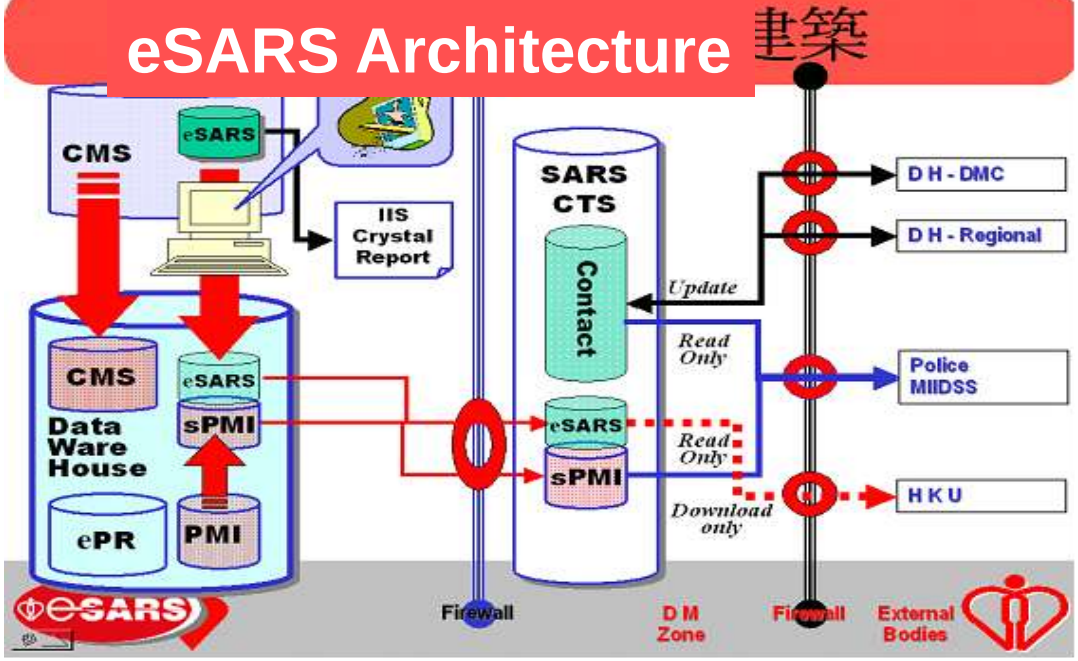
Fatality Rate by Age

Age	25-29	30-34	35-44	45-59	60-74	75+
%	7.0	11.6	14.7	28.0	44.1	73.3

The Hong Kong epidemic

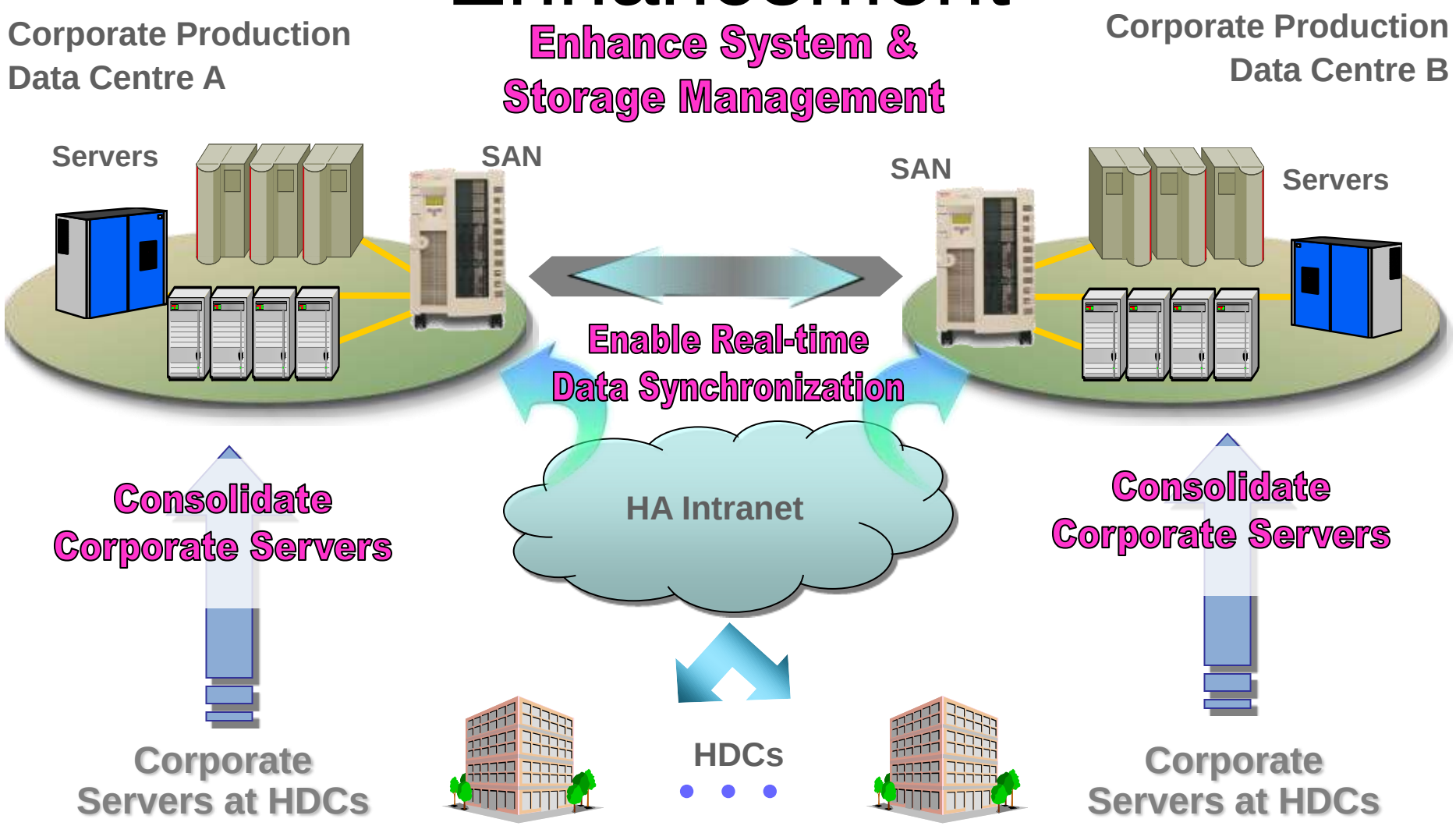


eSARS Architecture

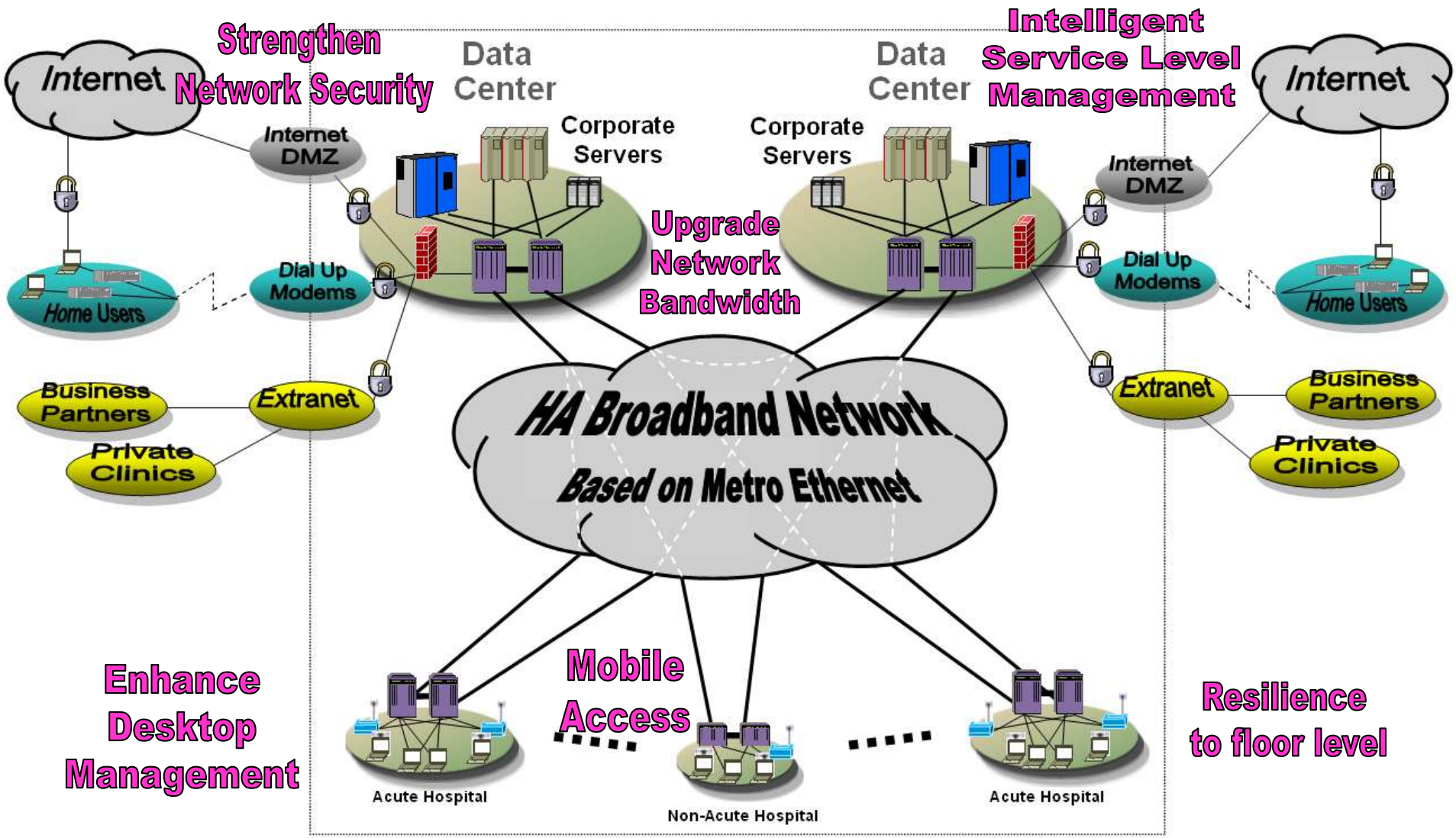


Video Conferencing

Technical Platform Enhancement



Network Enhancement



Patient Benefits

- Scheduled appointments for convenience
- Having their whole record available at point of care for more accurate and timely clinical decisions
- No need for repeated tests
- Better quality care through clinical decision support at point of care
- Less repeated studies decreasing radiation exposure

Clinician Benefits

- More efficient clinical practice
- No need to search for information and forms
- Better decision-making with comprehensive information
- Avoid errors associated with paper records

Organization Benefits

- Better use of resources
- Enforcement of policies & best practice at the point of care
- Data for planning, research and management

Forthcoming CMS III…
(2009 – 2013)

Clinical Management System

CMS: Integrated clinical workstation for direct use by all 30,000 clinicians in HA

- Phase I (1992-2001) – The Collector
- Phase II (2002-2007) – The Documenter
- *Phase III (2008+)* – *The Helper*
- Phase IV – The Colleague
- Phase V – The Mentor

	Collector	Documentor	Helper	Colleague	Mentor
Clinical documentation & data capture	Scanned documents Transcribed text Scanned results	Simple doctu… tools Minim…	Structured …ntation …	…summaries to	Automatically extract medical concepts …tegration with workflow and decision support
Clinical display	Static graphic or tabular displays Little user configurability	Simple graphic & tabular Clinician-specific views Clinical dashboard	Customiza…s Longitudina…ws Clinician-dependent views Multiple form factors	…ex graphical presentation	Population-specific cohort data
Clinical workflow	**CMS Phase III**	Physician-order entry (POE) Traditional workflow	Automatic notification Workflow tied to CDS & rule-based logic	Workfl… …	
Clinical decision support		Drug-drug …action Drug allergies	P…ways, CP…	Complex CDSS	Di…ostic workup
Store	Simple database design No structured data	Uniform file sys… Flexible data …	… …ulary	…egrity of information-…nge or delete, only annotated or …mended	Archiving capabilities
Knowledge management		Minimal access to medical references	Int…rnal & external knowledge bases Case management protocols & outcome analysis	…& exte… conte… V…	…edical …ange
Security	Password	Role-based access	Two factor security Notification of unauthorized viewing	Segme… view… Rule-based audit…s Digital signatures	…hange
Process & communication	One-way interface, only download from departmental system	Bidirectional communication with other systems	Within & outside organization Link to e-HR, XML	Bidirectional communication with e-HR & facilities	Full communication with outside & e-HR with communications to

Content

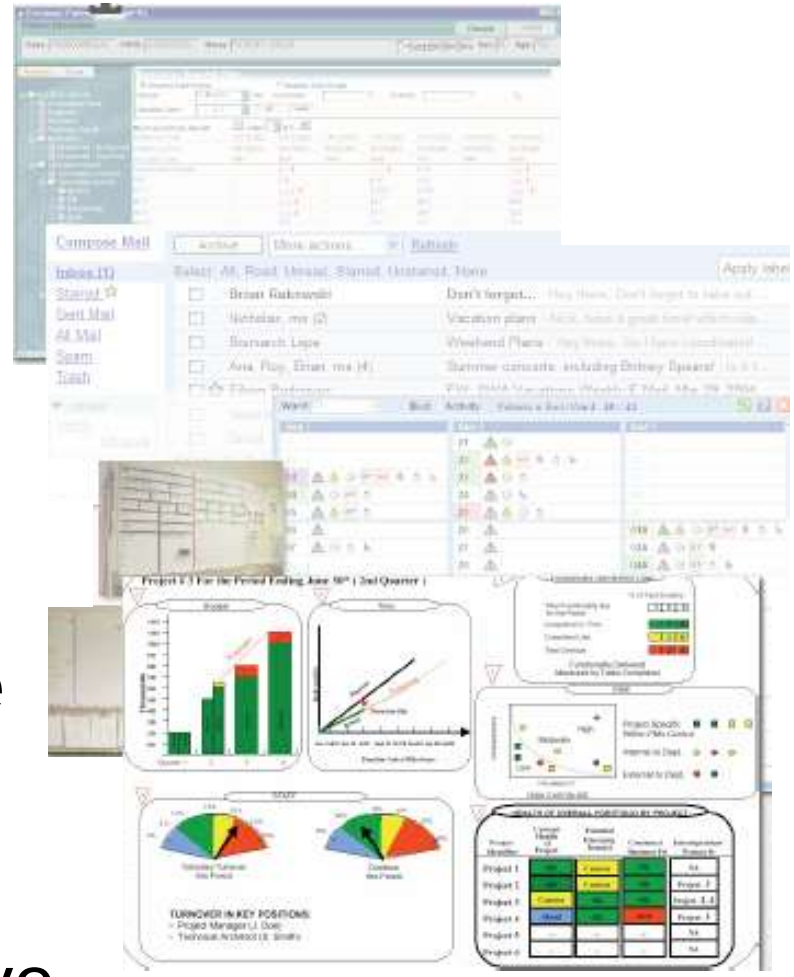
Workflow

Communications

Decision support

4 Perspectives

1. Patient Perspective
2. Clinician Perspective
3. Operational Perspective
4. Management Perspective



4 Strategic Objectives

1. Develop the content
   - Standards-based, comprehensive, multimedia patient-based ePR
2. Facilitate the process
   - Support for operational care processes
   - Workflow management and communication tools
3. Improve the outcome
   - Clinical decision support at point of care
   - Support for QA activities
4. ***Extend to the Community***

9 Major Priorities

- ✓ The Intelligent Record
- ✓ Risk Reduction and Patient Safety
- ✓ IPMOE
- ✓ Filmless Hospital
- ✓ Advanced Systems Architecture and Information Architecture
- ✓ Informational Systems
- ✓ eHealth and Integrating Healthcare Sectors
- ✓ Departmental Systems
- ✓ Health Informatics as a Specialty

Principles of Development

- ✓ “Engage and align”
  - Broad-based clinical systems governance process
- ✓ “Develop and roll”
  - Phase approach, constant user benefits
- ✓ “Generic and standardised”
  - Configurable and sustainable
- ✓ “Manage the information value chain”
  - Data definition, collection, reuse, aggregation, presentation
- ✓ “Keep the good”
  - Migrate gradually and preserve the value

End

传染病通报系统

Notifiable Disease and Outbreak Reporting System (NDORS)