

Advances and Progresses in Hospital Information Systems

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Healthcare is changing...

Today

Tomorrow

	Today		Tomorrow
Scope	Cure Patients	→	Care for Citizens
Focus	On the process and provider	→	On the patient
Time	Symptomatic, curative	→	Preventive, lifetime
Location	Hospital	→	Decentralized, at home
Methods	Invasive	→	Less invasive

The processes in health are changing ...

Today

Tomorrow

	Today		Tomorrow
Clinical Decisions	Personal preferences	➔	Guide lines / evidence based
The Process	Fragmented, isolated	➔	Disease mgt.
Experience	Individual	➔	Best Practices
Order Process	Manual	➔	Automated
Information	Fragmented, isolated	➔	Consolidated / complete

IT is changing ...

Today

Tomorrow

Technology	Isolated systems	→	Integrated systems
Data access	Limited, Difficult	→	Any time, any place
Data integrity	Manual/error prone	→	Systematic mgt. and control
Data completeness	Fragmented	→	Consolidated
Data availability	Slow	→	Real time

Health Institutions and Information Processing

- **Health information systems** strongly influence quality and efficiency of health care, and technical progress offers advanced opportunities to support healthcare;
 - Are Health information systems and healthcare are interrelated?
 - What is the significance of information systems for healthcare?
 - How does technical progress affect healthcare?
 - Why is systematic information management important?

What is the significance of information systems for healthcare?

- Information processing is an **important quality factor**, but an **enormous cost factor** as well. It is also becoming a **productivity factor**;
- Information processing should offer a **holistic view** of the patient and of the hospital;
- A hospital information system can be regarded as the **memory and nervous system of a hospital.**

Information processing as a quality factor

- Decisions of healthcare professionals are based on vast amounts of information about the patient's health state (annotations, signals, images, etc...);
- It is essential for the quality of patient care and for the quality of hospital management to fulfill these information needs;

When a patient is admitted to a hospital, a physician or nurse first needs information **about the reason for patient admission** and about the **patient history**. Later, she/he needs **results from services** such as laboratory and radiology which are some of the most frequent diagnostic procedures.

Information processing as a quality factor

- **Incorrect reports** (lab reports, annotations, etc) may lead to erroneous and even harmful treatment decisions;
- Repeated examinations or lost findings have to be searched for ->>> **the costs of health care may increase**;
- Information should be **documented adequately**, enabling healthcare professionals to access the information needed and **to make decisions**;
- In general clinical patient-related information should be **available on time**, and it should be up-to-date and valid.

Information processing as a quality factor

- People working in hospital administration also must be well informed in order to carry out their tasks. They should be **informed timely and receive current information**;
- Hospital management also **has an enormous information need**. Up-to-date information **about costs and proceeds** are necessary as a basis for controlling the enterprise;

Thus, information processing **is an important quality factor in healthcare and, in particular, in hospitals.**

- In 2007, states of the OECD¹ spent between 6% and 15 % of their total gross domestic product (GDP) for healthcare;
- The annual budget that healthcare institutions spend on information technology (IT) was in 2006 between 2.5% and 3.3% of the total hospital operating expense, depending on the number of beds
- In Brazil, most of the hospitals spend less than 1% of your budget with IT and less than 15% of the hospitals spend 3% to 5% with IT².

¹ Organization for Economic Co-operation and Development

² Getulio Vargas Foundation (<http://portal.fgv.br>)

- From an economic point of view, **productivity** of a hospital might be defined as the ratio of number of cases and full-time employees;
- If, however, output is considered as **quality of patient care**, it is much more difficult to calculate productivity;

For **high-quality patient care** and **economic management** of a hospital, it is essential that the hospital information system can make correct information **fully available on time**. This is also increasingly important for the competitiveness of hospitals.

Holistic view of the patient

- Information processing in a hospital should offer a comprehensive, holistic view of the patient and of the hospital;
- **Holistic in this context means to have a complete picture of the care of a patient available**, independent of the healthcare institutions and hospital departments in which the patient has been or will be treated;

This **holistic view on the patient** can reduce undesired consequences of highly specialized medicine with various departments and health care professionals involved in patient care.

Identificador: 27 / Matrícula: / Leito: F / Número: / Nome: MARIA

- ✓ Procedimentos
- ✓ Internações
 - ✓ 11/03/2005 - 19/03/2005
 - Diagnósticos
 - Atendimentos
 - ? Resumo Clínico de Saída
 - ? Prescrições Médicas
 - Ficha de Internação
 - ? Questionários

- ✓ Pronto-Socorro
 - ✓ 10/03/2005 - 11/03/2005 - Tipo de Saída:
 - Ficha de PS
 - Atendimentos
 - ? Resumo Clínico de Saída
 - ? Prescrições Médicas
 - Diagnósticos
 - ? Questionários
 - ? 20/10/2004 - 01/11/2004 - Tipo de Saída: Alta
 - ? 25/05/2004 - 01/06/2004 - Tipo de Saída: Alta

- ✓ Atendimentos Ambulatoriais
 - ? 05/05/2005
 - ? 16/02/2005
 - ? 12/01/2005

Realização	Hora	Exame	Nome	Situação
05/05/2005	12:50	POTASSIO	POTASSIO / SORO	Definitivo
05/05/2005	12:50	SODIO	SODIO / SORO	Definitivo
05/05/2005	12:50	TP	TEMPO DE PROTROMBINA	Definitivo
15/03/2005	12:17	PLAQU		
15/03/2005	12:17	CREA		
15/03/2005	12:17	GLI1		
15/03/2005	12:17	HG2		
15/03/2005	12:17	POTA		
15/03/2005	12:17	SODIC		
15/03/2005	12:17	UREIA		
11/03/2005	02:40	PLAQU		
11/03/2005	02:40	CREA		
11/03/2005	02:40	HG2		
11/03/2005	02:40	UREIA		
15/02/2005	11:24	CREA		
15/02/2005	11:24	POTA		

Imprime Lista

Diagnósticos

Atendimentos

Resumo Clínico de Saída

19/03/2005 - Saída Hospitalar - Pendente - Médico(a): SOLI

Prescrições Médicas

19/03/2005 - Liberado - Médico(a):	SO
18/03/2005 - Liberado - Médico(a):	SO
17/03/2005 - Liberado - Médico(a):	SO
16/03/2005 - Liberado - Médico(a):	LI
15/03/2005 - Liberado - Médico(a):	SO
14/03/2005 - Liberado - Médico(a):	RO
13/03/2005 - Liberado - Médico(a):	RO
12/03/2005 - Liberado - Médico(a):	RO
11/03/2005 - Liberado - Médico(a):	SA

FZ - FUNDAÇÃO ZERBINI (Produção (Apalaches))

Data: 19/03/2005 Leito: **LIBERADA**

Paciente: 2746350 MARIA I

Idade: 59 (a) 10 (m) 8 (d) Peso: (kg) Altura: (m) Exibe Suspensos ?

Lib	Item	Prescrição	Qty.p/ horario	Unidade	Via	Frequência	Observação	Dias Tot	Adm.	Dias Susp.	Horários
✓	1.00	DIETA ORAL GERAL HIPOSSODICA					RH 1500 ML				
✓	2.00	CAPTAPRIL 25MG	50,00	mg	vo	8/8h					14 2208
✓	3.00	FUROSEMIDA 40MG	1,00	comp	vo	2xd					16 08
✓	4.00	DIGOXINA 0,25MG	0,50	comp	vo	manha					08
✓	5.00	CARVEDILOL 25MG	25,00	mg	vo	12/12h					22 10
✓	6.00	VARFARINA SODICA	2,50	mg	vo	manha					08
✓	7.00	LANATOSIDED-C (DESLANOSIDO) 0,2MG/M	1,00	amp	ev	1xd					10
✓	8.00	OMEPRAZOL 20MG	1,00	comp	vo	manha					08
✓	9.00	ENOXAPARINA 40MG	1,00	amp	sc	1xd					10

Identificador	Matricula	Leito	Número Exame	Tipo Exame
274		F		
Nome				
MARIA				

Paciente	Admissão
Nome: MARIA HELENA MARDEGAN SCABELLO	Número Admissão: 02 05 38699
Ider: 2746350	Idade/Meses/Dias: 59 9 30
	Data e Hora da Adm: 11/03/2005 01:42

Paciente	Admissão
Identificador: 274	Número Admissão: 02 05 00038699
Matricula: 554	Tipo: IN
Nome: MARIA	Idade: 59 a 9 m 30 d
Data Nasc.: 11/05/1945	Data/Hora Admissão: 11/03/2005
	Data/Hora Saída: 19/03/2005
	Unidade Funcional: UN OPERACIONAL INTERNACOES



- ✓ Procedimentos
- ✓ Internações
 - ✓ 11/03/2005 - 19/03/2005 - Tipo de Saída:
 - Diagnósticos
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 - ? 25/05/2004 - 01/06/2004 - Tipo de Saída:
- ✓ Pronto-Socorro
 - ✓ 10/03/2005 - 11/03/2005 - Tipo de Saída: Internacao
 - Ficha de PS
 - Atendimentos
 - ? Resumo Clínico de Saída
 - ? Prescrições Médicas
 - Diagnósticos
 - ? Questionários
 - ? 20/10/2004 - 20/10/2004 - Tipo de Saída: Internacao
 - ? 25/05/2004 - 25/05/2004 - Tipo de Saída: Internacao
- ✓ Atendimentos Ambulatoriais
 - ? 05/05/2005
 - ? 16/02/2005
 - ? 12/01/2005

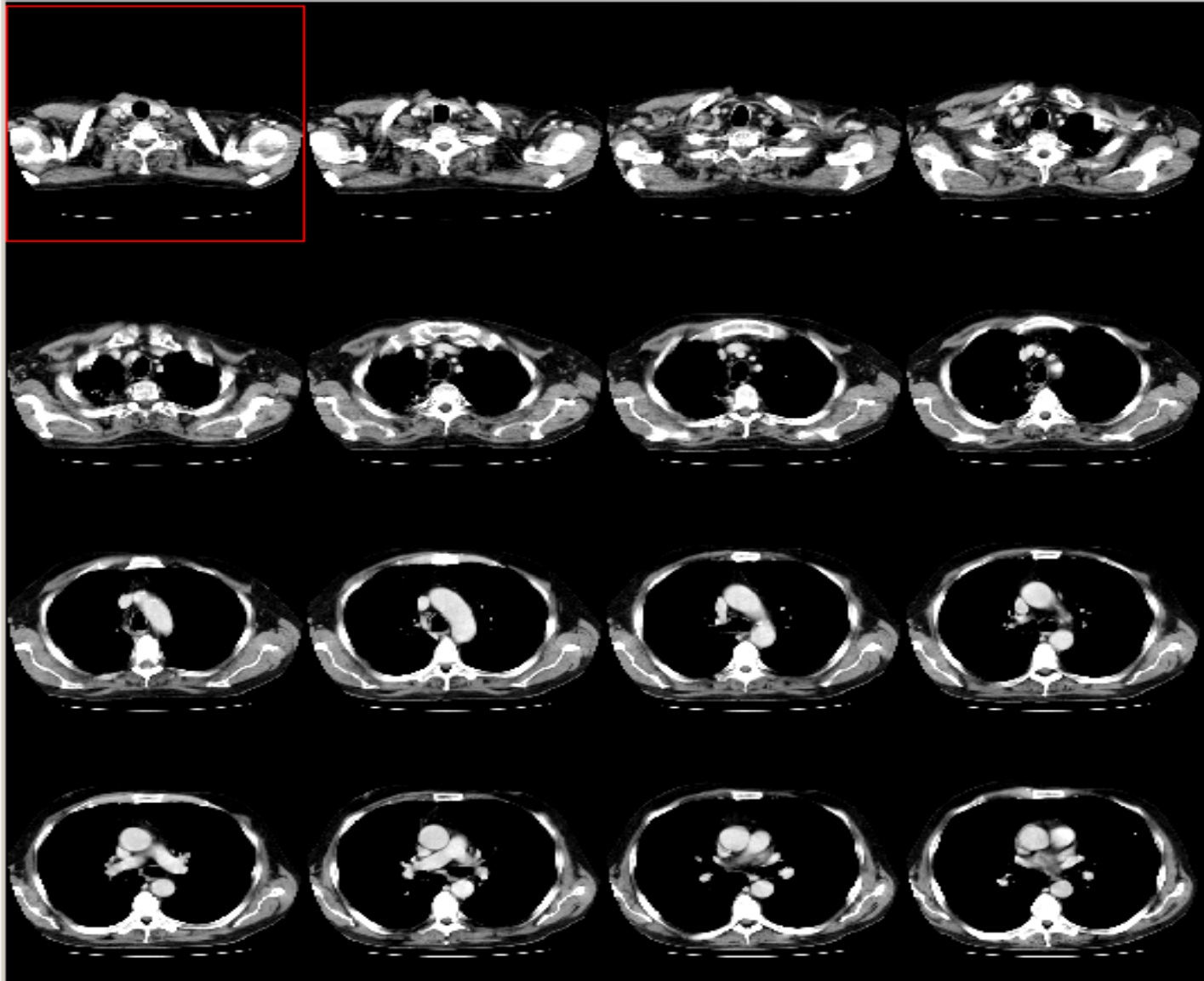
Atendimentos	Trocas de Leitos	Deslocamentos	Estados Clínicos
Unidade Funcional: UIEM		Especialidade: UN OPERACIONAL INTERNACOES	
Data/Hora Início: 11/03/2005 01:42		Data/Hora Fim: 19/03/2005 13:33	

FUNDAÇÃO ZERBINI INSTITUTO DO CORAÇÃO			
FICHA DE INTERNAÇÃO			
Número de Matrícula: 55409828F	Origem Paciente: PS	Número Admissão: 02-05-00038699	Destino:
	Unidade Funcional: UIEM	Tratamento: CLI	Leito: Admissão: Data/Hora: 11-MAR-05 01:42:14
Repecialidade: CORONARIOPATIA	Diagnóstico Provisório: Insuficiência cardíaca congestiva		
Identificador: 2746350	Nome do Paciente: MARIA		
Provedor: SUL AMERICA SERVICOS MEDICOS LTDA.		Doc. Previdenciário/Nº Guia:	
Data Nascimento: 11/05/1945	Idade: Ano 59, Mês 9, Dia 30	Sexo: FEMININO	Cor: PARDA
Instrução: IO. GRAU INCOMPLETO (ATE 4 ANOS)	Religião: CATOLICO	Estado Civil: VIUVO	
Endereço: / /			
Bairro: SUMAREZINHO	Distrito: PERDIZES	Cep: 05441000	
Município: Código IBGE, Descrição: 50308 - SAO PAULO - SP		Naturalidade/Nacionalidade: MIRASSOL - SP	
Nome da Mãe: MARIA ASSENCAO SANCHES MARDEGAN		Nome do Pai: SEVERIANO MARDEGAN	
Nome do Cônjuge:		Responsável: DAVA ELOISA DE LIMA/AMIGA	
Pessoa a ser Notificada - Parentesco:		Telefone para Recados:	
Endereço da Pessoa a ser Notificada:			
Registrante: valquiria.cardozo	Nome do Médico: 53343 - SOLANGE DESIREE AVAKIAN		
Restrições (Dieta/Medicamentos/Outros):	Observações: PAC. ASS. TERMOS, GUIA N/05/00296707 C/01 DIARIA, APTO L, 11/03/2005		
Documentos do Paciente: RG: 2.572.756; CONV: 73744000058490015 - sul america 445 ESP; CIC: 519655508-00			

Trocas de Responsabilização Profissional

SOLANGE DESIREE AVAKIAN

ANTONIO DE PADUA MANSUR



Séries

◀
◀
▶
▶
1 / 1

Animação da Série

▶
▬
▬

Visualização

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◀ [Progress Bar] ▶ 1 / 76

↑
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■
■
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■

Brilho / Contraste

W

L

Todas

WL Setting Head

Cores Grayscale

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🔍
🔍
1:1

🔄
👤
🔄
📄

90
90
↕
↕

📄
📄
📄
✖

Basic IP methods

The screenshot displays a medical software interface for viewing and measuring CT scan data. The main window shows a cross-sectional CT scan of the chest. A red line indicates a measurement of 265 mm across the heart area, with a cyan arrow pointing to the measurement line. Another red line indicates a measurement of 64.0° at the bottom of the heart area, with a cyan arrow pointing to the angle. The interface includes a control panel on the right with various settings and navigation options.

Série: 1 / 1 [CT]-

Séries

Visualização

Brilho / Contraste

W 642

L 51

Original Auto Todas

WL Setting Head

Cores Grayscale

Cor Vermelho

Java Applet Window



Zoom 75 %



Instituto do Coração - ICCCUSP

Laudo de Tomografia

Dados de Identificação

Idade/Sexo: 145

Nome: JOAO CARLOS DA SILVA

Data de Nascimento: 21/02/1972

Exame Realizado: TOMOGRAFIA COMPUTADORIZADA DE TÓRAX

Data do Laudo: 19/05/2002

Laudo do Exame:

Nome do Caso: 1

Nome do Exame: 10045

Resumo

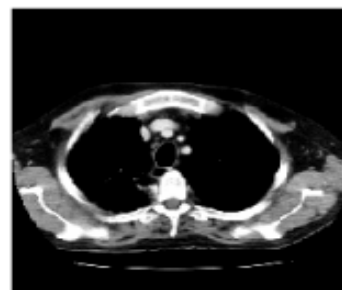
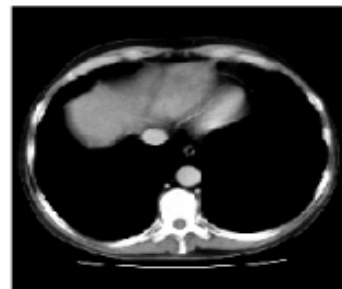
Atuação normal do coração no tórax e pulmões normais, mas com sinais de edema. Presença de derrame pleural bilateral em pequenas quantidades e de atelectasia em ambas as bases.

Laudo

Figura em corte axial, tomografia computadorizada de tórax, nível ao nível do 2º espaço intercostal. Coração de tamanho normal, com contornos regulares. Pulmões com sinais de edema, com áreas de atelectasia em ambas as bases. Presença de derrame pleural bilateral em pequenas quantidades. Não há sinais de doença pulmonar crônica. Não há sinais de doença vascular pulmonar. Não há sinais de doença vascular sistêmica. Não há sinais de doença renal crônica. Não há sinais de doença hepática crônica. Não há sinais de doença gástrica crônica. Não há sinais de doença intestinal crônica. Não há sinais de doença urológica crônica. Não há sinais de doença neurológica crônica. Não há sinais de doença oncológica crônica. Não há sinais de doença infecciosa crônica. Não há sinais de doença autoimune crônica. Não há sinais de doença endócrina crônica. Não há sinais de doença hematológica crônica. Não há sinais de doença imunológica crônica. Não há sinais de doença metabólica crônica. Não há sinais de doença nutricional crônica. Não há sinais de doença tóxica crônica. Não há sinais de doença traumática crônica. Não há sinais de doença iatrogênica crônica. Não há sinais de doença idiopática crônica. Não há sinais de doença de causa desconhecida crônica.

Conclusão

Coração normal. Pulmões com sinais de edema. Presença de derrame pleural bilateral em pequenas quantidades. Não há sinais de doença pulmonar crônica.



Progress in IT

IT has become economically important and decisive for the quality of healthcare and it will continue to change healthcare.

- Impact on quality of care
- Impact on economics
- Changing health care

The impact of IT on quality of healthcare

Progress in IT **changes societies** and **affects the costs and quality of information processing in health care**;

Important progress due to improvements in IT can also be observed in information systems of health care organizations;

The role of **computer-supported information systems**, together with **clinical documentation** and **knowledge-based decision support systems**, can hardly be overestimated in respect to the **quality of healthcare**, as the volume of data available today is much greater than it was a few years ago (BigData).

Impact on economics

The worldwide IT market volume is estimated at nearly **2.5 trillion € in 2009** with a **growth rate of about 5 %** per year;

IT has become a major factor for quality and efficiency of healthcare worldwide. IT in healthcare also emerged to a leading industry branch;

There is a significant and increasing economic relevance for IT in general but also in healthcare.

Changing healthcare

What changes in healthcare do we expect through IT?

The development of IT will continue to have a considerable effect on our societies in general and on our healthcare systems in particular

Changing healthcare

- The use of computer-based tools in healthcare is dramatically increasing, and new technologies such as mobile devices and multifunctional bedside terminals will proliferate;
- Computer-based training systems strongly support efficient learning for healthcare professionals;
- Documentation efforts are continuously rising and lead to more sophisticated computer-based documentation tools;
- Decision support tools, for example in the context of drug prescription, support high-quality care (drug-drug, drug-dose, ...);
- Communication is increasingly supported by electronic means instead of paper.

Importance of systematic information management

Systematic processing of information contributes to high quality patient care and reduces costs

The integrated processing of information is important because:

- All groups of people and all areas of a hospital depend on its quality;
- The amount of information processing in hospitals is considerable;
- Healthcare professionals frequently work with the same data.

Affected people and areas

- Nearly all people and all areas of a hospital are affected by the quality of the information system, as most of them need various types of information in their daily work
- The patient certainly profit most from high-quality information processing since it contributes to the quality of patient care and to reducing costs
- The professional groups working in a hospital, especially physicians, nurses, and administrative personnel, but also others, are also directly affected by the quality of the information system

Amount of information processing

The amount of information processing in hospitals, especially in larger ones, should not be underestimated. The Heart Institute, a **500 hundred beds hospital generates more than 20 TB/yr** (90% images and signals);

The computer-based tools of a university medical center encompass more than hundred of computer-based application components, thousands of workstations and other terminals, and more than hundred servers and the respective network.

Sharing the same data

There are different reasons for pursuing holistic and integrated information processing;

The most important reason is that various groups of healthcare professionals within and outside healthcare institutions need the same data.

The Hospital

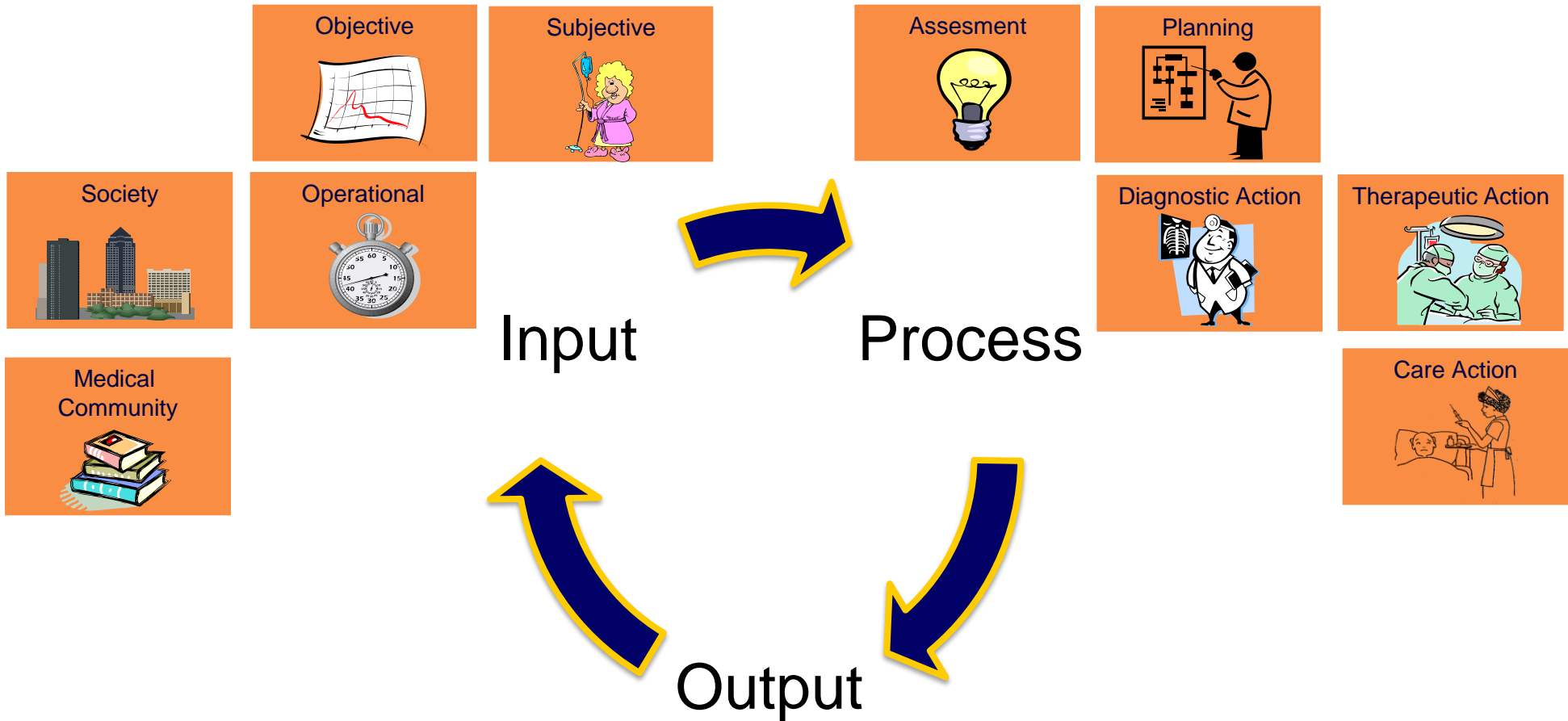
High Quality
Cost Effective



Medical Knowledge

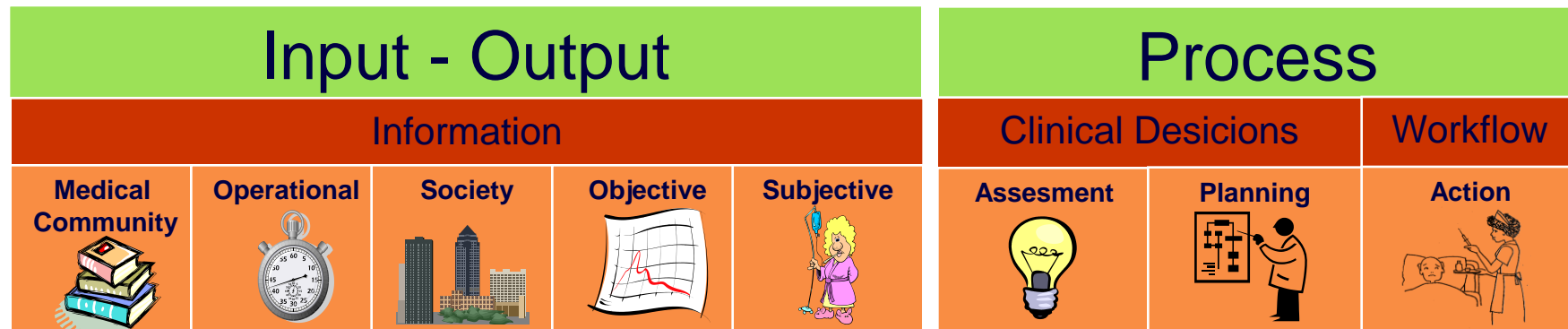


Healthcare as a Process



Healthcare as a Process

- Isolated information
- Fragmented information
- Not accessible information
- Too much information
- Bad information presentation
- Only clinical data is kept (no knowledge)
- Some information is not computer usable (free text, image features, genome in the future)
- No feed back to medical community and society
- Complex decisions
- Lack of training
- Changing knowledge
- Medical errors
- Inefficient workflow
- Understaffing
- No operational information
- No infrastructure information
- No common language

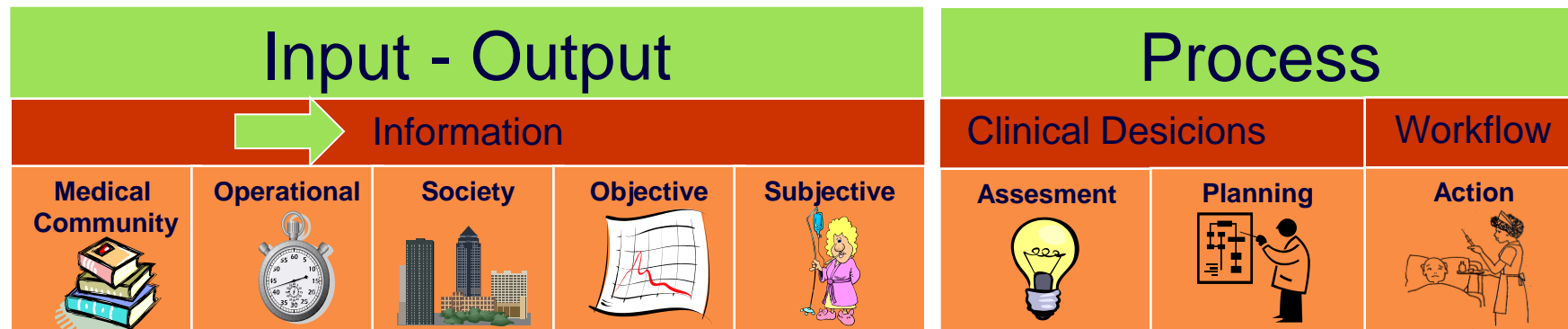


IT approach – wave 1

PAS: Patient Administration System

HIS: Hospital Information System

Result Distribution



IT approach – wave 2

PAS: Patient Administration System

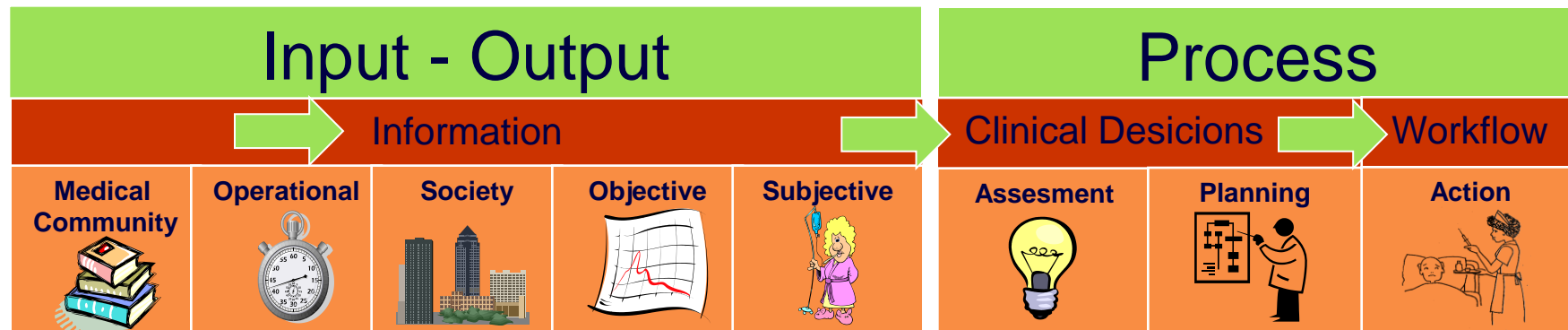
HIS: Hospital Information System

CIS: Clinical Information System

PACS: Picture Archiving And Communication System

Computerized Prescription Order Entry

Result Distribution



IT approach – wave 3

Information Filtering

Decision Support

Semantic Driven UI

Clinical Pathways

Evidence Based Medicine

Clinical Trials (data mining)

Terminology

Feature Extraction from Unstructured or Massive Information (images, text)

Advanced Connectivity Content

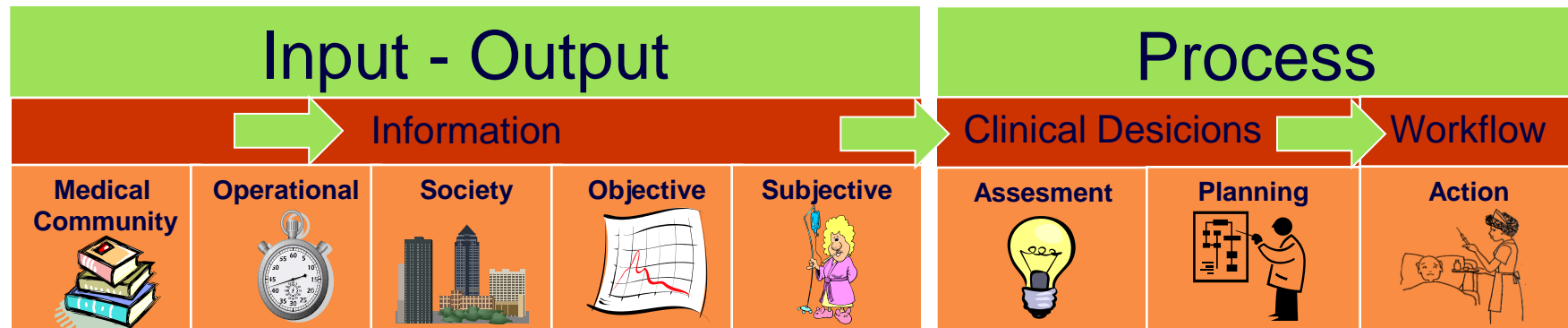
Workflow Optimization

Intelligent Patient Portals

Remote Data Capture (Telemetry)

Community Healthcare

Analytics



As a Hospital, what would we expect from an integrated hospital information system?

- Access to documents (texts, signals and images) for continuous patient assistance;
- Fast, distributed and confidential access;
- Integrated information;
 - demographic
 - administrative
 - clinical (reports, evolutions, exams, procedures, ...)

- Distributed
- Low level of structure
- Controlled by Heterogeneous systems

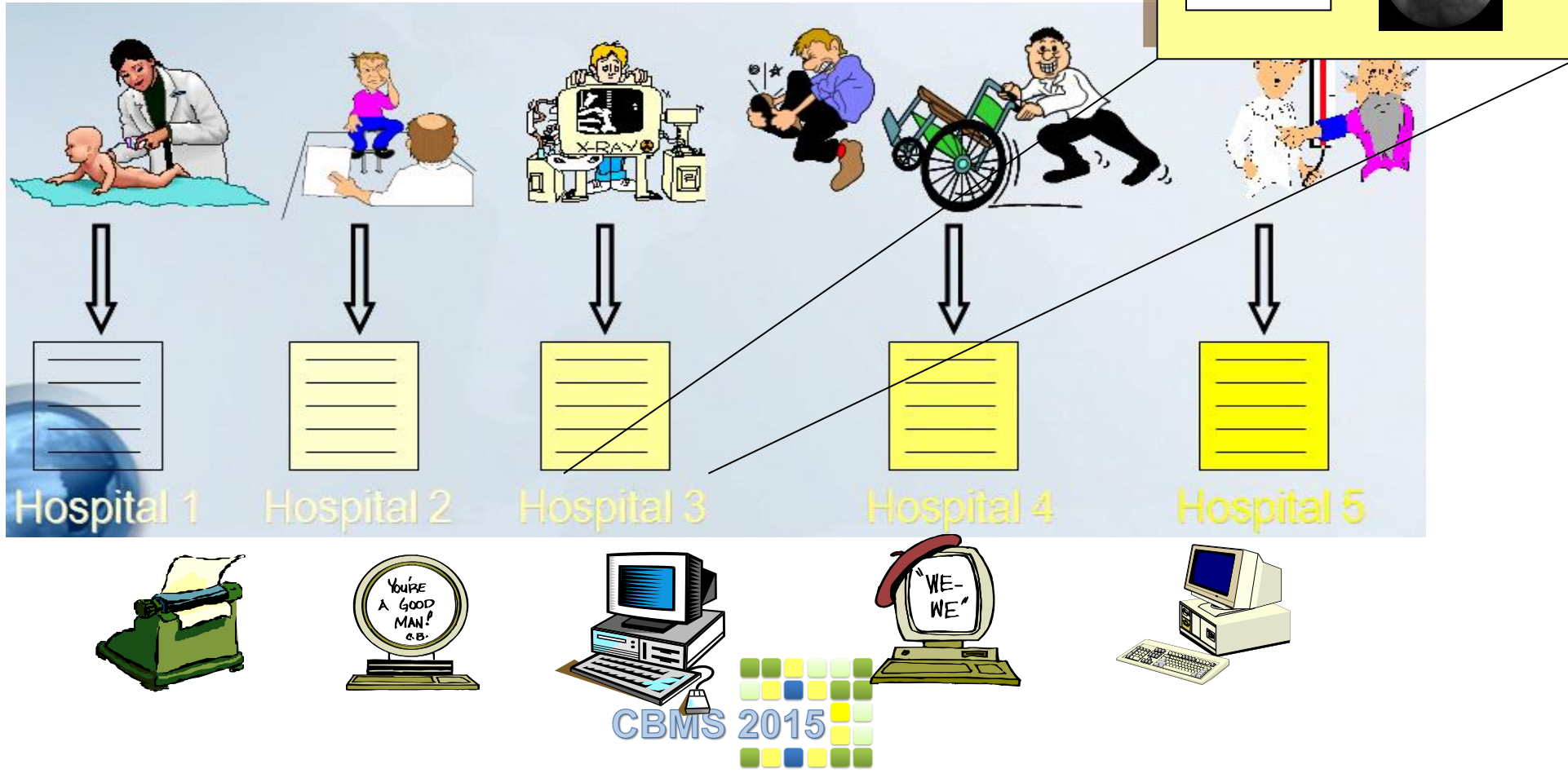
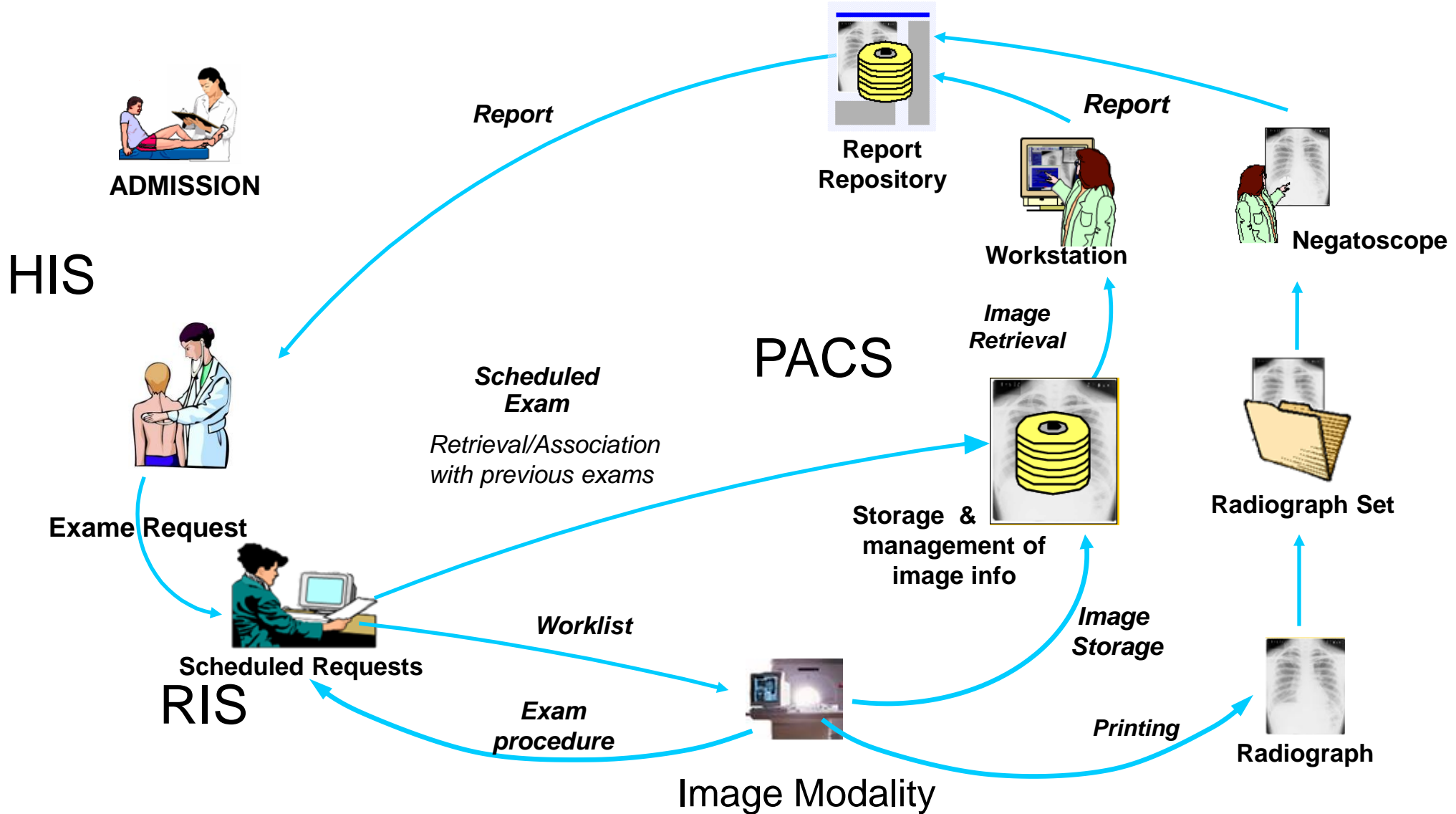
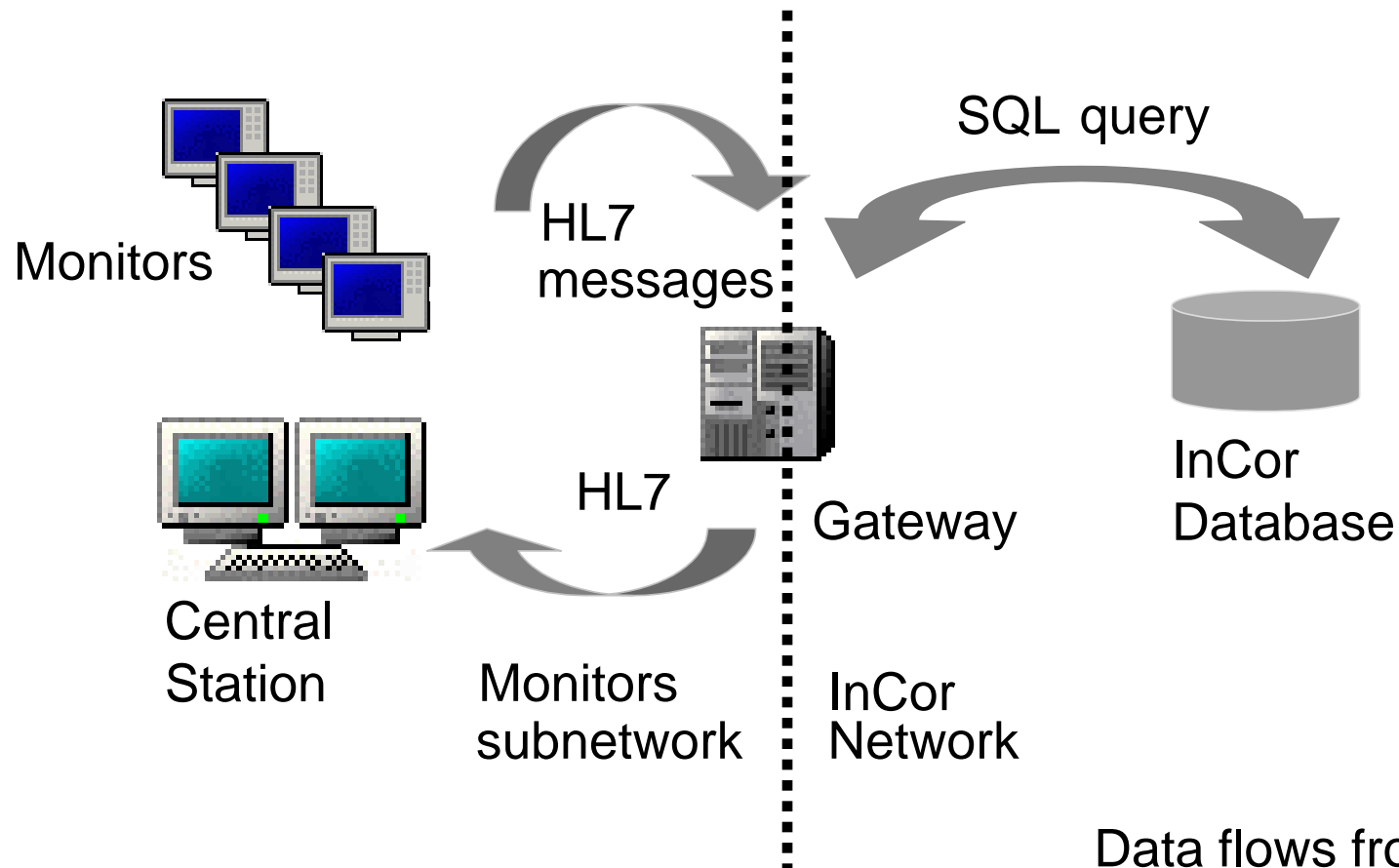


Image information workflow

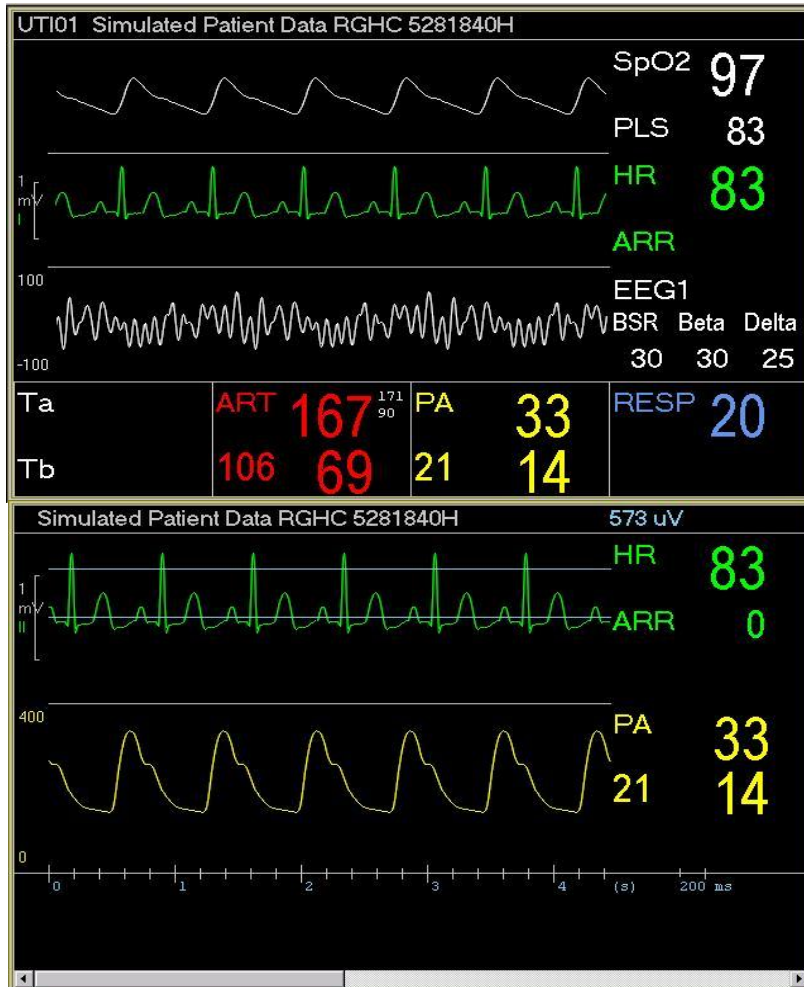


Integration of bedside monitors to the HIS

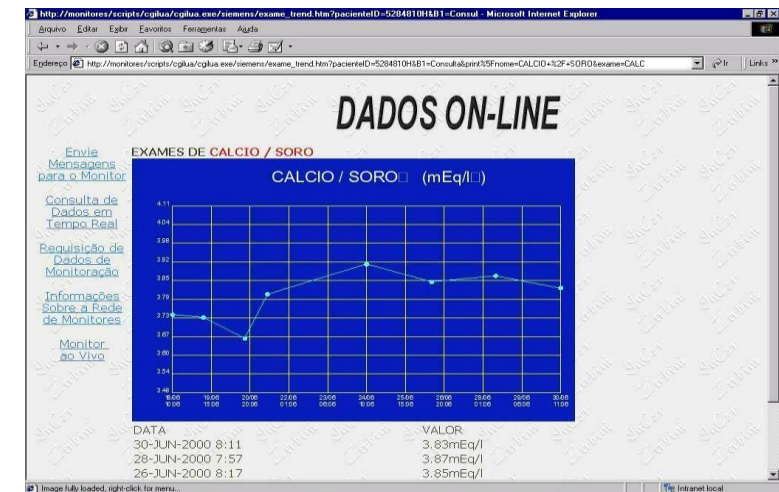


Data flows from the monitors' acquisition to data display on the Web

Integration of bedside monitors to the HIS



Real time presentation of bed-side monitors signals



Trend graphs

Dicom file storage and display allow measurements

The problems

- Integration of heterogeneous and distributed systems;
- Huge amount of data structured and unstructured (500 beds > 20TB/yr);
- Robust access & control (privacy, confidentiality, auditable, ...);
- Distributed access & mission critical (millions of hits/yr);
- Ubiquitous (every where/any time);
- Ability to perform complex searches and queries;

Basic X Comprehensive EMR (Clinical Documentation)

Requirement	Comprehensive	Basic
Demographic Characteristics of patients	X	X
Physicians' notes	X	
Nursing Assessments	X	
Problem Lists	X	X
Medication lists	X	X
Discharge Summaries	X	X
Advanced Directives	X	

Basic X Comprehensive EMR (Test & Imaging Results)

Requirement	Comprehensive	Basic
Laboratory reports	X	X
Radiologic reports	X	X
Radiologic images	X	
Diagnostic-test results	X	X
Diagnostic-test images	X	
Consultant reports	X	

Basic X Comprehensive EMR (CPOE)

Requirement	Comprehensive	Basic
Laboratory Tests	X	
Radiologic Tests	X	
Medications	X	X
Consultant Requests	X	
Nursing Orders	X	

Basic X Comprehensive EMR (Decision Support)

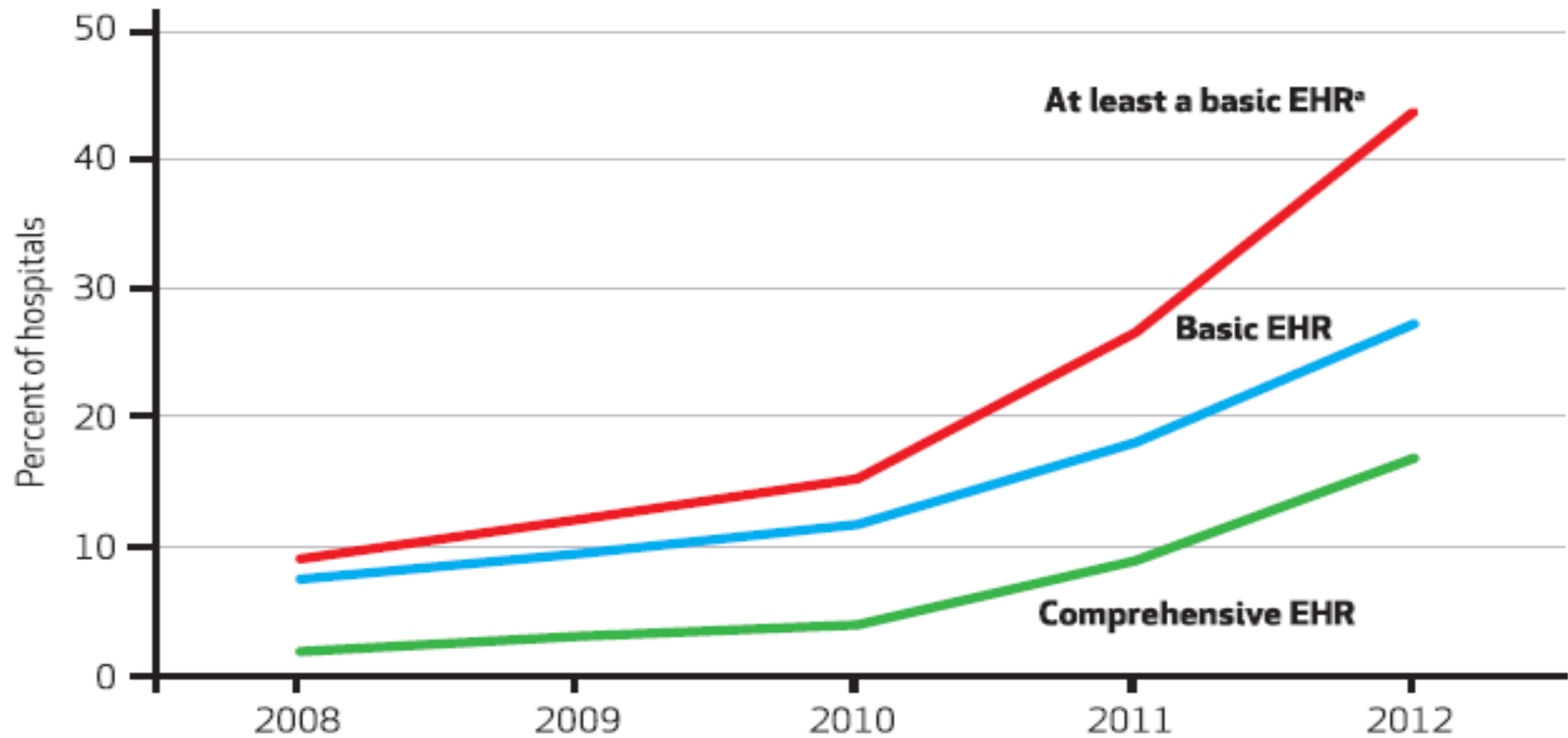
Requirement	Comprehensive	Basic
Clinical Guidelines	X	
Clinical Reminders	X	
Drug-Allergy Alerts	X	
Drug-Drug Interaction Alerts	X	
Drug-Lab interaction Alerts	X	
Drug-Dose Support	X	

Rate of Adoption: EMR & CPOE

	Germany	Australia	Canada	USA	Netherlands	England
Clinics						
EMR (%)	42	79	20	24	95	89
CPOE (%)	59	75	5	9	85	90
Hospitals						
EMR (%)	<5	<10	<10	<3	<5	<8
CPOE (%)	<5	<1	<1	<5	<5	<3

A.K. Jha, et al., *The use of health information technology in seven nations. Int J Med Inform. 77(12):848-54, 2008*

Hospitals' Adoption Of Electronic Health Record (EHR) Systems, 2008-12



SOURCE Authors' analysis of data from American Hospital Association, Annual Health Information Technology Supplemental Survey, 2012. **NOTE** All analyses were statistically weighted to account for potential nonresponse bias. ^aHospitals with either a basic or a comprehensive system.

Value of EMR

- Improved Quality, Outcomes, and Safety;
- Improved Efficiency & Productivity;
- Time Savings;
- Cost Reduction;
- Improved Service and Satisfaction.

Computerized Physician Order Entry (CPOE)

What is it?

- The definition for CPOE as it is being promulgated for patient safety is:
 - **The use of an institutional computerized health record by physicians to electronically enter their orders.**
- There are **THREE** major reasons to support this initiative - they all refer to the **IN-PATIENT** environment.

Reasons for CPOE

1. Order Communication

- Clarity of Orders
- Ease of Identifying the Ordering Physician

2. Standardization of Care

- Clinically validated order sets for
- Clinical diagnoses
- Procedures
- Situations (post-op order sets)

3. Alerts and Reminders (Real Time Decision Support)

- Drug Safety Database (Conflict Checking)
- Clinically validated rules

Reasons for CPOE

- CPOE can **reduce 55% of prescription errors** and **7% of adverse events** (Bates et.al., 1998);
- CPOE can reduce the drug use and exams (Kaushal et al., 2003; Teich et al., 2000);
- A multicentre study identified a **relationship** between the use of CPOE and **reduction in mortality** and **costs** (Amarasingham et al., 2009);

Bates, D. W., Leape, L., Cullen, D. J., Laird, N., Petersen, L. A., Teich, J. M., et al. Effect of computerized physician order entry and a team intervention on prevention of serious medication errors. Journal of the American Medical Association; 280(15), 1311—1316, 1998;

Kaushal, R., Shojania, K. G., & Bates, D. W. Effects of computerized physician order entry and clinical decision support systems on medication safety: A systematic review. Archives of Internal Medicine, 163(12), 1409—1416, 2003;

Amarasingham, R., Plantinga, L., Diener-West, M., Gaskin, D. J. e Powe, N. R. Clinical information technologies and inpatient outcomes: A multiple hospital study. Archives of Internal Medicine, 169(2), 108—114, 2009;

Order Communication

- Clarity of Orders
 - A large percentage of written physician orders are not clear;
 - 100% of electronic orders are...
- Physician Identification
 - Between 20 and 50% of Physician signatures are illegible;
 - Electronic Identification is absolute (almost...);
 - Worse with larger medical staff;

Transcript

With CPOE

Locate Chart

Write Order

Flag Chart

Return Chart to Rack

Periodically Review Chart Rack

Check Order Completeness

Enters Order in Computer

Notifies Pharmacist

Notify Nurse

Notify Nurse

Check Order Completeness

Notifies Pharmacist

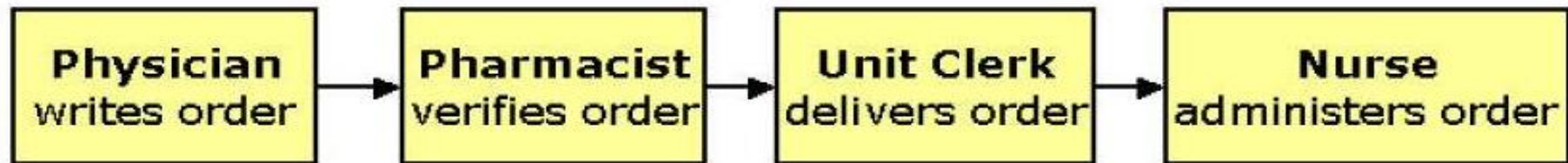
Pharmacist Verifies Order

Med Sent to Floor

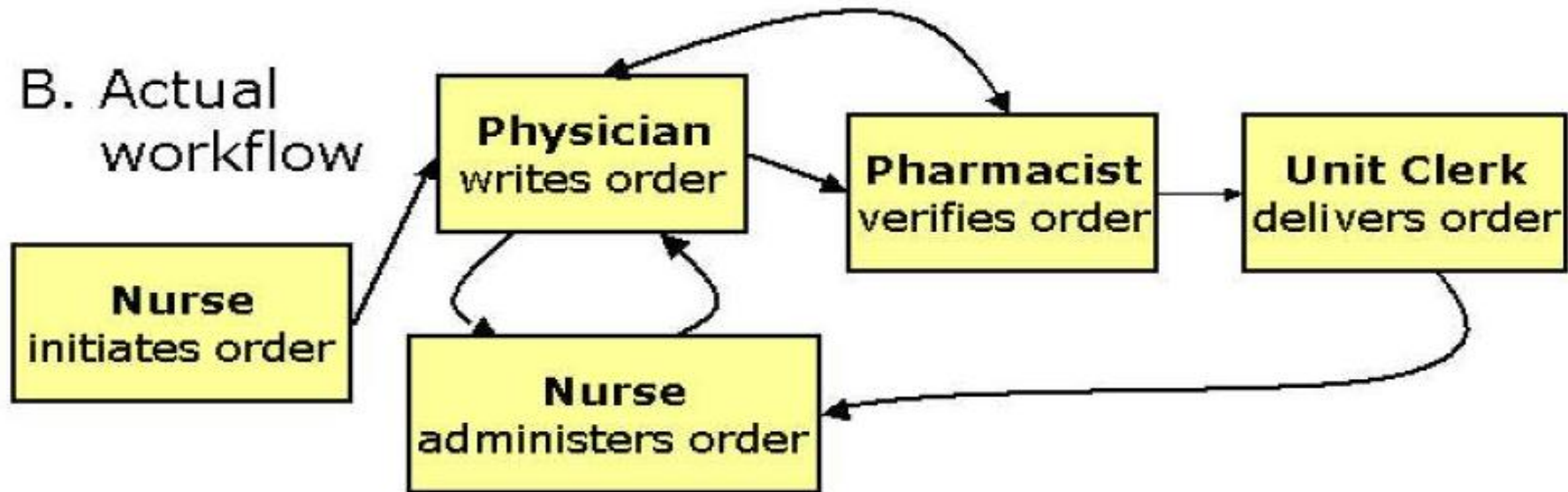


CPOE and Workflow

A. CPOE conceptualization of workflow



B. Actual workflow



Standardization of Care

- Rules and order sets must be clinically and locally validated (medical staff must approve of them before use);
- Provide a clinically validated care path for the situations to which they refer;
- Most Physicians are opposed at first (“cookbook medicine”) but rapidly become comfortable with these order sets as they use them.

Real Time Decision Support

Pharmacy Rules (alerts) must appear if there are conflicts

- **Drug-Drug; Drug-Lab; Allergy; Maximum Dose;**
- Must be aware that the more granular these rules are, the more they will be ignored by the users (**Alert Fatigue¹**);
- Rules must appear only for the most frequent and serious situations.

¹CW Carspecken, *A Clinical Case of Electronic Health Record Drug Alert Fatigue: Consequences for Patient Outcome. PEDIATRICS Vol. 131 No. 6 June 1, 2013 pp. e1970 -e1973*



What to Look for

CPOE WILL **delay rounding time** for visiting MD's at first.
Expect months of grouching;

- The module's **must be intuitive** and reflect how MD's currently write orders;
- Electronic Signature **must be available** by groups of orders;
- Order Sets must be easy to find and use;
- Obtaining local physician input on the **ease of use** is essential.

Options on Order Communication to Nursing

- How does a nurse or pharmacist know that an order has been written?
- Nursing and Pharmacy **must be involved** in selecting the method of communication;
- Most software vendors will offer flexible ways to communicate to the nurse / pharmacist that electronic orders have been written;
- Nursing Alerts - Real time;
- Log-in alerts;

What to Look for

Ease of Insertion of Rules and Reminders

- Most software vendors already have this
 - At various stages of development
- Need to have these “tailorable” by institution
 - Density is an issue
 - Adding or subtracting rules should be easy

Physician Acceptance and Use

- Physicians are spending less time in the hospital;
- CPOE will be **viewed by many as a waste of their time** and put in place mostly for the hospital's benefit (“...now they want us to be unit secretaries...”);
- There must be significant local physician (not only the leadership) input at **multiple levels in developing and tailoring the system** before it goes live (physician participation).

Physician Acceptance and Use

- Physician Input:
 - Screen Flow (how the orders are actually put in)
 - Decision Support (which rules go in and which do not)
 - Order Set Creation (best done by department or section and validated by medical staff)
- Find a “Physician Champion” to help implement it;
- Provide adequate education and support weeks before a unit implements CPOE;
- Provide 24/7 support on the unit for weeks after go live;
- Wireless Computing will also help (usually not PDA’s).

Expectations ...

- Expect at first:
 - physician resistance
 - slow starting and high frustration levels
 - communication issues
- Expect ultimately:
 - clearer orders with ease of MD ID
 - improved nursing and MD satisfaction
 - better patient safety and clinical care

Be Patient and Persistent!

CPOE Resistance

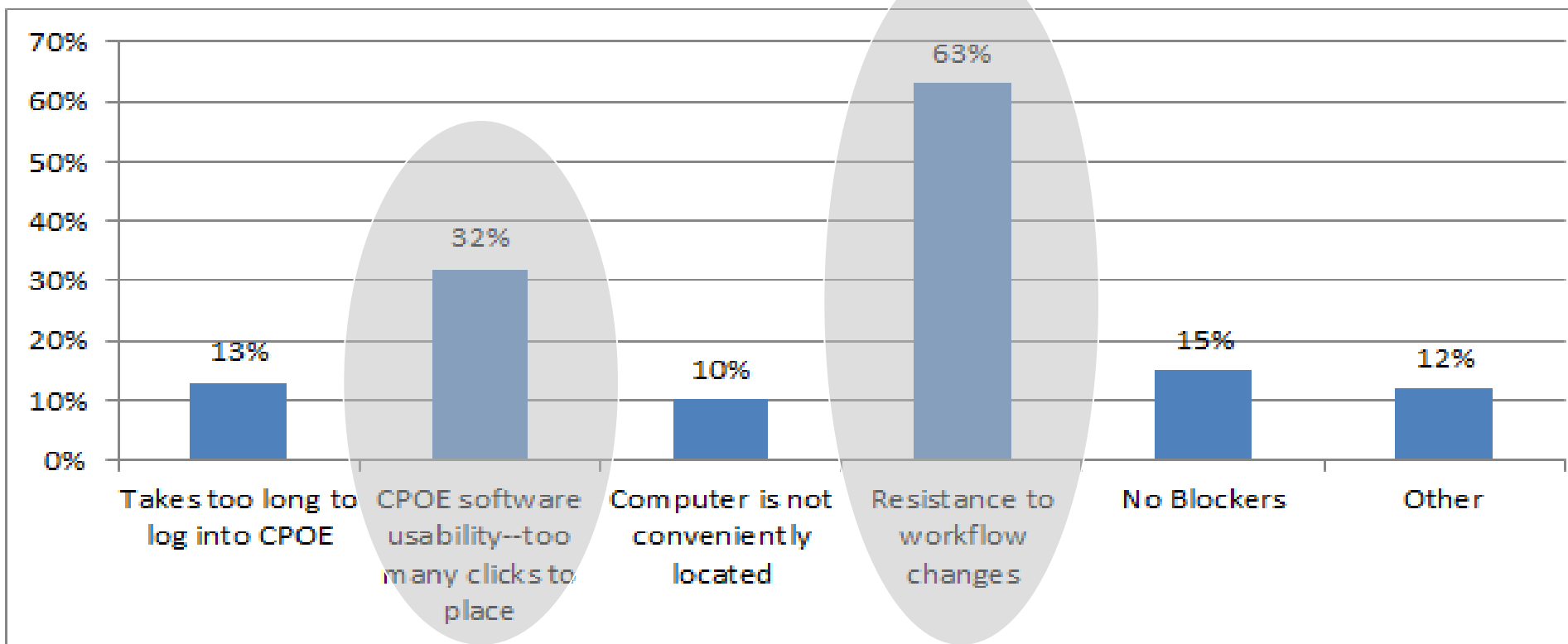


Figure 3: Key Blockers to CPOE Adoption

Reference: <http://www.imprivata.com/content/2012-cpoe-and-meaningful-use-research-brief>

US EMR Adoption ModelSM

Stage	Cumulative Capabilities	2011 Q2	2014 Q1
Stage 7	Complete EMR, CCDAs transactions; Data Analytics to Improve Care	1.1%	3.1%
Stage 6	Physician documentation (structured templates), full CDSS, full R-PACS	4.0%	13.3%
Stage 5	Closed Loop Medication Administration = Bar Code Enablement	6.1%	24.2%
Stage 4	CPOE, or e-Prescribing, Clinical Decision Support (clinical protocols)	12.3%	15.7%
Stage 3	Clinical documentation, CDSS (error checking)	46.3%	27.7%
Stage 2	CDR, Controlled Medical Vocabulary, CDS, HIE capable	13.7%	7.2%
Stage 1	Ancillaries - Lab, Rad, Pharmacy - All Installed	6.6%	3.2%
Stage 0	All Three Ancillaries Not Installed	10.0%	5.6%



Data from HIMSS Analytics[®] Database © 2012
HIMSS Analytics



N = 5439 N = 5449

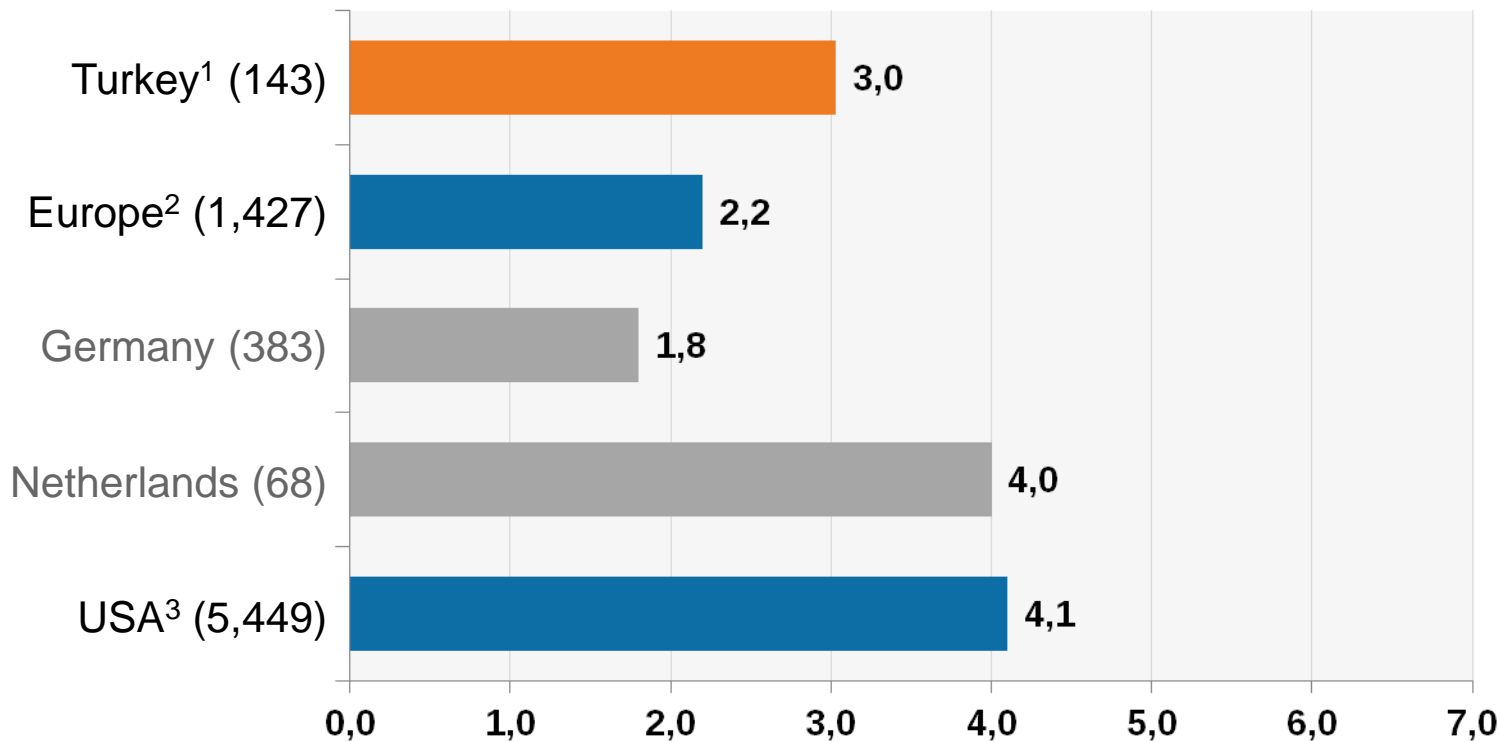
EMR Adoption in the U.S. Market Trended 2006 – 2014

Stage	2006	2007	2008	2009	2010	2011	2012	2014 Q1
Stage 7	0.00%	0.00%	0.30%	0.70%	1.00%	1.20%	1.80%	3.10%
Stage 6	0.10%	0.80%	0.50%	1.60%	3.20%	5.20%	7.30%	13.30%
Stage 5	0.50%	1.40%	2.50%	3.80%	4.50%	8.40%	11.50%	24.20%
Stage 4	3.10%	2.20%	2.50%	7.40%	10.50%	13.20%	14.00%	15.70%
Stage 3	18.70%	25.10%	35.70%	50.90%	49.00%	44.90%	41.70%	27.70%
Stage 2	40.00%	37.20%	31.40%	16.90%	14.60%	12.40%	11.40%	7.20%
Stage 1	17.40%	14.00%	11.50%	7.20%	7.10%	5.70%	4.80%	3.20%
Stage 0	20.40%	19.30%	15.60%	11.50%	10.10%	9.00%	7.50%	5.60%
# of Hospitals	n = 4,237	n = 5,073	n = 5,166	n = 5,235	n = 5,281	N=5,337	N=5,310	N= 5,458

*This is how long it takes to make “significant” national progress
Data from HIMSS Analytics™ Database*

EMR Adoption Model Scores, Means per Country

(data from 4/13 – 5/14 (Turkey), 4/12 – 3/14 (Europe), 4/13 – 3/14 (US), no weighting etc. applied)



1) Only public hospitals, of those 90% with >200 beds

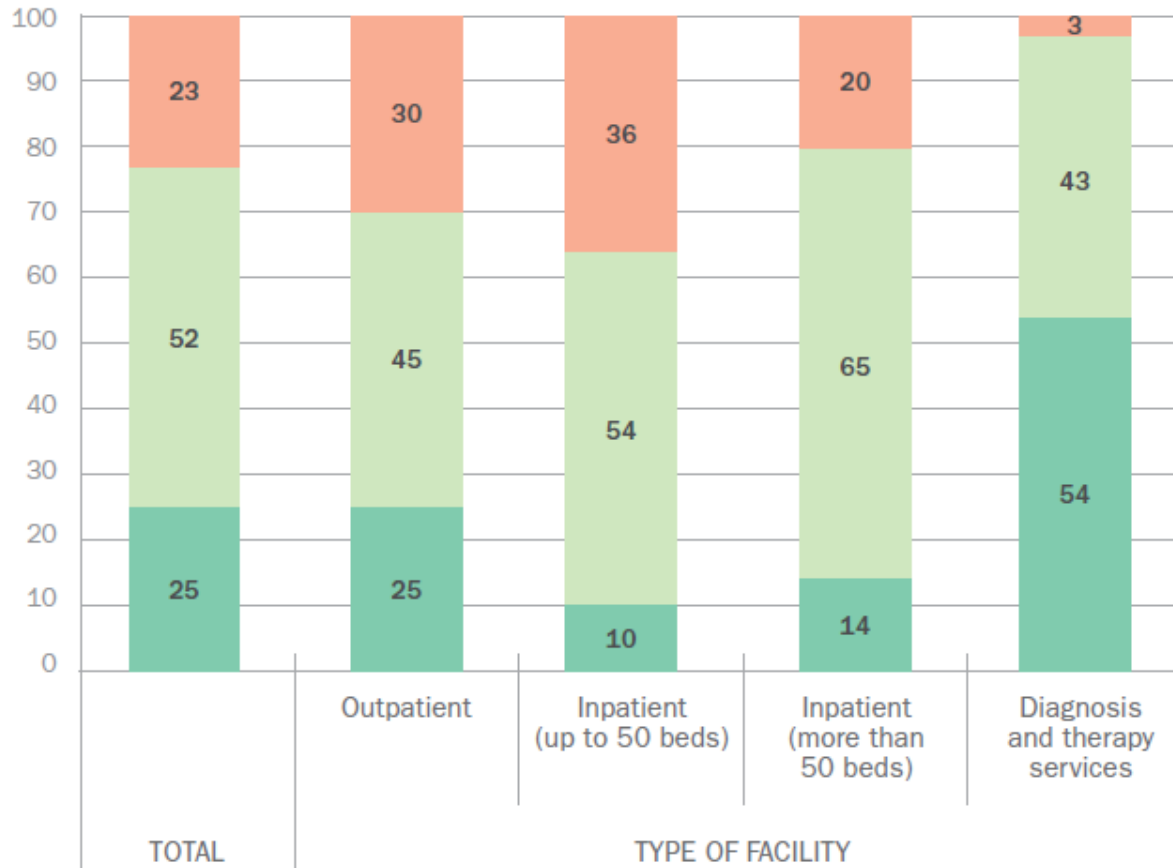
2) Excl. Turkey; incl. Austria (42), Belgium (1), Denmark (16), Finland (3), France (17), Germany (383), Ireland (2), Italy (524), Netherlands (68), Norway (3), Poland (83), Portugal (29), Slovenia (2), Spain (220), Sweden (1), Switzerland (8), UK (25)

3) The EMRAM algorithm between Europe and the US differs in some degrees in order to reflect HIT implementation of that particular region

EMR Adoption in Brazil

PROPORTION OF HEALTHCARE FACILITIES BY METHOD USED TO INPUT INFORMATION IN PATIENTS' MEDICAL RECORDS

Percentage of the total of healthcare facilities that have used the Internet in the last 12 months



- RECORDS ARE TOTALLY ELECTRONIC
- RECORDS ARE PARTIALLY ON PAPER AND PARTIALLY ELECTRONIC
- RECORDS ARE TOTALLY ON PAPER

ICT in health 2013 : Survey on the Use of Information and Communication Technologies in Brazilian Health Care facilities. Comitê Gestor da Internet no Brasil, 2014 (www.cgi.br).

The screenshot displays a multi-windowed EMR application. The main window, titled 'Prontuário Eletrônico', shows a patient list with columns for 'Identificador', 'Matricula', 'Leito', 'Número Exame', and 'Tipo Exame'. A patient with ID 2746350 is selected, and their name 'MARIA HELENA MARDEGAN SCABELLO' is visible. A secondary window shows detailed patient information, including admission details (Admissão) and clinical status (Estados Clínicos). A third window, 'Ordens Médicas (Prescrição)', lists medical orders such as 'VANCOMICINA, CLORIDRATO DE - 500MG' and 'PIPERACILINA 4,0G+'. A fourth window, 'WebView InCor - Microsoft Internet Explorer', displays a patient's vital signs and lab results, including HR (83), ART (167), RESP (20), and SpO2 (97). A fifth window shows a series of chest CT scan images with a control panel for viewing and adjusting contrast.

Registro De Precauções E Isolamento Ccjh

Ação Editar Campo Registro Pesquisa Ajuda Janela

FZ - FUNDAÇÃO ZERBINI (Desenvolvimento (Kunlun))

Data:

Unidade Funcional: UN OP INTERN GERAL 6º ANDAR

Leito: Data de Alta Prevista: Hora:

Matricula Paciente: G ou Identificador: TESTE INFO

Matricula Médico: ou Identificador: MEDICO (SÓ PARA USO DA INFORMATICA)

Papel do Profissional:

Médico Responsável pela Internação:

Atenção : Paciente em precauções e isolamento

Prescrever Evoluir Interconsulta Diagnóstico Resumo Clínico Procedimentos Realizados Receituário Índice Apache II Precauções e Isolamento Alergias Intolerâncias RT



CPOE (Physician)

Ord0300

Ação Editar Campo Registro Pesquisa Ajuda Janela

FZ - FUNDAÇÃO ZERBINI (Desenvolvimento (Kunlun))

Data: 16/09/2014 Leito: 6013 **LIBERADA** Copiar Proced. Anterior Copiar Prescr.Padrão

Paciente: 55550144G TESTE INFO Ver Prontuário Copiar Prescr. Anterior

Idade: (a) (m) (d) Peso: Kg Altura: cm Exibe Suspensos ? Repetir Prescrição

Dieta Medicamento med. N padrão diluição Inalação medic + prOc Gases procedimento interconsulta Cuidados eVolução

Item	Prescrição	Quantidade por horário	Unidade	Via	Frequência	Observação	Total Dias Adm. Presc.	Informação Adicional	Susp.	Horários
1.00	JEJUM					DIETA ORAL LEV			<input type="checkbox"/>	
2.00	CLOPIDOGREL 75MG	8,00	comp	vo	agora				<input type="checkbox"/>	
3.00	CLOPIDOGREL 75MG	1,00	comp	vo	manha				<input type="checkbox"/>	08
4.00	ACIDO ACETILSALICILICO 100MG		comp	vo	almoço				<input type="checkbox"/>	12
5.00	SINVASTATINA 10MG		comp	vo	noite				<input type="checkbox"/>	22
6.00	DIPIRONA 1 G/2ML AMP. 2ML	1,00	amp	ev	sn 6/6h				<input type="checkbox"/>	22
7.00	LORAZEPAM 1 MG	1,00	comp	vo	noite				<input type="checkbox"/>	22
8.00	METOCLOPRAMIDA 10MG 2ML	1,00	amp	ev	sn 8/8h				<input type="checkbox"/>	22 10
9.00	SOLUCAO FISIOLÓGICA A 0,9% 500ML	1,00	fr	ev	12/12h	APÓS PROCEDIME			<input type="checkbox"/>	22 10

Alterar Sequência Elaborar Visualizar Liberar Liberar / Imprimir Autorização

Triagem/Dispensação

Ação Editar Campo Registro Pesquisa Ajuda Janela

FZ - FUNDAÇÃO ZERBINI (Protótipo (Pirineus))

Lista Prescrições Ver todas as admissões em aberto

Data: 09/03/2006 Ordenar por: Data/Hora Ult.Alteração

Un.Func.: UTIG4

Nome Médico: /

Pres	Leito	Matricula	Identificador	Paciente	Dispensado Totalmente	Dispensado Parcialmente	Com Item Suspenso	Com Rescisamento	Com Devolução	Triada	Alterada	Material não Dispensado	Pendente CCIH	Imp	Pres	Evol.	Méd.	Mat.	
<input checked="" type="checkbox"/>		/	/	/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	4038	/	/	/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
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<input type="checkbox"/>					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Impr. Seleção Fechar

Registro: 2/6 <OSC>

Triagem/Dispensação

Ação Editar Campo Registro Pesquisa Ajuda Janela

FZ - FUNDAÇÃO ZERBINI (Protótipo (Pirineus))

Data: 09/03/2006 Peso (Kg) Altura

Unid. Func.: UTIG4 Leito: 4038

Paciente: Ano Mes Dia

Médico: 29 0 30

Triagem

Ord	Cd. Item	Item	Qtd. Horario	Unid.	Via	Freq.	Qtd. p/24hs	Qtd. Dispensar	Unidade Disp.	Dt Prev. Prox. Disp	Bx Triado	Est?	Can	Disp.	St
9.00	111552X	OMEPRAZOL 40MG	1,00	AMP	iv	1xd	1,00	AMP	1,00	FRASCO/A	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N	P
10.00	11293305	HIDROCORTISONA,SUCC	50,00	MG	iv	6/6h	200,00	MG	200,00	FR.AMP	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N	P
12.00	11294802	L-TIROXINA SODICA 25M	25,00	MCG	sne	jejum	25,00	MCG	25,00	COMP	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N	P
13.00	11171376	DIPIRONA 1 G/2ML AMP.	2,00	ML	iv	sn 6/6h	2,00	ML	2,00	AMP	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N	P
14.00	11492200	GLICOSE 50% 250ML	250,00	ML	iv	aem	250,00	ML	250,00	FR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N	P
15.00	12010959	CALCIO CLORETO 10 O/C	1,00	AMP	iv	aem	1,00	AMP	1,00	AMPOLA	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N	P
16.00	12044660	METIL CELULOSE 1% 10	1,00	GTS		4xd	4,00	GTS	1,00	FRASCO	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N	P
17.00	11511254	CETOCONAZOL 2% (CRE				2xd			1,00	BISNAGA	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N	P

Descr. Item: HIDROCORTISONA,SUCCINATO SODICO DE,100MG

Observação:

Tria Todos Horários

Horário de Administração

09/03/2006 18:00:00 10/03/2006 00:00:00 10/03/2006 06:00:00 10/03/2006 12:00:00

Cons. Autorização Dispensação Imprimir Fechar

Registro: 19/25 <OSC>

CPOE (Nurse)

Confirmação De Horário (Enfermeiro)

Ação Editar Campo Registro Pesquisa Ajuda Janela

FZ - FUNDAÇÃO ZERBINI (Desenvolvimento (Kunlun))

Leito: [] Data da Prescrição: 16/09/2014 Unidade Funcional: UTI CIRURGICA II

Identificador: [] Paciente: [] Admissão: 02 10 118787

Matrícula: [] K Idade: 0 a 0 m 14 d Peso: [] Kg Altura: [] m

Médico: [] Profissional logado: flavia.matheus Ver todos Horários

Enf	Item	Prescrição	Qtd p/hora	Unid	Via	Freq	Observação	Status	Horário Sugerido	Hora Adm. Inicial
<input checked="" type="checkbox"/>	1.00	Testar posicionamento da sonda a						Administr...		16/09/2014 10:19:2
<input checked="" type="checkbox"/>	2.00	Controlar e anotar infusão de dieta por				3/3H		Suspensio	16/09/2014 15:00:00	
<input checked="" type="checkbox"/>	2.00	Controlar e anotar infusão de dieta por				3/3H		Não Adminis...	16/09/2014 18:00:00	
<input checked="" type="checkbox"/>	2.00	Controlar e anotar infusão de dieta por				3/3H		Administrad...	16/09/2014 11:00:00	16/09/2014 11:00:00
<input checked="" type="checkbox"/>	2.00	Controlar e anotar infusão de dieta por				3/3H		Suspensio	17/09/2014 00:00:00	
<input checked="" type="checkbox"/>	2.00	Controlar e anotar infusão de dieta por				3/3H		Não Adminis...	17/09/2014 03:00:00	
<input checked="" type="checkbox"/>	2.00	Controlar e anotar infusão de dieta por				3/3H		Pendente	17/09/2014 06:00:00	
<input checked="" type="checkbox"/>	2.00	Controlar e anotar infusão de dieta por				3/3H		Pendente	17/09/2014 09:00:00	
<input checked="" type="checkbox"/>	2.00	Controlar e anotar infusão de dieta por				3/3H		Pendente	17/09/2014 12:00:00	
<input checked="" type="checkbox"/>	3.00	Realizar Flush de _____ de água após				3/3H		Administrad...	16/09/2014 11:00:00	16/09/2014 11:00:00
<input checked="" type="checkbox"/>	3.00	Realizar Flush de _____ de água após				3/3H		Administrad...	16/09/2014 12:00:00	16/09/2014 12:00:00

Login Atualização: flavia.matheus 16/09/2014 10:19

Horários:

Dispensado: NÃO DISPENSADO ■ Administrado ■ Horário Vencido ■ Suspensio ■ Pendente ■ Não Administrado/Devolvido

Equipamentos / Gases Hemocomponentes Anotação Imprimir Anotação Fechar

Next to the bedside (ubiquitous systems)



- Mobile (Wireless);
- Robust;
- Ergonomic (screen, height, length)
- Battery autonomy (> 6hrs);
- Easy do Clean (keyboard & mouse washable);
- Multiple users (Physician, Nurse and Pharmacist);

We still need new solutions



MedKart InCor com módulo para dispensação de medicamentos.



The last mile!
Drug administration controlled by the system (who accessed the drug case, what time, ...)



iNYP Logout Search

Patient List Registry Patient Data

Profile History/Timelines **Data Review** Summaries

EMPI: NYP/CU: CMC:

Filter:	Go	Eclipsys Note - Columbia University (20	-10-17,20	-05-08)	More	Print
Cardiology Consult Follow-Up Free Text Note			20	-10-15 17:32	Final	NYP/CU
SW High Risk Screen			20	-10-15 13:34	Final	NYP/CU
Pastoral Visit Adult			20	-10-15 13:07	Final	NYP/CU
Milstein Hospitalist Resident/PA Follow-Up Free Text Note			20	-10-15 11:00	Final	NYP/CU
Procedure Note, Time Out Not Required			20	-10-14 19:44	Final	NYP/CU
Medicine Follow-Up Free Text Note			20	-10-14 08:06	Final	NYP/CU
Transfusion Nursing Note			20	-10-14 00:32	Final	NYP/CU
Nephrology Consult Free Text Note			20	-10-13 18:52	Final	NYP/CU
Milstein Hospitalist Attending Follow-Up Free Text Note			20	-10-13 15:27	Final	NYP/CU
Critical Test/Values Results Reporting			20	-10-13 11:13	Final	NYP/CU
Cardiology Consult Follow-Up Free Text Note			20	-10-12 15:40	Final	NYP/CU
Milstein Hospitalist Resident/PA Follow-Up Free Text Note			20	-10-12 11:02	Final	NYP/CU
Milstein Hospitalist Attending Follow-Up Free Text Note			20	-10-11 19:17	Final	NYP/CU
Milstein Hospitalist Resident/PA Follow-Up Free Text Note			20	-10-11 16:43	Final	NYP/CU
Cardiology Consult Free Text Note			20	-10-10 14:14	Final	NYP/CU
Medicine Follow-Up Free Text Note			20	-10-10 14:10	Final	NYP/CU
Case Manager Plan Of Care			20	-10-10 09:31	Final	NYP/CU
Initial Nutrition Assessment			20	-10-09 16:25	Final	NYP/CU
Milstein Hospitalist Resident/PA Follow-Up Free Text Note			20	-10-09 11:58	Final	NYP/CU
Milstein Hospitalist Resident/PA Follow-Up Free Text Note			20	-10-08 11:21	Final	NYP/CU
Cardiology Free Text Note			20	-10-08 09:19	Preliminary	NYP/CU
Nursing Adult Admission History			20	-10-07 06:24	Final	NYP/CU
Medicine Admission Free Text Note			20	-10-07 03:30	Final	NYP/CU
Transfer Note			20	-10-07 00:55	Final	NYP/CU
Emergency Department Disposition Note			20	-10-06 21:42	Preliminary	NYP/CU
Emergency Resident / Nurse Practitioner / Attending Note (Milstein)			20	-10-06 19:04	Final	NYP/CU

Expand Print

Cardiology Consult Free Text Note ■ 20 -10-10 14:14

Cardiology Consult

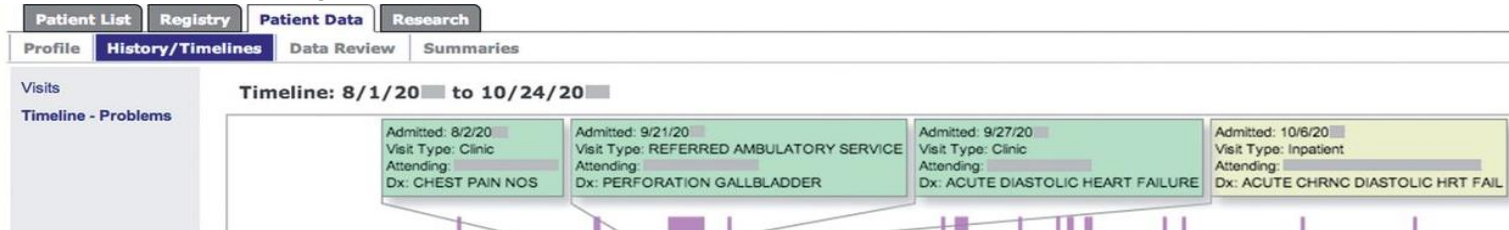
Requested by: Dr. [REDACTED]

Reason: Fluid overload

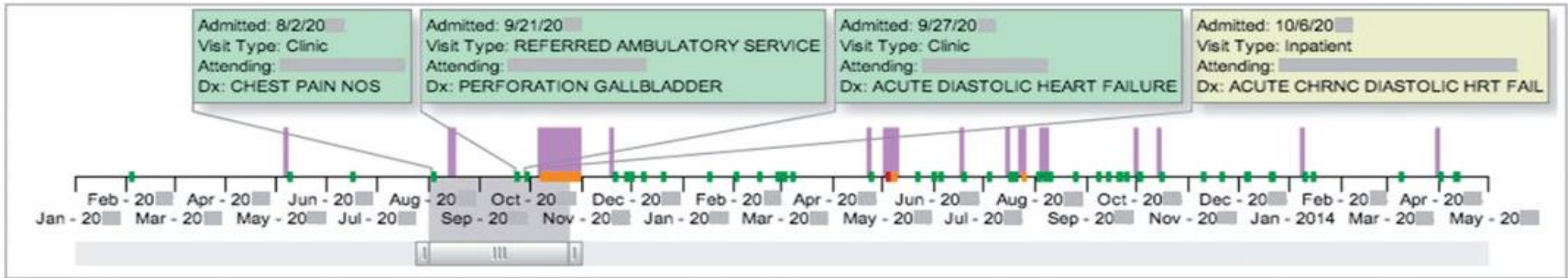
HPI: 57 yo woman with a pmhx significant for morbid obesity, HTN, HLD, DM2, CKD (stage V) not on RRT and making urine, CAD s/p mLAD DES in 7/20 [REDACTED], and pulmonary HTN (based on RHC on 7/20 [REDACTED] who presents with signs and symptoms of fluid overload. Cardiology is being asked to consult for further management. In regards to the patient's functional status, the patient lives a sedentary lifestyle and is now on disability. Over the course of the past month, she has had increasing fluid accumulation with a weight gain of over 25 kg, with worsening LE edema and facial puffiness. Prior to 1 month ago, her ET was 2 blocks, but has now decreased to 15 feet limited by SOB and occasionally with CP. Furthermore, she has a 6 pillow orthopnea that has been stable for 4 years but has had worsened PND this past month. The patient also reports 3 months of intermittent chest pain. She describes the pain as sharp, retrosternal, and located in the center of the chest, lasting 5 minutes with 1-2 episodes per week. These episodes occur at rest, and improved by sitting up and taking an aspirin.

PMHx:

- Morbid obesity
- HTN
- HLD
- DM2
- CKD (stage V) not on RRT and making urine
- CAD s/p mLAD DES in 7/20 [REDACTED]



Timeline: 8/1/20 to 10/24/20

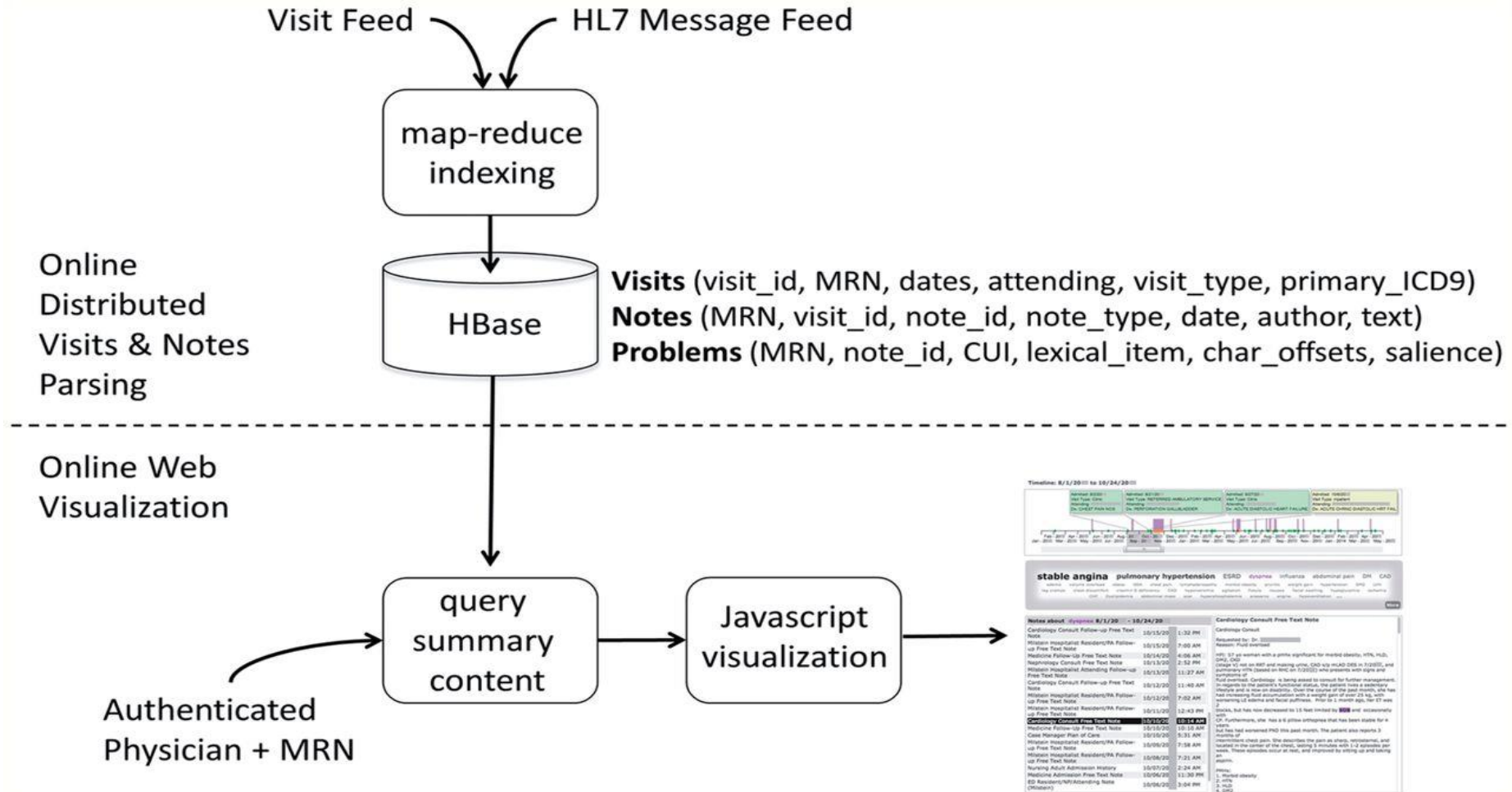


stable angina pulmonary hypertension ESRD **dyspnea** influenza abdominal pain DM CAD
 edema volume overload obese OSA chest pain lymphadenopathy morbid obesity pruritis weight gain hypertension DM2 LVH
 leg cramps chest discomfort vitamin D deficiency CKD hyponatremia agitation fistula nausea facial swelling hypoglycemia ischemia
 CHF Dyslipidemia abdominal mass scar hyperphosphatemia anasarca angina hypoventilation ...

More

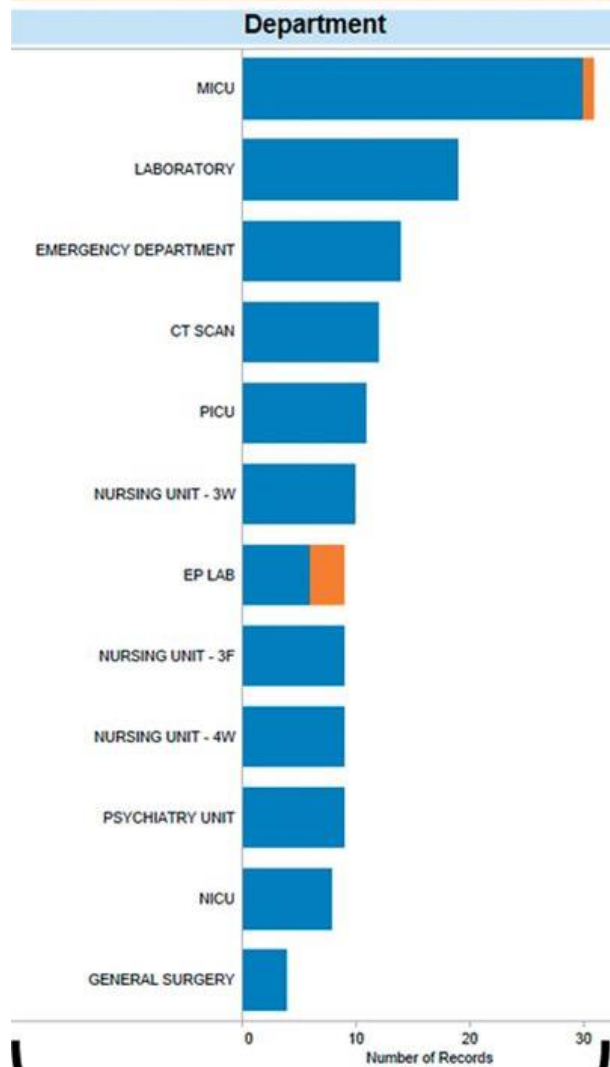
Case Manager Plan of Care	10/10/20	5:31 AM	months of intermittent chest pain. She describes the pain as sharp, retrosternal, and located in the center of the chest, lasting 5 minutes with 1-2 episodes per week. These episodes occur at rest, and improved by sitting up and taking an aspirin. PMHx: 1. Morbid obesity 2. HTN 3. HLD 4. DM2
Milstein Hospitalist Resident/PA Follow-up Free Text Note	10/09/20	7:58 AM	
Milstein Hospitalist Resident/PA Follow-up Free Text Note	10/08/20	7:21 AM	
Nursing Adult Admission History	10/07/20	2:24 AM	
Medicine Admission Free Text Note	10/06/20	11:30 PM	
ED Resident/NP/Attending Note (Milstein)	10/06/20	3:04 PM	

A proposal of architecture.

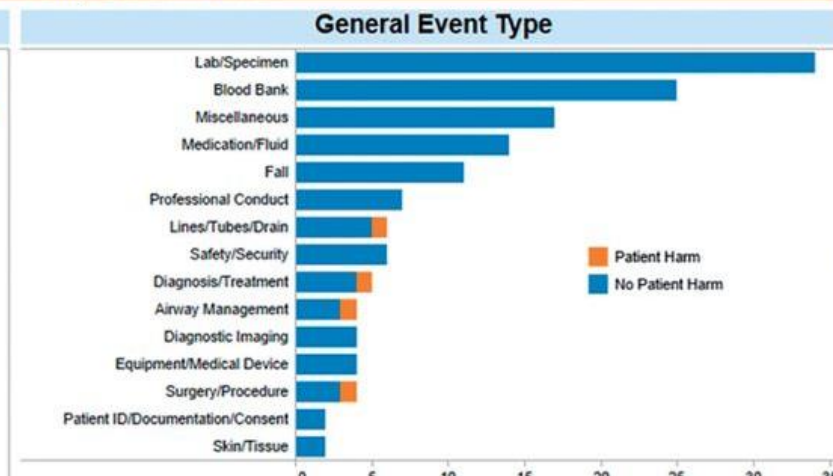


Analytics & Patient Event Reports

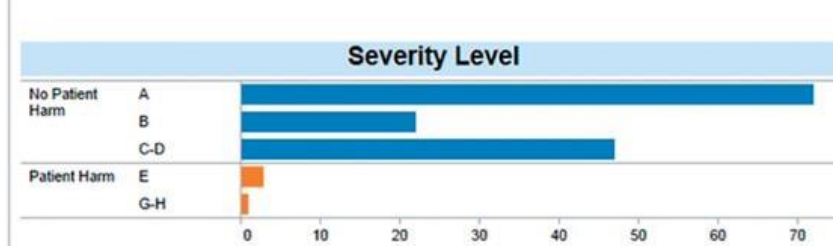
Weekly Dashboard



Count of events by department and severity level



Count of events by event type and severity level



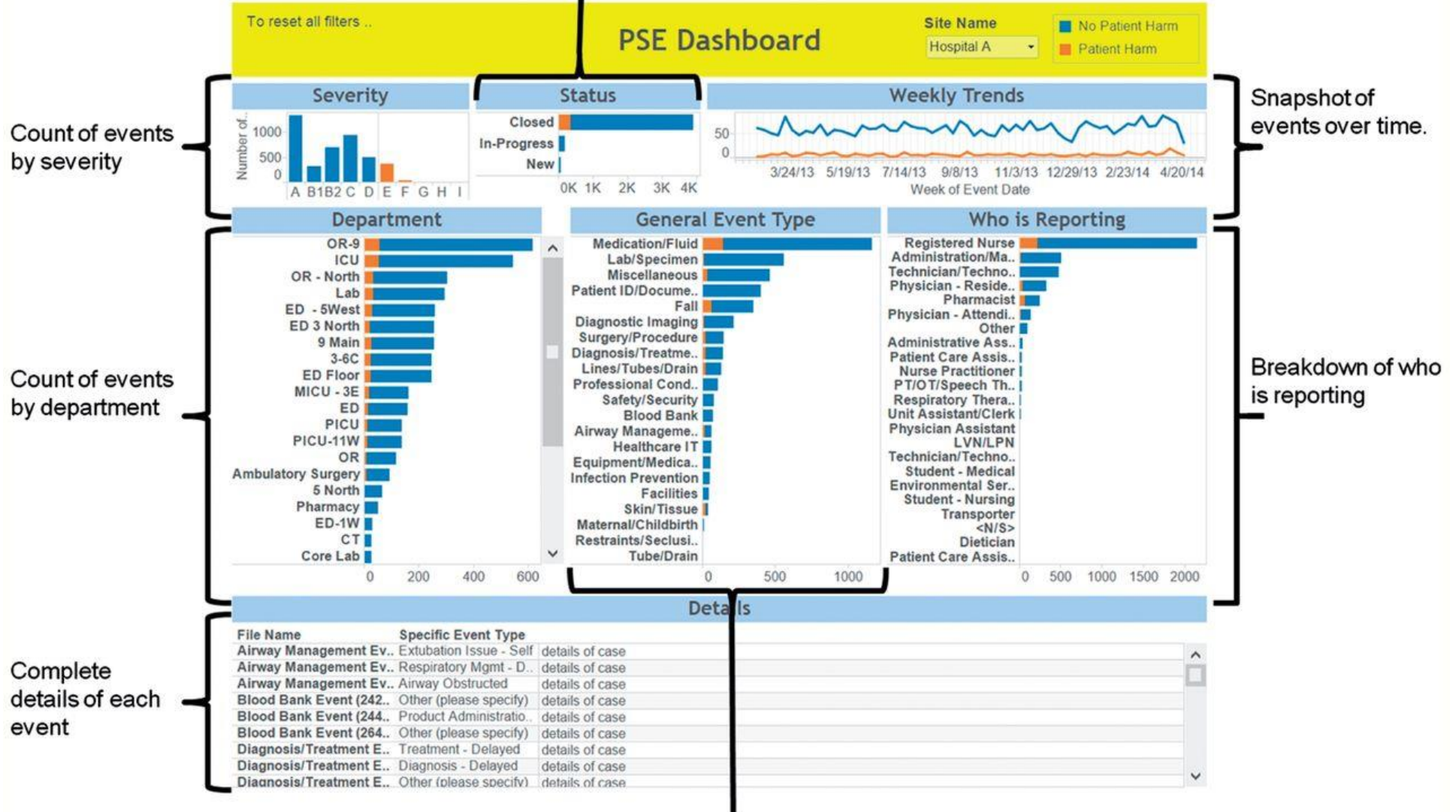
Count of events by severity level

File Name	Day of Event Date	Detailed description of case - free text field
Report 1	November 18, 2013	Detailed description of case - free text field
Report 2	November 17, 2013	Detailed description of case - free text field
Report 3	November 20, 2013	Detailed description of case - free text field
Report 4	November 21, 2013	Detailed description of case - free text field
Report 5	November 14, 2013	Detailed description of case - free text field
Report 6	November 20, 2013	Detailed description of case - free text field

Specific details of the events

Analytics & Patient Event Reports

Review status of events



Count of events by severity

Snapshot of events over time.

Count of events by department

Breakdown of who is reporting

Complete details of each event

Count of events by general event type



The visual analytics dashboard user interface consists of a **central display region** with **tabular and graphical data representations**, as well as a variety of relevant filtering options framing the central display region.



Summary

Information processing:

- **Is an important quality factor**, but an **enormous cost factor as well**;
- Is becoming a **productivity factor**
- Should offer a **holistic view of the patient** and of the hospital.

A hospital information system can be regarded as the memory and nervous system of a hospital;

IT has become economically important and decisive for the quality of healthcare. It will continue to change healthcare

Summary

- The integrated processing of information is important because:
 - **all groups of people and all areas of a hospital depend on its quality,**
 - **the amount of information processing in hospitals is considerable, and health care professionals frequently work with the same data**
- The systematic processing of information:
 - **contributes to high-quality patient care, and**
 - **reduces costs**
- Information processing in hospitals is complex and therefore we need:
 - the **systematic management and operation of hospital information systems,** and
 - **medical informatics specialists responsible for the management and operation of hospital information systems**

Thank you!

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CBMS 2015

