HEALTHCARE IT MANAGEMENT

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THE OFFICIAL JOURNAL OF THE EUROPEAN ASSOCIATION OF HEALTHCARE IT MANAGERS

EHRs: TECHNOLOGY ACCELERATES THEIR GROWTH

- MEDICAL IMAGE PROCESSING
- INTEGRATING LIS IN CLINICAL LABORATORIES
- DESIGNING A HIGH -PERFORMANCE TELEMEDICINE SYSTEM

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HEALTHCARE IT MANAGEMENT

Letter from the Publisher

Dear Reader,

Welcome to the first issue of *Healthcare IT Management*, the official voice of the European Association of Healthcare IT Managers (EAHITM), a central, credible communications platform to its members and relevant stakeholders.

Healthcare systems in Europe are complex, both in terms of organisation and technologies. Nevertheless, the eEurope 2005 Action Plan sets out goals and targets of a European cooperation in the field of health ICT and several actions towards a competitive internal market are already being taken at a fast rate. This and many other reasons make it vitally important to unify the sector of healthcare IT users. EAHITM, the umbrella organisation for national healthcare IT manager associations across Europe, will take a leading role in this process. EAHITM believes there is an extensive need for modern and common standards, best practice solutions and cross-border collaboration within healthcare IT. Only a powerful official representation for healthcare IT managers will ensure the stable evolution of this sector.

The launch of Healthcare IT Management is a logical and vital step in this process. This bi-monthly official publication will bring you amongst other issues the latest developments within EAHITM and the European Institutions, technical trends and developments, best practice solutions, efficient management strategies, relevant to healthcare IT managers. Leading authorities from all over the world will find their target audience in this unrivalled publication.

In this inauguration issue we explore: the selection, implementation and new technologies of Electronic Health Records; the quality, safety and performance of European healthcare IT, and the first in a three-part series exploring the steps taken to design a high-performance telemedicine system. Our product comparison chart assesses different manufacturers' cardiology image and information management systems. In addition to these and other topics, you will also regularly read about the EU institutions and how to lobby them. Finally, in our first Country Focus we will take an in-depth look into the UK healthcare IT sector.

Your support, your opinions and suggestions are important to us. Please contact our Managing Editor, Karmin Ruocco, at k.ruocco.me@eahitm.org with your comments, thoughts and contributions. Your support is vital and always well received!

Always yours

Christian Marolt
Publisher

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INTEGRATED HUMAN RESOURCES MANAGEMENT

ORACLE MANAGES THE NHS HUMAN RESOURCES SYSTEM

As healthcare organisations struggle to streamline and automate their workforce management – do more with less – empowering the workforce is key to attracting and retaining the best employees and clinicians, reducing administrative costs and improving quality of patient care. To achieve this goal, organisations require applications that are easy to use, offer self-service capabilities and are integrated with critical enterprise systems.

Oracle HRMS (HR Management System) responds to these crucial needs and has been selected to achieve the daunting task of running NHS HR and payroll solutions: the NHS in England and Wales employs 1.2 million people within approximately 600 different organisations, is the third largest employer in the world, and comprises thousands of different payroll and HR processes. The initial pilot was completed in 2005, and comprised 39 organisations with 108,000 employees as a test group. Due to the success of the pilot program, the NHS will be rolling out the Oracle based product suite to all of the NHS in a series of 12 waves beginning in early 2006.

Jim O'Connell, a former NHS HR Director and now ESR (Electronic Staff Record) Program Director for the NHS, has been overseeing a complex 5 year project to introduce a single, integrated HR and Payroll solution in the NHS. He is now responsible for the new HR and Payroll solution for England and Wales, and, as overseer of the largest Oracle HRMS Site in the world, endorses the Oracle HRMS solution.

AUTOMATION

A healthcare organisation's ability to differentiate itself assists in attracting and retaining quality employees. To stay ahead of the competition, healthcare organizations are deploying online portals to provide a collaborative environment for real-time recruitment. In that respect, the NHS test sites are now using a comprehensive system that allows for automated payroll, recruiting and training administration, as well as employee and manager self-service. Jim O'Connell explains that the goal of ESR, as soon as the pilot sites start using the full suite of modules, is to "free employees to spend less time on paperwork and administration, and more time providing value added service."

EMPOWERMENT

With Oracle HRMS, healthcare organisations can efficiently identify, measure and record employee competencies. They can accurately measure their workforce responsibilities against their own goals, thus removing unnecessary barriers between management and the timely information they need for optimal proficiency.

This system also empowers employees to do more. The self-service functions of the software mean that employees are able to manage their own data. Jim O'Connell reminds that "the NHS recruits about 250,000 people annually, but only about 20% from outside the NHS. With Oracle HRMS, each employee will have a portable record that can follow him/her throughout their career within the NHS. Prospective employees will use their (e-recruitment) electronic application form as a basis for their employee records upon hiring."

Beside the obvious administrative and financial gains, an intangible benefit is the ownership and a sense of belonging that the employee will feel towards the organisation and an increased control of their own career, resulting in higher retention and stronger employee loyalty. As far as the NHS is concerned, the reporting functionality allows the organisation to understand their workforce better. This helps in planning, decision making, and the effective deployment of the workforce.

SECURITY

Last but not least, main concerns about technological progress and healthcare IT solutions often revolve around essential privacy and confidentiality requirements, which can indeed be jeopardized by inadequate software applications. Oracle HRMS security features, however, allow for all c600 NHS organisations to maintain their own Virtual Private Database, with strict guidelines as to data sharing. This prioritises the overall security of the system, while allowing free sharing of necessary and authorised data. The User Responsibility Profile (UPR) limits examination of data to pre-assigned levels of employee access. The NHS has customised c30 different levels of access, to coincide with the users' duties.

For more information contact ie@oracle.com

Jim O'Connell
ESR Program Director

HEALTHCARE IT MANAGEMENT

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The European Association of Healthcare IT Managers (EAHITM)

The Association

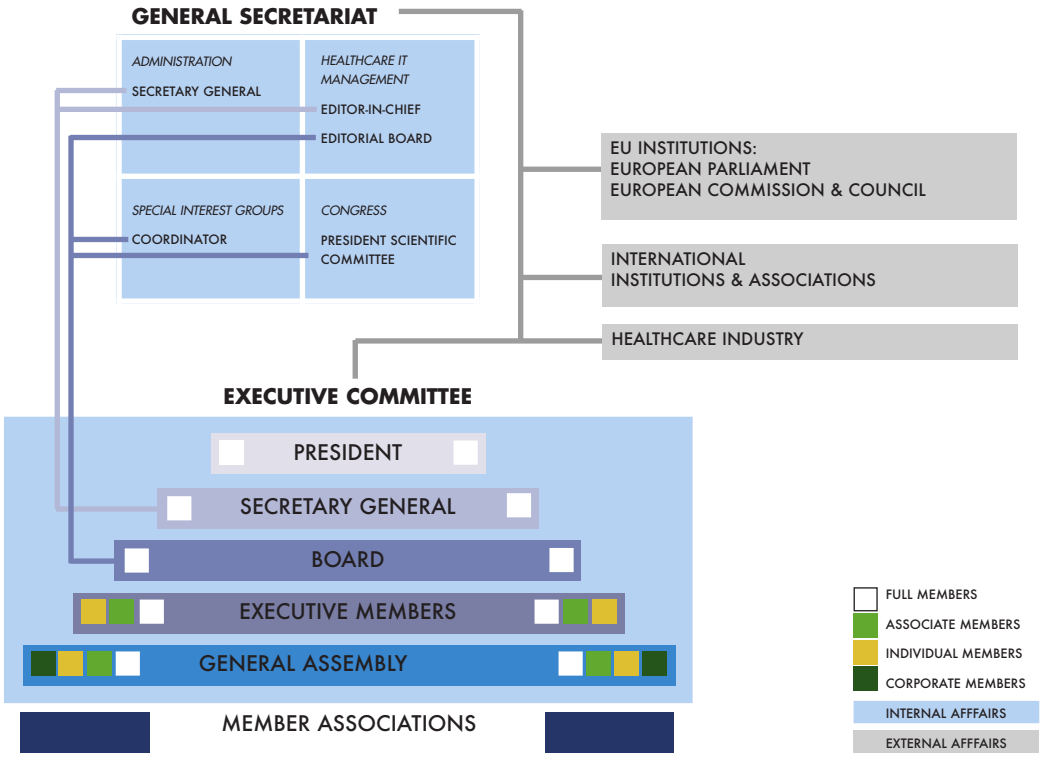
EAHITM is a non-profit organisation outlined as the pan-European umbrella association of all relevant national healthcare IT associations in Europe. Believing in the fundamental importance of unifying healthcare IT professionals at European and global levels, EAHITM is committed to increasing the professional authority and responsibility of healthcare IT managers and representing their interests to international institutions and associations. With membership in EAHITM steadily growing, the first annual General Assembly is being planned for the end of 2006.

Mission

The mission of EAHITM is:

+ to establish common healthcare IT standards, policies and strategies at EU and international levels;
+ to increase the visibility, importance and role of IT management in healthcare facilities;
+ to educate key policy makers, industry players and the general public of the benefits of healthcare IT, and
+ to promote cross-collaboration of various healthcare sectors

Organisational Structure



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Membership

As the only pan-European association dedicated to healthcare IT management, EAHITM offers its members unique opportunities to:

+ participate in advocacy groups that impact EU healthcare IT legislation;
+ share your knowledge with and learn from the experiences of your peers;
+ learn industry best practices and standards, and
+ attend the EAHITM annual General Assembly, Congress and other special events.

Membership in EAHITM consists of three levels:

Full Members	
Category A	€ 2,500
Category B	€ 1,800
Category C	€ 1,000
Associate Members	
Category A	€ 1,500
Category B	€ 1,000
Individual Members	€ 40
Corporate Members	

Contact us for more information

Full Members

Full members are comprised of national healthcare IT management associations, with the opportunity to nominate one representative to the EAHITM annual General Assembly. This representative will have the power to speak and vote on EAHITM priorities & organisational objectives, fundamental advocacy efforts, election of the Executive Members and the Board, and much more.

Associate Members

Associate members are representatives from healthcare IT organisations, with the opportunity to speak, but not vote, at the EAHITM annual General Assembly. Associate members will also have the privilege of electing one member to represent them in the Executive Members group.

Individual Members

Individual members are directly involved with healthcare IT management, with the opportunity to elect one member with the power to speak, and vote at the EAHITM annual General Assembly. Individual members will also have the privilege of electing one member to represent them in the Executive Members group.

Corporate Members

Corporate members are representatives from corporations engaged in supplying products and services to the healthcare IT sector. While corporate members may attend the annual General Assembly, they do not have the power to speak or vote. However, corporate members may elect one member from amongst the Diamond Founding Supporters to represent them in the Executive Members gro

Opportunities for Corporate Support

The successful establishment of this critically needed Association will not be possible without the support of industry leaders. EAHITM therefore offers several opportunities to contribute to the growth and development of EAHTIM. Participation as a Founding Corporate Supporter gives your organisation a powerful marketing edge with indispensable benefits that allow you to connect with new prospects and reinforce your message with existing clients. Most importantly, your sponsorship efforts prove you are more than just a vendor - you are an innovative leader who supports our goals.

For more information on membership or corporate support opportunities, please contact Karmin Ruocco, Project Director of EAHITM, at k.ruocco.pd@eahitm.org.

European Association of Healthcare IT Managers
Membership Application

❑ **Yes,** I would like to apply for membership with the EAHITM as Organisation

❑ **Yes,** I would like to apply for membership with the EAHITM as Individual

Organisation Information

Organisation Name:

.....

City/Town:

.....

Country:

.....

Street Address:

.....

Postal Code

.....

Website:

.....

Personal Information (representative of association above or individual applicant)

Preferred title:

.....

First Name:

.....

Position:

.....

Department/Division:

.....

Email Address:

.....

Fax:

.....

Gender:

.....

Surname:

.....

Function:

.....

Telephone:

.....

GSM:

.....

Membership categories per year

(in the start-up process all are valid until December 2007):

Full Members: (directly involved in healthcare IT management)

❑ Cat. A - Associations with more than 2,500 members (€2,500)

❑ Cat. B - Associations with more than 1,000 members (€1,800)

❑ Cat. C - Associations with less than 1,000 members (€1,000)

❑ I apply for an initial reduction of my membership fee of 50%, valid until 30 June 2006

Associate Members (indirectly involved in healthcare IT management)

❑ Cat. A - Associations with more than 1,000 members (€1,500)

❑ Cat. B - Associations with less than 1,000 members (€1,000)

As part of their membership benefits, Full and Associate Members will receive a subscription to *Healthcare IT Management* for all of its members.

Individual Membership: (directly involved in healthcare IT management)

❑ Yearly membership, including a one-year subscription to *Healthcare IT Management* (€ 40)

Corporate Membership (Companies working in the IT field)

❑ **Please send me an offer.**

For more information on joining the European Association of Healthcare IT Managers, please contact Karmin Ruocco, Project Director, at k.ruocco.pd@eahitm.org.

The following companies would like to wish
the European Association of Healthcare IT Managers
a successful future.

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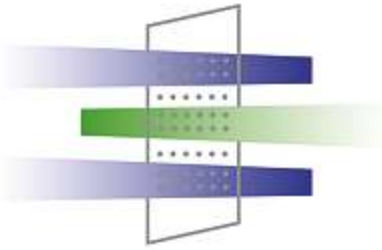

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MISYS

Philips Showcases Integrated Healthcare Information Technology Solutions

At the Healthcare Information Management and Systems Society (HIMSS) conference in San Diego, Philips demonstrated its portfolio of integrated healthcare information technology (HIT) solutions, aimed at reducing medical errors, improving patient safety and workflow efficiencies and moving hospitals closer to the adoption of Electronic Health Records (EHRs).

Oran Muduroglu, CEO of Healthcare IT for Philips Medical Systems, stated "this strategy is complemented by our demonstrated leadership in open architecture integration leveraging our iSite PACS Application Programming Interface (API), which enables best-of-breed integrations with multiple specialty vendors."

In the demonstration, Philips showcased Xtenity Enterprise integrated with Philips IntelliVue monitors, iSite PACS solutions and SpeechMagic voice recognition technology. According to Philips, this HIT solution represents the company's approach to patient-centric care, and was demonstrated through the story of Ana, a fictional patient who experiences the patient care cycle from home to an ambulatory visit, to an inpatient stay, and finally back home again.

eHealth Success Stories to be Showcased at Tromsø Conference 23-24 May

At Tromsø Telemed, the third annual European ministerial conference on eHealth, jointly organised by the European Commission and the Norwegian government, best practices in eHealth will be showcased to the public. Among the success stories from European research in eHealth, several projects such as clothing that actively monitors health data, more accurate instruments for keyhole surgery, health websites that facilitate more reliable and better quality health information, and an integrated health platform that captures and processes information for chronically ill patients will be on display.

CERNER AND MISYS EARN RECOGNITION AND REWARDS FROM KLAS

In the 2006 KLAS CPOE Digest, Cerner was announced as an industry leader in providing healthcare information technology solutions. In its fourth annual CPOE Digest report issued on 10 February 2006, KLAS reported that Cerner's CPOE solution, based on its Cerner Millennium architecture, offers the highest value proposition for providers.

The report, an impartial summary of the CPOE market, focused on using CPOE in live inpatient and major ambulatory facilities in North America. The report focused on four primary areas of evaluation for measuring CPOE value: physician buy-in; depth of use; solution types, and patient safety, alerts and reminders. According to Kent Gale, President of KLAS, "The annual KLAS CPOE Digest report provides the healthcare industry with a measurable scorecard of healthcare IT usage and value specific to computerised physician order entry. By providing this unique tool, our objective is to help healthcare IT companies continue to improve the healthcare experience for customers. Cerner's continued strong results on our CPOE Digest demonstrate aggressive use of the Cerner Millennium solution for patient care."

This is the second year that Cerner has received the highest value proposition score in the annual KLAS CPOE Digest report.

In addition, Misys Healthcare Systems also continued its strong performance in the annual KLAS ratings with its acute-care departmental products and EHR offerings, earning high marks. KLAS recognises healthcare vendors for their leadership in working with customers to resolve issues and match expectations to reality.

Misys Laboratory and Misys Radiology were designated as "2005 Best in KLAS" for placing first in their respective market solution categories for the second year in a row. Misys' leading EHR solutions – Misys CPR, Misys EMR and Misys Homecare – as well as their enterprise practice management solution, Misys Vision, were also among the leaders in their categories, or showed improvements from last year.

KLAS Enterprises is an organisation dedicated to improving healthcare information technology delivery. During the assessment process, KLAS performs in-depth, confidential interviews with IT executives and department directors to gather insight into specific strengths, weaknesses and future expectations of the products being reviewed.

Ekahau and Symbol Technologies Team Together to Location-Enable Passive RFID Tags

At RFID World on 27 February, Ekahau and Symbol Technologies announced a radio frequency identification (RFID) solution that promises more efficient tracking of the location of inventory and assets. The first applications of this new application will use a mobile computing RFID reader, which incorporates wi-fi location-enabling software designed to locate where RFID tags are being read.

Ekahau system is the only software-based, real-time location system on the market today. Leveraging existing Wi-Fi networks, the patented positioning technology, based on site calibration, can identify the location of tracked objects within a few metres.

Explaining the EU

The European Commission

This is the first in a four part series which covers the structure and operations of the EU institutions. In this part, we will introduce the European Commission, how it functions and what the relevant Directorates-General are for healthcare IT.

In the second of the series, the composition, functioning and main role of the European Parliament will be discussed. The third installment exmines the structure, role and operation of the Council of the European Union. Representations on the Council, the decision-making process and a careful distinction between the European Council and the Councils of Europe and the European Union will also be included. Finally, in the fourth part of the series, the European Court of Justice will be discussed.

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Presenting the EU´s executive body

The European Commission is the European Union´s executive body and carries out its day-to-day operations. Its official seat is in Brussels (Belgium), although it also has offices in Luxembourg, representations in all EU countries and delegations in many capital cities around the world. The Commission comprises the President, currently Mr. José Manuel Barroso, 25 Commissioners, one for each country, and approximately 24,000 members of staff. The Commission must be able to act with complete independence from the governments of Member States; its members represent the EU as a whole, and not their respective native countries.

Staff

The administrative staff manages the daily work of the Commission, and is organised into departments, known as "Directorates-General" (DG) and "Services", such as DG Information Society, Informatics Service. Each DG is responsible for a particular policy area and is headed by a Director-General who is answerable to one of the Commissioners.

Designing a legislative proposal

Under the Treaty, the Commission has the "right of initiative"; in other words, it is responsible for drawing up proposals for new European legislation. The Commission proposes action at EU level only if it believes that a problem cannot be solved more efficiently by national, regional or local action. This principle is called the "subsidiary principle".

For example, if the Commission recognises a need for EU legislation to protect data privacy, DG Freedom, Security and Justice will draw up a proposal, based on extensive consultations with national Justice ministries in the Member States and international organisations concerned with privacy issues.

The proposed legislation is then discussed with all relevant Commission DGs and amended, if necessary. It will then be checked by the Legal Service and approved by the Commissioners' "Cabinets", which comprise the Commissioners' personal political staff.

Once the proposal is completed, the Secretary-General places it on the agenda for a forthcoming Commission meeting. The "college" of 25 Commissioners meets once a week in Brussels. At this meeting, the Freedom, Security and Justice Director-General explains the proposal to colleagues. If agreed, the college of Commissioners "adopt" the proposal and send it to the Council and the European Parliament for consideration. If there is disagreement among the Commissioners, the President initiates a vote. If a majority is in favour, the proposal is adopted by the Commission and forwarded for consideration by the Council and Parliament.

Directorate-General organigram

- Commissioner + personal Cabinet
- Director General
- Dep. Director-General, if appointed
- Directors
- Heads of Units
- Normal staff in a unit

What happens when multiple DGs are involved in a legislative proposal?

Because of the horizontal nature of certain issues, legislative proposals will sometimes fall all under the responsibility of more than one DG in the Commission. For example, in the case of data privacy, DG Information Society & Media shares responsibility for its development and implementation with DG Internal Market and DG Freedom, Security and Justice. In such circumstances, a proposal for new legislation is assigned to one DG, who then consults the other DGs involved during the legislative process.

Proposing legislation to the Commission

Individuals or national or European organisations can raise an issue

continued on page 4

Your relevant Directorates-General and Commissioners

In this article, we give an overview of the European Commission Directorates-General active in policies relevant to healthcare IT and present examples of their legislation, activities and contact details.

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DG Information Society and Media
Commissioner Viviane Reding

Correspondence:
European Commission, DG Information Society, BU 24 0/41, Rue de la Loi 200, B-1049 Brussels, Belgium

Most relevant to healthcare IT, this DG is responsible for EU policy on:

- eHealth and eLearning developments in the European Union;
- radio spectrum policy / wireless communications;
- broadband;
- security of networks and data;
- digital rights management;
- overcoming obstacles to 3G deployment;
- ambient intelligence;
- health related effects of exposure to electromagnetic fields, and
- the quality of health related websites.

Examples of EU legislation and activities in these fields:

- the *e*Europe Action Plan, which addresses health telematics infrastructures, establishes best practices for electronic health services in Europe & quality criteria for health-related websites, and the establishment of health technology and data assessment networks
- launched in July 2003, the Electronic Communications Regulatory Framework, safeguarding radio spectrum resources to include: wireless communications, the use of satellite wireless communications, the use of satellite technologies, mobile telephony and scientific research;
- establishing the development of information society technologies as a priority within the EU's Sixth Framework Programme;
- a Directive on privacy and electronic communications;
- annual Conferences on eHealth, including the upcoming eHealth 2006 Conference in Malaga, Spain 10-12 May and IST 2006 in Helsinki, Finland 22-24 November, and
- political action calling on governments and the private sector to make better use of information and communication technologies (ICT) in Europe's healthcare systems.

DG Enterprise & Industry
Commissioner Günter Verheugen

Correspondence:
European Commission, Enterprise DG, Rue de la Loi 200, B-1049 Brussels, Belgium

This DG is responsible for EU policy on:

- telecommunications;
- information and communication technologies;
- electrical risk and electrical equipment, and
- medical devices.

Examples of EU legislation and activities in these fields:

- harmonised standards for radio & telecommunications terminal equipment;
- harmonised standards for electromagnetic compatibility, and
- with regards to medical devices, the European Community's involvement concerns mainly the regulatory framework for market access, international trade relations and regulatory convergence, and the competitiveness of industry. In May 2005, the Commission started a public consultation process to improve public health and safety of medical devices.

DG Health and Consumer Protection (known as DG "SANCO")
Commissioner Markos Kyprianou

Correspondence: European Commission, DG Health and Consumer Protection, Rue de la Loi 200, B-1049 Brussels, Belgium

This DG is responsible for EU policy on:

- public health: including health information networks, eHealth initiatives, electronic health cards, and health information privacy and protection, and
- dissemination of health information and data.

Examples of EU legislation and activities in these fields:

- a Decision in December 2004 to set up the 'Executive Agency for the Public Health Programme', for the management of Community action in the field of public health;
- in conjunction with DG Information Society and Media, the *e*Europe Action Plan (adopted in June 2000), and
- in February this year, the Commission launched the Health Information Project, which aims to foster the exchange of health information across Europe.

DG Employment, Social affairs and Equal Opportunities
Commissioner Vladimir Spidla

Correspondence: European Commission, DG Employment and Social Affairs and Equal Opportunities, Rue Joseph II 37, B-1049 Brussels, Belgium

Relevant to healthcare IT, this DG is responsible for EU policy on:

- labour law and work organisation;
- health and safety at work, including exposure to electromagnetic fields, radiation and visual display units, and
- free movement of workers.

Examples of EU legislation in these fields:

- the Directive concerning certain aspects of the organisation of working time, currently in revision;
- a Directive on minimum health and safety requirements in working with display screen equipment;
- a recent Directive on exposure to electromagnetic fields, and
- a Directive on the right of citizens of the Union and their family members to move and reside freely within the territory of the Member States.

DG Internal Market and Services
Commissioner Charlie McCreevy

Correspondence: European Commission, DG Internal Market and Services, Rue de la Loi 200, B -1049 Brussels, Belgium

This DG is responsible for EU policy on:

- electronic public procurement;
- data protection;
- electronic commerce and online services, i.e. electronic pay services and smart cards;
- free movement of persons, i.e. mutual recognition of professional qualifications, and
- free movement of services.

Examples of EU legislation and activities in these fields:

- adopted in June 2000, the eCommerce Directive establishing the harmonisation of rules and transparency requirements for online service providers, commercial communications, electronic contracts and limitations of liability of intermediary service providers;
- a Directive on the legal protection of electronic pay services (including the piracy of smart cards);
- a Directive relating to the recognition of professional qualifications, adopted on 6 June 2005, and
- a Directive on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts, in force since April 2004.

DG Research
Commissioner Janez Potocnik

Correspondence: European Commission, DG Research, SDME 7/15, B-1049 Brussels, Belgium

This DG is responsible for EU policy on:

- ICT research and development;
- creating a regulatory environment that enables the rapid development of services based on information, communications and audio-visual technologies;
- encouraging the widespread availability and accessibility of ICT-based services, and
- promoting a better understanding of the role of science in modern societies .

Examples of EU activities in these fields:

- A European Research Framework Programme (the 7th programme is currently in preparation and due to start in 2007) that helps to organise and financially support cooperation between universities, research centres and industries, and
- the creation of a European Research Area which is regrouping all Community support for the better coordination of research activities and the convergence of research and innovation policies, at national and EU levels.

DG Freedom, Security and Justice
Commissioner Franco Frattini

Correspondence: European Commission, DG Justice, Freedom and Security, B-1049 Brussels, Belgium

This DG is responsible for EU policy on:

- data protection;
- data privacy, and
- the transfer of data to third countries.

Examples of EU activities in these fields:

- a Directive on the protection of individuals with regards to the processing of personal data;
- decisions on the adequacy of the protection of personal data in third countries, and
- developing model contracts for the transfer of personal data to third countries.

Cardiology Image and Information Management Systems (CIIMS)

ECRI Europe
A NONPROFIT AGENCY

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ECRI (formerly the Emergency Care Research Institute) is a nonprofit health services research agency and a Collaborating Centre of the World Health Organization (WHO). Such organisations are appointed to contribute to the WHO's public health mission by providing specialised knowledge, expertise and support in the health field to the WHO and its member nations. ECRI's mission is to improve the safety, quality, and cost-effectiveness of healthcare. It is widely recognised as one of the world's leading independent organisations committed to advancing the quality of healthcare with over 240 employees globally.

ECRI's focus is healthcare technology, healthcare risk and quality management, patient safety improvement and healthcare environmental management. It provides information services and technical assistance to more than 5,000 hospitals, healthcare organisations, ministries of health, government and planning agencies, voluntary sector organisations, associations, and accrediting agencies worldwide. Its more than 30 databases, publications, information services, and technical assistance services set the standard for the healthcare community.

ECRI's services alert readers to healthcare system and technology-related hazards with strategies to correct them; disseminate the results of medical product evaluations and health technology assessments; provide expert advice on technology acquisitions, staffing, and management; report on hazardous materials management policy and practices; and supply authoritative information on risk control in healthcare facilities and clinical practice guidelines and standards.

Amongst its many products and services, ECRI is pleased to provide the readers of *Healthcare IT Management* with sample information on products for cardiology image and information management from its Healthcare Product Comparison System (HPCS), which contains over 280 reports. The HPCS reports contain extensive information about the technology, its purpose, its principles of operation, stage of development and reported problems.

This extract from the ECRI database contains model by model specifications for easy assessment and review and also includes ECRI's 'Recommended Specifications' (generic templates) which can be used for comparison and tendering purposes.

The data presented are extracted from ECRI's 2005 database and have additionally been reviewed and updated, where possible, by the respective manufacturers. Publication of all submitted data is not possible: for further information please contact ECRI or k.ruocco.me@eahitm.org.

	ECRI-recommended specifications	GE Healthcare	SCHILLER	AGFA
MODEL	**BASIC CIIMSS**	**CENTRICITY**	**SEMA 200**	**IMPAX FOR CARDIOLOGY**
FDA CLEARANCE		No	NA (SW only)	Yes
CE MARK (MDD)		Yes	NA (SW only)	Yes
INFORMATION/IMAGES	Either or both	Both	Information	Both
HARDWARE & SOFTWARE OR SOFTWARE ONLY	Either or both	Both	Software only	Both
CLINICAL FEATURES:				
Data/waveform/image ECG	User preference	Yes/yes/yes	Yes/yes/no	No/no/no
Cardiac Cath	User preference	Yes/yes/yes	No	No/no/yes
Echocardiology	User preference	Yes/yes/yes	No	No/no/yes
Stress testing	User preference	Yes/yes/yes	Yes	No/no/no
Electrophysiology	User preference	Yes/yes/yes	Yes	No/no/no
Holter	User preference	Yes/yes/yes	Yes (ECG and ABP)	No/no/no
Other lab/devices	User preference	Hemodynamic monitor & MUSE data/waveform	Spirometry, Stress Spirometry	None
SYSTEM SIZE				
# concurrent users	5	Unlimited	1-1000	By user requirements
# connected labs	10	Unlimited	Unlimited	By user requirements
# review stations			Unlimited	
Central	1	Unlimited	NA	By user requirements
Remote	User preference	Unlimited	Unlimited	By user requirements
Others		None specified	None	None
CENTRAL WORKSTATION				
Monitors/station	1	Not specified	NA	Up to 3
Screen, diag, cm	48	User selected	NA	53.3
# cases/display	2	Up to 16 per screen	NA	User selected
Input device		laptop, PC	NA	Jog wheel
Output options		Print, fax, e-mail	NA	Print, export to AVI, JPEG, CD
REMOTE WORKSTATION				
Screen, diag, cm	43	User selected	User selected	53.3
Input device		Bar-code scanner, laptop, PC	Windows 2000/XP compatible	CD
Output options		Print, fax, e-mail	Windows 2000/XP compatible	Print, Export to CD
SYSTEM CONFIGURATION				
Hardware platform	No preference	HP DL 380	User selected	Dell 650 or compatible
Operating system	No preference	Windows 2000/2003	Windows 2000/XP compatible	Windows 2000
DB management sys	No preference	Gupta SQLBase	Advantage Database Server	Sequel, Oracle
Servers	No preference	HP	Advantage Database Server	Sun, Dell
Program languages	No preference	Gupta SQLBase for Windows, C++	Not specified	C++, Java
Memory, MB	512	Not specified	256 MB or better	Up to 16,000
Integrity	Secure, redundant, auto tape backup	Secure, redundant, auto tape backup	Hard disk, CD, DVD	Secure, redundant, auto tape backup
NETWORK				
Communication protocols	TCP/IP	TCP/IP	TCP/IP, HTTP	TCP/IP
Architecture	Client/server	Client/server	Client/server, local	Client/server, distributed or central
Cable type	No preference	Wireless, twisted pair, coaxial	RS-232, Ethernet, wireless	Twisted pair, coaxial, fiberoptic
WAN	Dial-up, DSL, cable modem, satellite	No	Not specified	All supported
INTERFACES	HIS, RIS	HIS, ADT, orders, results	HL7, GDT, SEMA I, SEMA II, XML, PDF	HL7
IMAGE INPUT				
Modalities	CT, MR, NM, XA, echo	XA, MRI, CT, CR, NM, PET, ultrasound	NA	CT, CTA, EBCT, MR, US, CR, DR, NM, cath, echo, IVUS
Digital acquisition	Direct or direct capture	Direct DICOM connections	NA	Direct image capture, frame grabber
Film digitizer(s)	No preference	No	NA	Lumisys, Vidar
IMAGE DISPLAY				
Matrix size, pixels	1024 x 1024	800 x 600, 1280 x 1024	NA	1280 x 1040
Screen, diag, cm	48.3	Not specified	NA	53.3
ROI resolution	Optional	Unlimited zoom	NA	Yes
COMPRESSION TYPE	Lossless or lossy	Lossless: Lossy	NA	Lossless, lossy
Ratio	3:1	2:1 : 20:1	NA	2:1 lossless
ACCESS TIME, SEC				
Information/images				
Online	5/5	1-5/3	Not specified	2-4/2-4
Archives	20/110	1-5/30-40	Not specified	30-5 min/30-5 min
SYSTEM SECURITY	Multilevel pw and user ID	Multilevel pw and user ID	Multilevel pw and user ID	Multilevel pw and user ID
REPORTS GENERATED	User preference, user customizable preferred	Unlimited (echo, EP, cath, stress, ECG, implants, stats)	Not specified	Quantitative analysis for coronary and left ventricular measurements
ARCHIVING				
Storage device	Hard disk, CD	Spinning disk	Hard disk, CD-R(W), DVD-R(W), User selected	Hard disk, DVD, CDR/RW
Capacity, MB	512	Unlimited	Depends on medium	Unlimited
DICOM 3.0 CONFORMANT	Yes	Yes	NA	Yes
STANDARDS SUPPORTED	HL7	HL7, DICOM, XML	HL7, GDT, SCP, XML	HL7

CEDARON Medical	DEL MAR REYNOLS Medical	EIGEN LLC	SIEMENS	WELCH ALLYN
CARDIACCARE	CARDIONAVIGATOR	ENTERPRISE EIGEN-NET	ACOMNET	WELCH ALLYN CARDIOPERFECT WORKSTATION
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes/with PACS	Information	No/Yes	Both	Both
Software only	Both	Both	Both	Both
Yes/yes/yes	Yes/yes/yes	No/no/no	Yes/yes/yes	Yes/yes/yes
Yes/yes/yes	No/no/no	No/no/yes	Yes/yes/yes	No/no/no
Yes/yes/yes	No/no/no	No/no/yes	Yes/yes/yes	No/no/no
Yes/yes/yes	Yes/yes/yes	No/no/yes	No/no/no	Yes/yes/yes
Yes/yes/yes	No/no/no	No/no/yes	Yes/yes/yes	No/no/no
Yes/yes/yes	Yes/yes/yes	Not specified	No/no/no	Yes/yes/yes
None specified	Event recording, 24 hr ABPM, 12-lead ECG	None specified	None	ABPM, event ECG, spirometry (not USA)
Unlimited	50+	>100	Up to 99	5, unlimited options
Unlimited	50+	>20	Up to 15	Unlimited
Unlimited	50+	Up to 100	Up to 99	Unlimited
Not specified	50+	Up to 100	Up to 50	Unlimited
None specified	None	Up to 100	None	None
Up to 10	50+	Not specified	Up to 2	Unlimited
43.1, HW dependent	User selectable	User selectable	43.1	PC monitor
Not specified	By request	4	1 patient/ 2 studies	Not specified
Handheld, laptop, PC,bar-code scanner,	Laptop, PC, chip card reader	PC	PC, laptop	Handheld, bar-code scnner, laptop, PA
Print, fax, digital image	Print, fax, PDF, RTF, HL7	Print, image, CD, DVD	Print, fax	Print, fax, digital image
38.1, HW dependent	Varies	User selectable	43.1	PC monitor
Handheld, bar-code scanner, laptop, PC	Laptop, PC, chip card reader	PC	PC, laptop	Handheld, bar-code scnner, laptop, PA
Print, fax, digital image	Print, fax, PDF, RTF, HL7	Print, image, CD, DVD	Print, fax	Print, fax, digital image
IBM AS1400, UNIX, HP 9000	Compaq	HP	Intel	PC server
Windows NT/2000/XP	Windows 2000/XP	Windows 2000	Windows 2003	Windows 98/NT/2000/XP
MS SQL	SQL	Relational	Relational	SQL
2000 server	Compaq	HP, Dell	Siemens Fujitsu	PC
C++, VB, HTML, XML, Java, .net	C++	C, C++	C++	Delphi
By user requirements	512	1-2 GB	Up to 2 GB	> 128 required
Secure, redundant, auto tape backup	Secure, auto tape backup	Secure, redundant, auto tape backup	Secure, redundant, auto tape backup	Tape, other backup devices
TCP/IP	TCP/IP	TCP/IP	TCP/IP	TCP/IP
Distributed, client/server, centralized	Client/server	Not specified	Client/server	Client/server, distributed, centralize
Wireless, twisted pair, coaxial	Twisted pair	10BaseT	Twisted pair, fiberoptic	Dial-up, DSL, cable modem,
T1	DSL	Satellite, DSL, cable modem	DSL, cable modem	satellite
HIS, ADT, PAC CDR, hemo, bill/inventory	HIS	RIS, HIS	HIS	RIS, HIS, ADT, billing
Interfaces with PACS system (JPEG embedded in Word doc)	NA	XA, FL, US, MR, CT, CR, DR	Cath, echo, NM, CT, MR	ECG, exercise/ event ECG, Holter, ABPM
PACS system	NA	Frame grabber or digital	Direct DICOM, frame grabber	Serial, USB, memory cards
NA	NA	Vidar	NA	Not specified
NA	NA	2048 x 1536	1027x768 or higher	1600x1200 maximum
NA	NA	User selectable	17	PC monitor
NA	NA	Unlimited zoom	2x, 4x	Not specified
NA	NA	Modality dependent	Lossless	Lossless
NA	NA	2:1 to 20:1	2:1	3:1
Not specified	Not specified/NA	NA/2-10	Within 2	System dependent
Not specified	Not specified/NA	NA/2-10	Within 30	System dependent
Multilevel pw and user ID	Multilevel pw and user ID	Multilevel pw and user ID	Multilevel pw and user ID with domain login	Multilevel pw and user ID, roles
Cath, procedure log, echo, stress, PV, angio, OP notes, etc.	Holter, stress test, resting ECG, 24-hr ABP, event recording	Various	Not specified	ECG, exercise/ event ECG, Holter, ABPM, multiple formats
Not specified	Hard disk, DVD, CDR/RW	HD, tape, NAS, DVD	MOD, DVD, tape, RAID drives (SAN)	Hard disk, DVD, CDR/RW
Not specified	By document size	500 GB to 7 TB	500 GB to 40 TB	Varies by request
NA	NA	Yes	Yes	Not specified
HL7, ASTM, X/Open	HL7	DICOM, HL7	HL7	HL7, XML

	LUMEDX	MEDCON	OPTIMED	PHILIPS Medical Systems
		MEDCON TELEMEDICINE		
MODEL	CARDIOPACS	TECHNOLOGY	OPTICOR	TRACE MASTER
FDA CLEARANCE	Yes	Yes	Yes	Yes
CE MARK (MDD)	Yes	Yes	Yes	Yes
INFORMATION/IMAGES	Both	Both	Both	Information
HARDWARE & SOFTWARE OR SOFTWARE ONLY	Primarily software	Both	Both	Both
CLINICAL FEATURES:				
DATA/WAVEFORM/IMAGE ECG	Yes/yes/yes	Yes/yes/yes	Yes/yes/yes	Viewing, storage
Cardiac Cath	Yes/yes/yes	Yes/yes/yes	Yes/yes/yes	Via Xcelera
Echocardiology	Yes/yes/yes	Yes/yes/yes	Yes/yes/yes	Via Xcelera
Stress testing	Yes/yes/yes	Yes/yes/yes	Yes/yes/yes	Via CH200
Electrophysiology	Yes/yes/yes	Yes/yes/yes	Yes/yes/ye	Via Xcelera
Holter	Yes/yes/yes	No/no/no	Yes/yes/yes	Via Zymed
Other lab/devices	Defibrillators	NM, MRI, CT	None specified	None
SYSTEM SIZE				
# concurrent users	Unlimited	Unlimited	Unlimited	Unlimited
# connected labs	Unlimited	Unlimited	Unlimited	Up to 10
# review stations				
Central	Up to 5	Unlimited	Unlimited	NA
Remote	Up to 3	Unlimited	Unlimited	Unlimited, VPN/PC
Others	None	None	As needed	None
CENTRAL WORKSTATION				
Monitors/station	1 or 2	Unlimited	Unlimited	NA
Screen, diag, cm	User preference	43.2-53.3 (CRT/LCD)	43.1/45.7/48.3/53.3	NA
# cases/display	Up to 9 on 1	approx140, scalable	>200	NA
Input device	bar-code scanner, voice	PC, handheld, bar-code scanner, laptop	Handheld, bar-code scanner, laptop, PC	NA
Output options	Print, fax, DICOM print, e-mail	Print, digital image, e-mail, fax, e-fax	Print, fax, digital image, e-mail	NA
REMOTE WORKSTATION				
Screen, diag, cm	User preference	43.2-53.3 (CRT/LCD)	43.1/45.7/48.3	43.2 minimum
Input device	Keyboard, mouse, barcode scanner, voice	PC, handheld, barcode scanner, laptop	Handheld, bar-code scanner, laptop, PC	PC, handheld
Output options	Print, fax, DICOM print, e-mail	Same as central	Print, fax, digital image, e-mail	Print, fax, digital image
SYSTEM CONFIGURATION				
Hardware platform	Dell, HP, IBM; user preference	Dell, Compaq, HP, IBM, off-the-shelf	IBM, Dell, Compaq	Compaq Proliant ML-370
Operating system	Windows 2000	Windows 2000/2003	Windows NT/2000/XP	Windows NT 4.0
DB management sys	Relational, Oracle, SQL	SQL 2000	Relational, Oracle, SQL	SQL
Servers	Dell, HP, IBM; user preference	Enterprise, departmental	Dell, Compaq	Compaq
Program languages	C, C++, Java	VB, C++, C#, ASP, .NET	C, C++, Java	C, C++, Java
Memory, MB	1+ GB	512 and up	512, 1 GB	512
Integrity	Secure, redundant, auto tape backup	Full redundancy, clustering, RAID (also NAS, SAN and DVD)	Secure, redundant, auto tape backup	Secure, redundant, auto tape backup
NETWORK				
Communication protocols	TCP/IP	TCP/IP	TCP/IP	TCP/IP, HTTP
Architecture	Client/server, centralized	Open, PC-based client/server	Distributed, client/server, centralized	Client/server
Cable type	Wireless, twisted pair, coaxial	Twisted pair, fiberoptic, CAT 5	Wireless, twisted pair (CAT5), coaxial	Ethernet
WAN	DSL, cable modem, satellite	DSL, cable modem, satellite	DSL, cable modem	Not specified
INTERFACES	RIS, HIS, ADT, billing	HIS, ADT, RIS, billing, DICOM worklist	RIS, HIS, ADT	HIS, RIS, order, results
IMAGE INPUT				
Modalities	Cath, peripheral vascular, echo, NM, IVUS, CT, MR, DR, CR	XA, MR, CT, NM, US, RF, CR, IVUS, SC	Cath, echo, NM, US, CT, MR	NA
Digital acquisition	Direct capture, frame grabber	Direct capture, frame grabber	DICOM, direct capture, framegrab	NA
Film digitizer(s)	No	No	No	NA
IMAGE DISPLAY				
Matrix size, pixels	1280 x 1040	512 x 512, 1024 x 1024, 2048 x 2048	1280 x 1040 (or higher)	Not specified
Screen, diag, cm	User preference	Any	Not specified	Not specified
ROI resolution	Unlimited zoom	8x	Unlimited zoom	Zoom
COMPRESSION TYPE	Lossless, DICOM 3.0 format	Lossless/lossy	Lossless, lossy	Proprietary
Ratio	2:01	DICOM/configurable	2:1 lossless	2:1
ACCESS TIME, SEC				
Information/images				
Online	1-5/5-10	<1	1-5/1-5	<5/<5
Archives	1-6/5-20	<15 (for 1st image)	5-10/5-10	<5/<5
SYSTEM SECURITY	Multilevel pw and user ID	biometrics, user groups, SSL, HIPAA	Multilevel pw and user ID	pw, editing levels, auto log off
REPORTS GENERATED	Not specified	Cath echo, NM, vascular, EP	Cath, echo, vascular, stress, peds	ECG, management
ARCHIVING				
Storage device	SAN, NAS, HD, DVD, enterprise, CD-R/RW	SAN, NAS, DVD-R, MO, DLT, CD, others	Hard disk, DVD, CDR/RW, SAN, NAS	Hard disk, DAT tape for backups
Capacity, MB	User preference	Unlimited	1-8 TB or cascaded	12 GB
DICOM 3.0 CONFORMANT	Yes	Yes	Yes	NA
STANDARDS SUPPORTED	HL7, ASTM, X/Open	HL7, HIPAA, DICOM, CCOW	HL7, ASTM, XML	HL7, XML

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TECHNOLOGY OF THE 21ST CENTURY

Reliability and advanced technology add value and increase safe diagnosis

In 1896, just a few months after Wilhelm Conrad Roentgen's discovery of X-rays, Genzo Shimadzu Jr. and Professor Muraoka of Kyoto University succeeded in taking the first X-ray images in Japan. This was the starting point for a 110 year long tradition in medical technology. Since then, the list of success stories especially in X-ray technology is extensive. Together with analytical instruments, medical technology has turned *Shimadzu* into one of the leading suppliers world-wide. The systems are at home equally in medical practices and hospitals.

Today, *Shimadzu* develops, manufactures and distributes a broad range of diagnostic systems in all areas of clinical application – computer tomography, Digital Subtraction Angiography (DSA), cardiovascular systems, digital radiography & fluoroscopy systems, ultrasound and general radiography equipment. The latest developments include

Heartspeed with direct- conversion Flat Panel Detector "Safire".

angiography systems with C-arm rotation speeds of up to 60 degrees/second, two digital color Doppler ultrasound units and mobile X-ray systems.

The next milestone in *Shimadzu*'s X-ray technology is the so-called "Safire" flat-panel detector, the world's first FPD which converts X-rays directly into electronic signals using amorphous Selenium.
The direct-conversion technology offers distinct advantages in image quality and dose efficiency in comparison with indirect-conversion flat panel. The current image amplifier technology, inferior in image quality and dose efficiency, will soon become obsolete.

Mobile X-ray system "MobileArt". Frost & Sullivan award in 2004.

"Safire" merges economic with diagnostic benefits

Introducing the "Safire direct-conversion FPD" to the medical sector enables digitizing of all X-ray related diagnostic imaging. This allows faster diagnosis, improved diagnostic capabilities and accelerated remote medical diagnostics. In Japan, over 100 "Safire" systems are already in use. The 23 x 23 cm (9-inch-square) or 43 x 43 cm (17-inch-square) "Safire" FPD can be used both for still images and fluoroscopy.
Historically, for medical diagnostics, X-ray film has been used. But recently, with increasing implementation of digital and information technology in the medical field, the need for a high-resolution, high-sensitivity direct-conversion flat-panel detector has been keenly awaited as an appropriate X-ray detector for high-tech medical practices.

How does the "Safire" flat-panel technology work?

Compared with the indirect-conversion flat panel, the new direct-conversion technology now creates clearer high-resolution images with less signal deterioration and reduced noise. The top layer of the flat-panel detector, an X-ray conversion film, converts X-rays passing through the patient's body directly into electric signals using amorphous Selenium. A TFT (thin-film transistor) array then collects the signal from each pixel and transfers the data immediately to the processing system.
The direct-conversion flat-panel detector is far more sensitive than conventional X-ray films. It produces still images as well as fluoroscopic images which are qualitatively equal to or better than film, even when the X-ray radiation emitted is reduced from one half to one third of conventional X-ray examination. This dramatically reduces the dosage exposure to the patient.

Shimadzu has traditionally invested heavily in research and development. The company has always followed a simple yet vital concept: offering the best diagnostic system possible, combined with high patient- and user-friendliness.

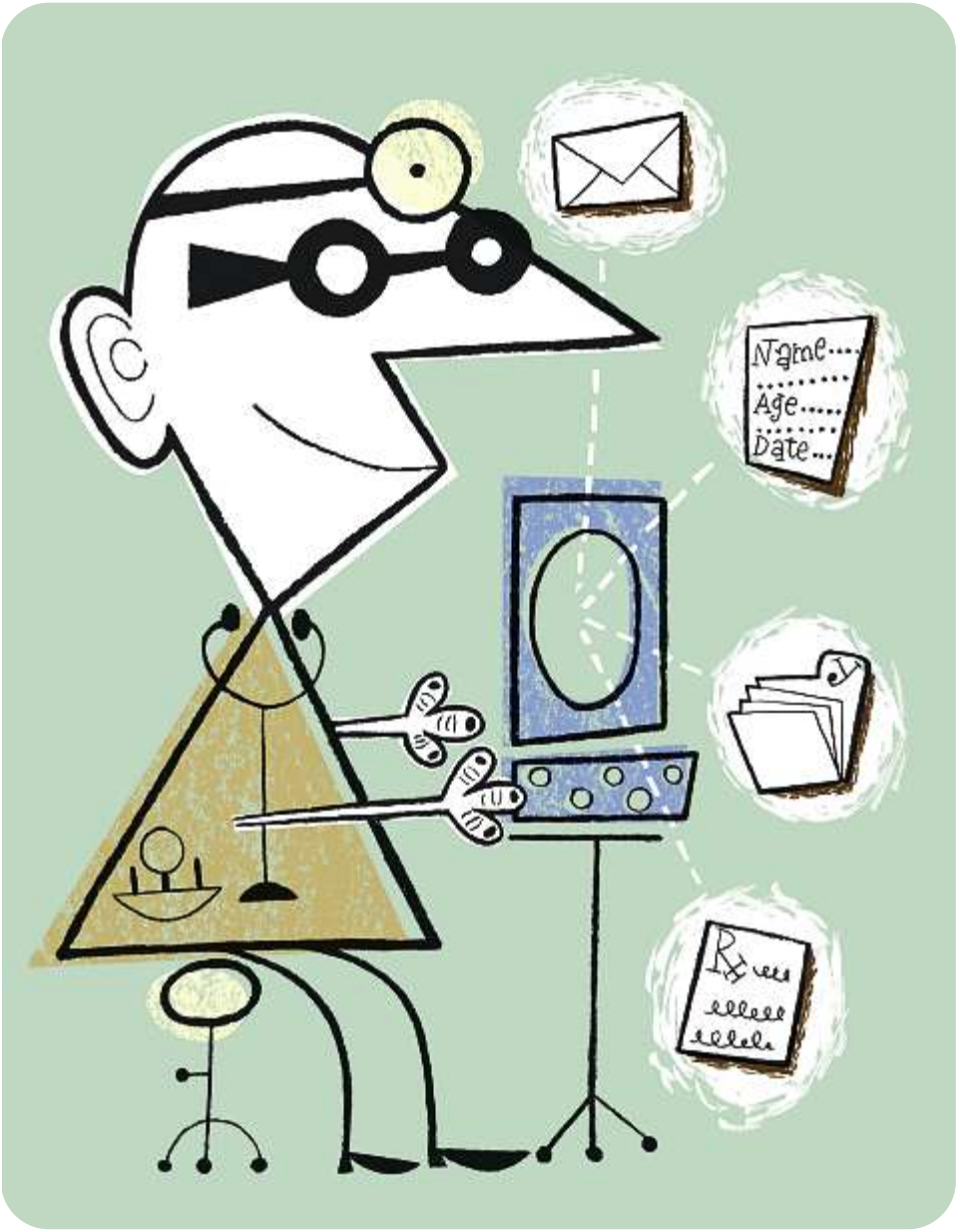
Shimadzu medical systems are being used on every continent. The experience gained all over the world is integrated into the design of new systems. Hence, every single user can benefit from the know-how gathered world-wide.

SELECTING AN ELECTRONIC

By: Dr. Jerome H. Carter, MD, FACP

The key to successful EHR selection

Selecting an Electronic Health Record (EHR) is a daunting task. Although there are many EHR products currently on the market, there are no well-defined standards for judging their features or quality. Organisations interested in implementing an EHR must therefore provide their own standards for judging whether or not a product meets their needs. However, this task is not as difficult as it first may sound. The key to successful selection is to have a good idea of the objectives that the EHR should meet; knowing how the EHR will be used; a realistic idea of the organisation's available resources, and a formal process for identifying the key functions and features required to support the goals and objectives of the organisation.



The selection process begins with defining EHR goals and objectives

Vague objectives are a major reason for inappropriate product selection and for EHR implementation failures. Therefore, the EHR selection process should begin with a period of self-study in order to determine the major issues that are to be addressed with an EHR. During this process, it is very important to be specific. For example,

having `improved quality` as a goal is quite admirable. However, determining if that goal has been reached can be quite difficult without specific guidelines. Stating that the EHR should allow the identification of all patients with a specific diagnosis provides a specific metric for both determining if your goal has been achieved after implementation as well as providing a means for judging between products during the selection process. Another way of thinking about this is that goals provide a high-level view of the clinical and business issues that the organisation wishes to address. Objectives, on the other hand, are metrics by which products are to be judged and their implementation success measured. For this reason, at least one month should be set aside to identify all important goals, objectives, problems, and issues.

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HEALTH RECORD

What to consider before using a specific EHR system

In most healthcare settings, two types of users of the EHRs can be identified - primary and secondary. Each group has specific needs that should be reflected in EHR features and functions. Primary users are those who provide direct patient care. This group uses the EHR for record-keeping and they are interested in features that reflect information found in paper charts, rapid response times, ease of use, and quick access to patient data.

Secondary users, on other hand, are those who use information in the EHR for research, education or management purposes. For this group, reporting and querying capability are the most important features. Understanding the differences between these two groups is critical as EHR products are rarely optimised for both. It is therefore important to be very sure for whom the intended uses are for prior to selecting a system.

Implementing an EHR requires more than the actual cost

A sound EHR selection process will result in a product that meets key needs and does not break the budget. Be aware: bells and whistles can be very expensive and rarely provide significant benefit to the organisation. Also, keep in mind that the cost of implementing an EHR is much more than the actual cost of the product. Successful implementations require extensive changes within the organisation. This often means hiring new personnel, extensive job retraining, implementing new security and disaster recovery measures, and upgrades of existing hardware and networks. With this in mind, the EHR selection criteria should focus on functions and features that will be used immediately and meet the most important objectives of the organisation.

Finally, the budgeting requirements for an EHR project should focus on the total cost of a complete implementation; not solely on the cost of the software plus hardware required.

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NEW TECHNOLOGIES ACCELERATE EHR GROWTH

By: C. Peter Waegemann

New technologies and computerisation are propelling EHR adoption

As EHR strategies are being developed and systems implemented, new technologies are demanding attention. Today's mobile healthcare systems include several promising new developments that need to be integrated. New tablet technologies, use of smart phones for physicians, better connectivity, and new applications make point-of-care computing easier. The most promising field of new technology development is that of tracking both items (assets) and people. For instance, by tracking patients throughout a hospital with Radio Frequency Identification (RFID), one can manage patient flow and monitor how long patients have to wait in various waiting areas of hospitals. For the first time at the TEPR 2006 conference (Baltimore, Maryland, 20-24 May 2006) this technology will be demonstrated.

"The benefits of computerisation are clear and have been widely acknowledged: increased patient safety, higher efficiency, higher quality patient care, and lower cost"

At the beginning of the 21st century, the move to computerisation dominates all societies, from the most advanced to those much less advanced. While other industries are bringing substantial benefits through computerisation to citizens, healthcare is generally behind in its attempt to create systems that ensure that every physician and practitioner is computer guided and computer supported when providing care. Yet, the benefits of computerisation are clear and have been widely acknowledged: increased patient safety, higher efficiency, higher quality patient care, and lower cost are the rewards at the

end of the Electronic Health Record (EHR) journey.

Trend One: Speech recognition is increasingly being used

The key issue regarding EHR use is getting information into the computer. Doctors don't like the computer keyboard, but should not handwrite notes either. This leaves speech as the dominant input method. In the United States, transcribing healthcare information has become a huge business with over 400,000 transcriptionists and a price tag of over $25 billion (€ 20.5 billion). For a long time IT solutions have been sought to curb that expense. Speech Recognition (SR), the technology that recognises spoken words and captures them as written words, thereby automatically transcribing text, has been around for more than 20 years. Despite use of larger and larger medical dictionaries as bases of such software in healthcare, SR systems have not had much acceptance outside the radiology and pathology departments. Those who put great hope into SR were disappointed. Now, this is being reversed. Today, SR is being increasingly used in two ways - as back-end speech recognition or front-end speech recognition.

From the outside, back-end speech recognition seems to function the same way as traditional transcription. The doctor dictates and sends the dictated information to the transcription department. The transcriptionist does not transcribe but rather edits the 'recognised' text, which after editing, is presented to the doctor for his signature. This process speeds up the turn-around time and costs less than traditional medical transcription.

Front-end speech recognition does not involve medical transcriptionists and therefore gives the doctor the power to manage the documentation process completely. As she dictates, the speech recognition software recognises the text with an accuracy rate of 90 to 98 percent. According to training and editing skills, a practitioner can achieve a high accuracy rate and then edit the few words the software does not accurately recognise. When finished, he can put an electronic signature to the note and create a legal document. This process can represent substantial time savings and great cost savings. However, the success depends on the willingness to spend some six to ten hours for special training and a certain persistence to learn this somewhat difficult technology. For the first time, Medical Records Institute is offering a series of public seminars to teach healthcare practitioners to use speech recognition.

Trend Two: the Continuity of Care Record is becoming an international standard

TOP TRENDS WITH EHRS

1. Speech recognition
2. Continuity of Care Record
3. EHR implementation is going global

The latest and most important technology, however, comes from a new national US standard, the Continuity of Care Record (CCR). Physicians and other clinicians sometimes provide patient care without knowing what has been done previously and by whom, resulting both in wasteful duplication and in clinical decisions that do not take into account critical data related to patient health.

In order to overcome this problem, a dataset is needed that will enable the next provider to easily access essential patient information at the beginning of an encounter and easily update the information when the patient goes on to another provider, in order to support the safety, quality, and continuity of patient care. In this way, the core data set may be used as a vehicle to exchange clinical information among providers, institutions, and other authorised entities. It may also be used by the patient as a comprehensive but brief summary of recent care. The Continuity of Care Record has been developed by ASTM International Standards Worldwide in collaboration with 11 key medical and other healthcare organisations that represent 500,000 physicians, 19,000 group practice managers / leaders, over 13,000 health IT managers, and over 12,000 long-term care institutions.

Approximately 60 EHR vendors have integrated the CCR into their software, making it possible that an 'incoming' CCR be easily integrated into the EHR and that an updated CCR can be created and sent to the next provider at the end of each encounter. This is history-making progress, enabling doctors to leave behind the era of having to provide healthcare 'blindly'. ASTM International is also working on universal translation systems that would enable the CCR to automatically translate from one language into another.

The Final Trend: EHR implementation is spreading across the globe

After more than 20 years of promoting EHRs, it is gratifying to see that the idea has caught on in many countries. For example, in the United States leading politicians of both parties have issued joint statements on the necessity to adopt EHRs, some states have accelerated their EHR activities, in short, government, employers, medical associations, payers and others are part of a national action to make EHRs a reality. A number of activities by the US Department of Health and Human Services (DHHS), international standards bodies and other organisations are moving several issues ahead. In the United Kingdom, efforts to create integrated record services are well-funded and top the agenda for change. From Canada to Australia and New Zealand to Denmark, one finds that EHR plans are developed, national strategies defined and systems are implemented.

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STANDARDISATION, INTEROPERABILITY AND TECHNOLOGY TRANSFER IN MEDICAL IMAGE PROCESSING

By: Dr. Alexander Horsch & Dr. Thomas M. Lehmann

According to the European Federation for Medical Informatics (EFMI) Working Group on Medical Image Processing (WG-MIP), there is a lack of integration of medical image processing into routine applications of image management systems. In general, insufficient handling of both processing algorithms and image data are seen as major weak points. Two particular problems are identified: (i) reliable evaluation of algorithms for medical image processing and (ii) automatic content analysis of medical images on a high level of abstraction. For the first point, the activities of the EFMI WG-MIP are described, which are based on the EFMI reference image database initiative. For the second, the focus is on content-based image access in medical applications, a topic of increasing importance as the data volume of digital images acquired in the healthcare industry explodes.

The past and present of medical image processing

Medical image processing and analysis have been active fields of research for more than 25 years[1,2,3]. Currently, a method-driven modeling approach dominates the field of biomedical image processing as algorithms for registration, segmentation, classification and measurements are developed on a methodological level. The future of medical image processing is, however, seen in task-oriented solutions that are integrated into diagnosis, intervention panning, therapy and follow-up studies[4].

In 2001, the WG-MIP was established within the EFMI to foster this integration[5]. In particular, the WG-MIP aims at supporting the discussion of how to integrate decision support by means of medical image processing into clinical practice, including the important topics of clinical evaluation, standardisation and technology transfer.

Content-based access to images relies on numerical features that are computed from the pixel values. In the medical field, the context of an image might change between the time the image was captured and stored, and the time of image retrieval.

Successful technology transfer is based on evidence, i.e., research and approvals. However, evidence in complex domains such as medicine, pharmacy and medical image processing cannot be created without appropriate evaluation methods and validation platforms. The latter are serving as an environment for testing the performance of novel methods and systems in terms of absolute measurement, comprehensive benchmarking and detailed comparison with known and proven methods and systems.

Evaluating computer algorithms for medical image processing

In medical image processing, a non-trivial problem exists with respect to validation environments. The development of new methods is based typically on images taken from one or a few image acquisition units. Hence, the algorithms tend to be optimised to these machines and can seldom be used on other devices without substantial modifications. Furthermore, research groups usually use different and incompatible datasets which prevent comparisons of methods. Image datasets obtained from only one research center never represent the medical variety desirable for sound clinical studies. In academia, innovation of medical image processing is emphasised in terms of algorithmic novelty. Instead of sound validation and evaluation of clinically relevant data, only feasibility studies are

conducted. Consequently, the industry has problems with the acceptance of image processing applications as automated tools in the approval procedures by certification authorities.

In 2002, the WG-MIP of EFMI started an initiative aiming to establish a reference image database in order to support reliable validation and comparison of methods and systems. In close contact with other initiatives, especially with the National Institute of Health (NIH, Bethesda, MD, USA) and the Insight Software Consortium (ISC, Clifton Park, NY, USA), the reference database was built for research and development groups in medical image pro-cessing as well as the industry. The concept of the EFMI reference image database initiative consists of the following main points[6]:

+ create an overall, economically sustainable framework for life cycles of reference image datasets and corresponding tools meeting the demands for validation and quality control of both academia and industry in research and approval processes;

+ establish a board of experts and let them define criteria to assess the relevance of a medical problem with respect to the importance of image processing;

+ perform an assessment of medical problems using the defined criteria and identify the most relevant ones with a high potential of improvement of diagnostic and treatment outcomes through the application digital image processing methods;

+ specify the image datasets needed and quality criteria for scientifically sound validation and evaluation of these highly relevant problems, and standardise data structures for annotations (gold standards[7]);

+ collect image data from image providers (single institution or a group of institutions) that meet these specifications and prepare validated image datasets to serve as common references for research and development groups in academia and industry;

+ set up a platform for the dissemination of the reference image datasets, including bilateral cooperation agreements or contracts between provider and user with or without licensing, depending on the type of dataset and usage, and

+ follow-up the impact of the dissemination in terms of outcome indicators such as number and qual ity of published results, or number, costs and time for approval processes using the datasets, compared with before their introduction.

During the last three years, conceptual and promotional work was completed by the EFMI WG-MIP. Although there exists, to a certain extent, awareness of the usefulness or even necessity of the initiative, the concrete commitment to contribute is still rather limited. Academic institutions do not have the resources to set up such a framework, and therefore have to focus on the outcomes of their own research projects, including image data acquisition and management. Industry concentrates on the procedures required by the regulatory authorities and struggles with the threatening of their economic benefits by development and approval cycles that are too long. Both sides would benefit from an approved and powerful common platform for validation. Since setting up such a platform needs joint efforts from the public and industry, the WG-MIP tries to form a strong alliance of academia and industry to create a model for a sustainable platform which will be implemented in a common public-private effort. Currently, an ongoing discussion among representatives of public initiatives and industry is fostered by workshops and meetings at various events (recently in the USA and Europe). The goal is to coordinate and strengthen the activities and make the results available to the global community.

Content-based management of medical images

Not only for the sake of evaluation and validation, digital image archives in medicine are required and must be managed. However, such image repositories dramatically increase their volumes. In addition to the growing number of digital modalities, improved resolution in time and space results in more and more medical images.

With the increasing data volume of medical images that are routinely acquired in today's healthcare institutions, common methods of image management become inefficient. Even in modern picture archiving and communication systems (PACS) that are based on the Digital Imaging and Communications in Medicine (DICOM) standard, image data is addressed by alphanumerical indexes such as patient name and examination date. Since an image tells more than a thousand words, recall and precision of this type of medical image information retrieval is limited in general[8,9].

Content-based access to images relies on numerical features that are computed from the pixel values. In the medical field, the context of an image might change between the time the image was captured and stored, and the time of image retrieval. It is therefore difficult to define appropriate features that satisfy complex queries at the time of data entry. As a solution, features are extracted on three different levels:

01 Global features: On a basic level, a numerical feature vector is extracted from the entire image or volume dataset. Using this representation, medical images can be automatically categorised according to the anatomy (A) and bio-system (B) shown in the image as well as the creation (C) and direction (D) of imaging. Relying on a reference database of more than 10,000 images, this categorization can be performed with an error rate of about 15%, 9% - or less than 5% if the best match or a set of the five or ten best matches are considered, respectively[10]. More recently, this annotated reference image database has been used also for benchmarking and comparison of different algorithms for automatic image annotation[11].

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02 Local features: On the next level of complexity, image objects are modeled as local regions of interest. Such an approach involves several challenges. At first, meaningful regions that correspond to objects must be extracted from the medical imagery. Since the level of detail of these objects depends on the context and application (e.g., the entire bone for maturity but a fracture as small part of the bone for emergencies), a multi-scale partitioning should be used[12]. This is done in the Image Retrieval in Medical Applications (IRMA) project[13]. Then, each region on each level can be represented by a numerical feature vector describing shape and texture. First experiments were made on a set of 105 radiographs of human hands, which were taken arbitrarily from the routine of bone age assessment. Performing a query for the metacarpal bones that is based on 25 sample regions selected manually, recall and precision of 0.6 and 0.53 are obtained for the images that have not been used for training, respectively[14]. For automatic training, the best result was obtained using a support vector machine. Based on 50 training regions, recall and precision yielded 0.58 and 0.67, respectively. In relation to the complexity of the problem, these results are very promising.

03. Structural features: Regardless, modeling individual objects in medical images is insufficient for many applications. For instance, maturity assessment of infants is based on size and shape of several bones as well as their distances. In other words, a spatial or temporal constellation of multiple objects within an image must be regarded[8]. In the IRMA project, structural prototypes are trained from manual references, where node and edge attributes are represented by Gaussian Mixture Models (GMM). Edge attributes such as the normalised distance, the angle between two regions' main axis, or the relative gray scale are used to represent spatial and / or temporal relations between individual objects (scene description). Accordingly, image similarity is expressed by means of graph to sub-graph matching techniques. In particular, a neural network based on the approach of Schädler and Wysotzki[15] is used to efficiently compute the graph-based image similarity.

Although research in medical image processing is currently at the beginning of developing such sophisticated methods of image analysis and interpretation, it is forseen that in the near future these methods will be required to handle the increasing volume of image data in healthcare. Content-based image management supports research, diagnostics and training of physicians. It will open new opportunities for case-based reasoning and evidence-based medicine.

Conclusion

The technology transfer of medical image processing into clinical routine application requires standardisation and interoperability. In particular, standardised image databases must be established to support reliable and comprehensive evaluation of algorithms. Also, more sophisticated approaches for modeling and understanding the content of medical images are required to support an interoperable management of image databases.

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INTEGRATING LABORATORY INFORMATION SYSTEMS IN CLINICAL LABORATORIES

By: Artsiom Anishchanka & Dmitry Mozheyko

The urgency of the problem of automating processes

A Medical Diagnostic Laboratory (MDL) occupies a large part of the structure of diagnostic research, both in the quantity of research and the clinical importance of test results – which are important sources of diagnostic information for modern medical diagnostic processes. According to world statistics, in previous decades the quantity of performed clinical laboratory tests and their diagnostic importance exponentially increased – and continues to increase[3]. As the current business environment becomes more and more competitive, the need to emphasise the use of automation technologies to improve laboratory productivity, to accelerate research turnaround time and to maintain the quality of services is paramount.

Subsequently, the automation of MDL processes is an actual problem with significant practical value. The use of Laboratory Information Systems (LIS) has now become the standard of MDL activity, with MDLs using a variety of automated information systems. However, only a portion of these use an LIS, which unites all subdivisions of a laboratory as the common system. Nevertheless, a small proportion of hospitals have an LIS integrated with a clinical Healthcare Information System (HIS).

This article describes general issues related to the first steps of developing a unified basis for inputting, processing, storing, accumulating and analysing laboratory diagnostic data and improving the performance and quality of laboratory activity.

Laboratory workflow peculiarities

A macro model of laboratory functioning follows a certain sequence of events. First, during input, research orders and biomaterial sam-

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ples are registered and brought into correspondence with each other. Next, analyses (a set of laboratory tests) are carried out automatically or manually. The obtained results of these tests are then passed to a requester. The following peculiarities can be outlined at this stage:

- test results (and their dynamics) are of great diagnostic importance;
- there is significant document circulation between clinical departments and laboratories;
- there are a great number of tests to perform;
- there is an availability of efficient automatic analyzers (information which can be transferred);
- there is a necessity to improve the reliability and quality of laboratory research;
- there is a great deal of routine work completed by laboratory employees, and
- the necessity of preparing laboratory operational statistics and the availability of scientific statistics.

All of these factors work together to propel the necessity of solving the problems of transferring and storing data, as well as the need to act responsibly to ensure the reliability and quality of publicly available laboratory research results. Therefore, the best solution to these problems is the use of modern IT technologies and facilities in laboratory activities.

MDL automation goals and tasks

The automation of MDLs pursues the following goals and tasks: providing of Electronic Health Record (EHR) support; manipulating laboratory information in a digital data format for storing, accumulating, processing and transferring; finally, improving internal laboratory workflow processes by facilitating the routine work of laboratory employees. The subtasks of improving workflow processes include:

- registration of research orders and order-sample authentication;
- tracking and control of samples' traffic and status; departments and laboratories;
- audit of samples' turnaround times and analyser's (laboratory equipment) use;
- automatic import of data from analyzers;
- automatic processing of tests results (norms conformity, calculating of indexes);
- automatic generating of laboratory work books and operation plans;
- tracking and planning of labour hours, and
- generating operational reports and statistical data automatically.

In order to achieve these objectives, it is necessary to implement an information management system into an MDL. It is then possible to allocate two basic directions of laboratory activity automation[6] – the use of computers to automate information and workflow processes in laboratories, and the interaction of laboratories with clinical departments using a module-based HIS.

Directions of laboratory activity automation

The first direction provides the use of computers for automating information and technical processes inside laboratories. Base functions of such systems include:

// Because an MDLIS is intended to be constructed on the basis of client-server technology with the use of RDBMS, allowing an MDLIS and HIS to share common information provides the optimal way to solve the problem of creating information analytical systems. //

- registration of samples and research orders, distribution of orders between laboratories, entry of tests results, and the operative and retrospective analysis of laboratory activity;
- automation of research performing, including input and processing of data from laboratory analysers, and creating reports on equipment utilisation;
- quality control of laboratory tests, the revelation and correction of mistakes, an estimation of the accuracy and correctness of analytical results and their statistical processing, and
- registration of the reception and use of reagents & equipment.

The purpose of this direction is to increase laboratory productivity and research quality to take into account the use of reagents and materials, and to reduce the amount of routine tasks performed by laboratory personnel.

The second direction of laboratory activity automation deals with solving the problems of the interaction of laboratories with clinical departments on the basis of utilising a module-based common HIS[1]. Included amongst these problems are the automation of processes of laboratory research orders registration and the transferring of results to clinical departments, and the implementation of expert systems for attending physicians based on laboratory diagnostics[2,5]. Within the bounds of this direction the following functions are implemented:

- the input of research orders from terminals in clinical departments and the delivery of research results to these terminals;
- the creation of a database with the results of laboratory analyses and their accessibility to attending physicians for operative use, and
- the automated support of medical decisions, including the granting of patient inspection programs, schemes of laboratory research orders, and methodical instructions on the interpretation of test results.

The main purposes of this direction aim to support attending physicians, reduce the delivery time of research orders to the laboratory, reduce the quantity of unreasonable analyses, and represent test results in a full and correct form.

Requirements of a laboratory information system

Advanced Medical Diagnostic Laboratory Information Systems (MDLIS) should therefore support the functions of both directions of laboratory activity automation. The general requirements of an MDLIS as a subsystem of an HIS include:

- conformity to domestic and international standards;
- binding of EHR primary data and laboratory data;
- support attending physicians with test results and their dynamics, and managers with statistic reports, and
- access restriction control to laboratory data on ethic and functional rules.

General requirements for an MDLIS should allow for:

- the input of data manually and from analyzers;
- a unified, scalable and customisable platform for any specialisation (biological, clinical, bacteriological, cytological, etc.); = research order creation from outside (physicians) as well as from inside (laboratory registrar);
- data export in various data formats;
- the ability to manage input data flows of research orders;
- the ability to control the traffic of samples and the status of analyses;
- registering checkpoint analysis times;
- L/H visualisation and calculated index support, norms bounds checking in accordance with patient's age, gender and used reagents;
- the generation of laboratory workbooks and operation plans on the basis of analysis data (order, results, executors);
- to provide accounting of time expenses of test performing, and
- preparation of operational and statistical reports in different slices.

Because an MDLIS is intended to be constructed on the basis of client-server technology with the use of RDBMS, allowing an MDLIS and HIS to share common information provides the optimal way to solve the problem of creating information analytical systems.

The solution

The first steps of any successful MDLIS development must include the investigation of a problem area and the formulation of the main objectives and requirements of MDL automation. In this case, the system was implemented within the bounds of research work conducted, the result of which was the creation of a scalable and flexible laboratory information system based on a unified data model. The resulting MDLIS was implemented both as stand-alone and integrated into an HIS in hospitals across Belarus and Russia, with the number of beds ranging from 200 to 1,500, as well as in a variety of different kinds of laboratories4.

The main goal for future work in this area is the realisation of information exchange between the diagnostic laboratories of multiple hospitals.

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DESIGNING A HIGH-PERFORMANCE TELEMEDICINE SYSTEM

Part One of a Three Part Series

By: A.V. Bogdanov, A.B. Degtyarev, Yu.I. Nechaev & A.V. Valdenberg

In the first of this three part series, the steps taken for designing a telemedicine system based on high-performance computer technology for the Institute of High Performance Computing and Information Systems in St. Petersburg, Russia is explained. In this general approach, the creation of this telemedicine system and the applications of new technologies for cardiologic aid tasks focuses on users with various cardiologic medical qualifications. However, the basis of the developed approach could be used for information processing in other medical fields.

In the second part , the concept proposal for a telemedicine Internet portal will be identified, the role of a territorial telemedicine centre in relation to the distributed organisation will be discussed, and the functional prototype for a distributed telemedicine cardiologic system will be explained. In the final instalment, complex telemedicine architectures will be explored, along with how to integrate knowledge management and processing into the system; foundations of information processing and complicated situational modelling will

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be explained, with the series concluding by mapping a probabilistic model in a cluster architecture to achieve high-performance computing.

Telemedicine development is the basis for enhancing modern medicine, the main purpose of which is to provide medical services to remote patients located far from medical centres and who have limited access to medical services. The basis for telemedicine development is therefore the creation of a system capable of providing effective information transfer between users and providers of medical services, as well as other various levels of service providers. As the aim of a telemedicine system is to provide global, united and permanent access to medical care in real time through the use of modern communication and information technologies, a solid technical base for the transfer and reproduction of data makes it possible to launch videoconferences and transfer high-quality digital images at a distance, allowing for more efficient reanimation aid, faster transportation of the patient and quicker medical decisions[1,2,5].

The necessity of telemedicine development is dictated by various issues. The main circumstances are created by situations in which time and distance are critical factors. With a reference to cardiology, the basic spheres of telemedicine systems application can include the following:

+ emergency clinicoelectrocardiographic consultations, for instance, situational circumstances requiring electrocardiogram registration and tactical decision-making in the absence of the specialist (i.e., personal time off, in small medical-preventive offices where the expert is not in staff, etc. – when therapeutists, emergency doctors, and general practitioners need to ask for help);
+ complex clinical situations demanding the help of regional specialists (any time cardiologists, heads of cardiology and therapeutic departments ask for help), and
+ planned clinicoelectrocardiographic consultations.

There are many challenges to telemedicine in the consultation process, which is carried out in the following way: first, an electrocardiogram of the patient is registered and transferred through telemetric systems; the clinical consultation of the cardiologist then takes place. For many years this scenario has shown its effectiveness - as long as it allows for fully informing the doctor, especially in an emergency situation, about modern methods of diagnostics and specific treatments, to help to avoid diagnostic mistakes. At the same time, with regards to the features of rural public health services, the system of consultations is improved. In this case, one can use essentially more intensive and productive consultations.

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These activities are important not only for cardiology, as they have, in a certain sense, a universal character. It is therefore possible to emphasise the following basic problems of telemedicine that demand a solution and realisation:

+ information acquisition on the status patients in remote mode;
+ heterogeneous medical information transfer;
+ assimilation and pre-processing of incoming medical data;
+ timely and, whenever possible, qualified reaction in automatic mode on complicated personal health cases;
+ maintenance of timely and highly skilled consultations and statements of medical diagnosis;
+ detailed information-analytical doctor support for correct diagnostics and choice of effective patient treatment;
+ conducting virtual consultations and doctor teleconferences, and
+ multithread processing of medical information arriving from multiple remote sources.

The main goals and functions of a telemedicine system include a variety of methods, procedures and technical criteria. The first of these is the automation of performing partial or full medical examinations, utilising the opportunities of computer technologies for primary consultations with medical advisers who are not always on duty in the consulting office, including doctors of adjacent specialities, etc. This allows for the opportunity to expand essential consultations, in particular: to organise dispensary and preventive examinations, to supply social services using necessary data, to provide consultations for remote patients who are unable to travel to polyclinic institutions, pre-shift examinations in locomotive depots, etc. Next is the application of methods based on electro-cardiography, but intended for more detailed diagnostics of Blood Circulation System (BCS) illnesses, for example, the analysis of cardiac rate variability, the research of heart rate potentials, and conducting tests of physical activity, etc.

The third objective is remote consultation utilising diagnostic methods based on other principles of information retrieval. For instance: the remote registration of heart noise (phone-cardiography), in combination with electrocardiograms and clinical data, can assist modern diagnostics of heart diseases, especially in a children's practice. Currently, the number of revealed heart diseases among children is much less than expected (two cases in 1,000 newborns) due to insufficient auscultation skill among children's doctors in maternity hospitals. Doctors, especially in small clinic prophylactic organisations (CPO), cannot in all cases and in proper time diagnose infectious endocarditis, the defeat of heart valves under myocardial ischemia, etc. Wide application of echocardiography methods, in this case helps, but does not solve, the problem because of the impossibility of meticulous examination and the necessity of high qualifications of a doctor- and from the other side due to the impossibility of emergency treatment or treatment

continued on page 44

Implementing an EPR in a Hospital: General Lessons Learned

By: Dr. Michael A. Shifrin

Principal goals of EPR implementation

There are different ways to develop best practices on the basis of specific knowledge and experience. One of them may be considered statistical. Its essence is to study similar cases in order to find general conclusions 'averaging' acquired knowledge. An alternative is to investigate only one, very complex and sophisticated case, to find general conclusions logically. The validity of these conclusions may then be guaranteed by the complexity of the case under investigation.

In the context of Medical Information Systems (MIS), this reasoning has been applied to present some best practices based on the experience of developing and implementing an isolated instance of an MIS: an EPR system for the N.N. Burdenko Neurosurgical Institute (EPR / NSI). The complexity of the implemented system is a result of the structure of NSI and the goals of the EPR project. As background information, the NSI has 300 neurosurgical beds; 40 intensive care beds; an outpatient department; a complete set of laboratory and diagnostic facilities and radiology and rehabilitation departments. The principal goals of implementing the EPR system for NSI were the following[2-4]:

- to deliver information support for diagnostic and treatment process;
- to deliver information support for numerous scientific investigations carried out by the NSI, and
- to build the core of the future MIS intended to support all business processes in the institution.

Lesson One: Integrating technology support in the life cycle of the information system

Any MIS project on a hospital-wide scale must be guided by integrated technology support throughout all stages of the life cycle of the Information System (IS), thus guaranteeing the evolutional development of the system. A technology solution of this kind – MEDSET – was developed as a part of the EPR / NSI project[2-4].

Strictly speaking, this was not a lesson learned from the EPR / NSI project. It was rather an axiom for developers that was confirmed in the process of the EPR implementation.

> *"Any MIS project on a hospital-wide scale must be guided by integrated technology support throughout all stages of the life cycle of the Information System (IS)."*

Lesson Two: Data organisation is crucial for the diagnostic & treatment process

Any MIS intended to support the diagnostic and treatment process in a hospital should preferably have a generation-oriented, rather than data use, organisation of data. This statement is based on the fact that internal data flows in a clinical environment are dramatically more intensive than in-and out-going flows and therefore play an extraordinary role in the self-organisation of the diagnostic & treatment process. From this point of view, medicine is an information-dependent type of human activity.

Another argument in favour of a generation-oriented organisation of data is that the alternative, data-use oriented approach, is more adequate for institutions with advanced regulation of personnel activities, when main business processes are organised by regulatory documents rather than by internal data flows.

Lesson Three: Identify business and activity processes

It is worthwhile to separate two kinds of processes running in medical institutions: business processes and activity processes. Business processes and their data organisation reflect an outer view on the activity of the institution. For example, every clinical institution has to admit patients, deliver basic and advanced blood tests, deliver plenty of diagnostic procedures, etc. These processes are common for many institutions and may be considered relatively stable.

On the other hand, activity processes and their organisation reflect an inner view on the activities of the institution - the organisation of personnel activities. Activity processes may be organised in many different ways they are unique for different institutions and are rather flexible.

Thereafter, the business process structure, a relatively stable one, may be represented in the IS by the database model as it is the component of an IS that has to be the most stable. The activity process structure, as a rather flexible one, may be represented in the IS by the interface model[2-4] and program code – as they are the more flexible components of an IS.

Lesson Four: Formalise end-user activities

MIS is the formalisation of end-users' activities in their professional fields. This helps the developer to ensure that the end product will be accepted by the user. At the same time, developers have to realise that users are not informatics professionals and therefore will need to select ways of formalisation adequate to the users' goals.

Formalisation may concern different aspects of user activity. The developing of screen forms for data input requires searching for a balance between the parts of free-text fields and fields with a fixed list of allowed values. While a fixed list of values guarantees easy reporting and data analysis, the former ensures the completeness of patient descriptions. The most important consideration of these aspects is that the form must be usable. Another consideration in the formalisation process is the representation of real world workflows as a set of users' functions, as an inadequate set of users' functions may result in recording conflicting data to the database and, in the most severe cases, a rejection of the system.

Lesson Five: End-user activity determines MIS development

The implementation and evolution of MIS is a "non-linear" process. This means that implementing and running MIS changes the informational environment that exists in the institution. These changes require, almost inevitably, changes in the MIS – and so on. Therefore, the development and implementation of any MIS is a "non-linear" process in its most profound sense – meaning it modifies its environment.

Combining lessons three and four, it may be said that end-user activity is the determining factor of the vector of MIS development. At the same time, it is necessary for system developers to predict users' requirements to some degree and to be ready to realise them. User requirements may be of various types. On one pole are placed minor – from the developer's viewpoint, but sometimes critical for the user – changes of screen forms. On the opposite pole, the developer may find requests for new user functions or even a family of connected functions. In any case, the base for the successful realisation of user requirements lies in integrated technology for systems development (as demonstrated in lesson one).

Lesson Six: EPR implementation should not adversely affect the patient treatment process

The deployment of an EPR system may be considered as a "technological intervention" in the diagnostic and treatment process. Every medical institution has a unique diagnostic and treatment process, in which medical record-keeping is an integral feature. The use of an EPR system dramatically changes this, making it essential for it to be introduced in such a way that it has no adverse effects on the treatment of any patient.

"Technical problems may be prevalent during the early stages of an EPR project, particular at moments of rapid expansion of the system or in developing new options."

An EPR should only have an indirect influence on medical technologies, changing organisational aspects of the diagnostic & treatment process, Such changes may both improve and impair the quality of treatment. Examples of "bad practices" may be found at the website of the EVAL working group of the European Federation for Medical Informatics (http://iig.umit.at/efmi).

Lesson Seven: Developers must be aware of problems affecting the lifecycle of an IS

There are three main categories of problems arising in the lifecycle of an IS: technical, organisational and psychological – and developers are expected to resolve problems of all three. At every moment, one of these categories plays a key role in the IS. As a result, developers have to recognise and concentrate their efforts on them, while at the same time maintaining the balance between them.

Technical problems may be prevalent during the early stages of an EPR project, particularly at moments of rapid expansion of the system or in developing new options. Psychological problems become prominent during moments involving users with low computer literacy. Organisational problems dominate at instances involving a large body of new users, especially when users have no direct benefit of the use of the system. Therefore, developers should observe for possible tensions and take appropriate steps to resolve them if they do occur.

The Final Lesson:

♥Love the user! This lesson is the most important because it must be present on any list of best practices and recommendations for IS developers and because it integrates all of the other lessons learned.

Conclusion

These best practices; though non-exhaustive, are the most important lessons learned while developing and implementing the EPR system for the N.N. Burdenko Neurosurgical Institute. The validity of these lessons was evidenced by the complexity of the project. All of them were apparent in the development of the project and by the fact that the EPR / NSI has been successfully running and evolving since March 2000.

Editor's Note:

This article was a summary of the presentation and project results given by Dr. Shifrin at the Special Topic Conference of the European Federation for Medical Informatics (2004, Munich, Germany

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The Boario Home Care Project

By: S. Scalvini, A. Giordano & F. Glisenti

This article on the Boario Home Care Project is the first in a two-part series. In this issue, the background and achieved results of the Boario Home Care Project, a telemedicine project that was implemented regionally and nationally across Italy, are explained. In the second part of this series, which will be published in Issue 2, a cost analysis of the project will be given.

THE HISTORY

of the Boario Home Care Project

The seemingly intransigent problems of increasing costs and inequitable access to quality health care, coupled with the merger of information technology and health services, gave rise to the field of telemedicine. In broad terms, since its inception in 1998, the history of the Boario Home Care Project can be characterised as consisting of three major phases: the creation of a telematic network in a remote territory, extending the network regionally and nationally, and finally implementing a service centre structure with the use of broadband technologies. Each phase has been closely linked to significant advances in information technology and telecommunications.

PHASE ONE:

establishing a telematic network

The first phase goal of the project was to implement a telematic network for the General Practitioners (GPs) in a mountain territory particularly hard to reach (Vallecamonica, a valley in the PreAlps) and to give them the possibility, over a 24-hour basis, of monitoring the cardiovascular diseases of their patients using a mobile electrocardiographer (ECG). The recorded ECG could then be sent by a fixed and mobile GSM telephone to the receiving station in Boario Terme, where a Cardiologist reported the trace, offered an interactive teleconsultation and prescribed therapy, if necessary. In this scenario, the Cardiologist was physically present and worked directly at a workstation in the call centre.

PHASE TWO:

extending the network regionally and nationally

In phase two, the project was extended to the regional and then national territory and the number of enrolled GPs increased. At the same time, a new way of disease management for chronic cardiac patients began. The vast amount of work generated by the call centre created an obligation to imagine the following "telework" flow: the call centre operator received the call, asked for the patient's data and received the ECG. Afterwards, the patient was put through to the Cardiologist who received the trace at home on his PC via fax, reported the trace and provided teleconsultation.

PHASE THREE:

implementing broadband technologies

In the third and present phase, the structure of the Service Centre was implemented with new broadband technologies (HDLS). The nerve centre is now equipped with four Hewlett Packard servers (with back-up hardware to avoid activity interruptions), a web server for Internet connection, a firewall for data security, a computerised call centre, 15 LAN workstations with four printers (over a network) and a central fax machine.

Project Phases:

1. Phase One: Establish a telematic network
2. Phase Two: Extend the network regionally + nationally
3. Phase Three: Implement broadband technologies

Telemed. Services offered:

1. General Practitioners
2. Chronic Patients
3. Telediagnosis
4. Call centre services for hospitals

The system information flow consisted of the following: a phone call arrived (from GPs, patients, health centres, rest homes, etc.) and the patient was automatically identifed through the stored telephone number or his identity code. Next, the phone call was sent to a free operator who recalled the patient's data stored in the enrolment phase and activated the "new call procedure", inserting new data relative to the call (a control call or a call made in the presence of symptoms). At this point, the trace could be received, the user put through to the Cardiologist or the duty nurse (a three-way call occurs) - both at home and connected to the central database through Internet. The specialist or the nurse proceeded by examining the stored clinical report and compared the trace with the baseline. Then, information was collected about the patient's history and clinical symptoms and a teleconsultation and / or nursing triage was provided. Finally, the reported ECG trace was sent to the patient by e-mail or fax and the data was stored, transferred to the web-server and made available on the Internet in the informatic clinical report, in an anonymous way and encrypted to ensure security.

An innovative teleworking model has been adopted for the medical professionals involved (the specialists and nurses), providing for a dedicated telephone line, a personal computer connected to the central system through the Internet via an `always on` ADSL Internet connection and a data protection system (Virtual Private Network). In this way, the remote personal computer works as a ter-

minal emulator to prevent the data stored in the central server from being transferred on local disk or printed.

CURRENT SERVICES BEING OFFERED

As a result of this project, four different types of services are now available:

SERVICE ONE:

General Practitioners

1,200 GPs receive a portable 12 leads electrocardiographer that can be interfaced to a fixed or mobile telephone and can transfer the recorded ECG trace back to the receiving station where a Cardiologist reports the trace and offers a teleconsultation. To date, GPs have requested teleconsultations for 104,568 patients, of which 35 cardiologists were involved. The analysis of a sample of 13,177 patients showed that teleconsultations solved the GPs' problems for 10,606 patients (80.4%); in 5% of cases, the patients were addressed to the Emergency Department and in 14.7% of cases a request for further diagnostic tests was made[1]. The diagnostic accuracy of the service (as regards the Emergency Department referral)[2], was tested on a sample of 3,456 patients and was 94.5% accurate, showing a substantial diagnostic value. The same accuracy was tested for chest pain symptoms with the results that the telecardiology service showed a sensitivity of 97.4%, a specificity of 89.5% and a diagnostic accuracy of 86.95%, compared against Emergency Department admissions for chest pains[3].

Moreover, the potential reduction of costs for the National Health Service through providing telecardiology services has also been estimated. In a group of 891 patients, there was a reduction of 47% of Emergency Department referrals and 95% in the number of cardiologic consultations in comparison with the normal procedure followed by GPs[4]. The same potential reduction of costs was tested in a subgroup of 311 elderly patients[5]. In Italy, many elderly patients with Atrial Fibrillation (AF) were followed by their GPs on a routine basis; it is therefore believed that a telecardiology service may provide a useful tool in the home-management of chronic AF and in the first detection of new cases[6].

SERVICE TWO:

Chronic patients

Chronic cardiac diseases, such as chronic heart failure, profit from multidisciplinary approaches that are able to reduce hospitalisation and improve the patient's quality of life, while at the same time, reduce costs involved for the National Health Service. Home Telenursing[7] is an integrated approach that must involve the patient, his family, the GP and Specialised Cardiac Centres. The physiological data and biological signal transmissions present objective data that may show the need for the intervention of a physician or a nurse. The possibility of the real-time transmission of this objective data by telephone, in association with subjective data given by the patient, allows telemedicine to become a new and unique approach to the problem of treating chronic patients.

As an example, a device that was able to record a one-lead trace was given to chronic heart failure patients; the trace could then be transmitted to the Service Centre where specially trained and experienced nurses were available for the evaluation of the trace and for an interactive teleconsultation about the patient's state of health, symptoms, weight, diuresis and therapy. This teleconsultation provided two different possibilities. Firstly, scheduled appointments (telemonitoring) and secondly, calls in the presence of symptoms (teleassistance), in which the patients could call the service centre 24 hours a day and 365 days a year, and speak with a nurse. The GP and the cardiologist of the reference hospital were informed about the patient's situation and could intervene at any moment regarding diagnostic and therapy arrangements. This study[8] showed significant reductions in hospitalisation and re-admission rates. In a preliminary study, the cost benefit ratio for telemonitoring (in which the implementation of a telemonitoring programme decreased annual medical costs) was assessed. This reduction was mainly attributed to hospitalisation costs[9].

SERVICE THREE:

Telediagnosis

Palpitations are a common symptom that sometimes results from a substantial cardiac arrhythmia. Establishing the cause of palpitations may be difficult because historical clues are not always accurate. A 24-hour Holter monitor is usually used, but the yield of this instrument is low in patients whose symptoms occur infrequently. Another instrument used to study palpitations is a transtelephonic event recorder. This hand-held device is given to patients and they can apply it to the chest when the symptoms occur. The patient presses a button to record about 30 records of cardiac rhythm, which is then stored in the memory of the device. The recording is later transmitted over the telephone for printing and interpretation to a call centre working 24 hours a day. In this case, a nurse compares the trace with the baseline, checks the patient's symptoms, and decides to end the telephone call or, in the presence of major arrhythmia, to request the cardiologist's intervention.

In a study to assess the effectiveness of telediagnosis, 310 patients were randomly assigned to receive an event recorder (ER) or a 24-hour Holter monitor. In the cases where an ER was assigned, it was used for seven days or until two recordings were obtained while symptoms occurred. The percentage of patients in whom the ER was able to record the ECG trace during palpitations was 76.8%, in comparison with the Holter monitoring in which the percentage was 47.8%[10]. In conclusion, more patients reached a clear diagnosis

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SERIES ON THE BOARIO HOME CARE PROJECT:

- **This article:** the project background & results
- **Volume 1, Issue 2:** the project cost analysis

Facts and Figures: The UK Healthcare System

By: Karmin Ruocco

Healthcare System

In the UK, the whole population is covered by the National Health System (NHS), which is financed through general taxation and run by the Department of Health. However, responsibility for the purchasing of health care services across the UK rests at the constituent country level: Primary Care Trusts in England, Health Boards in Scotland, local health groups in Wales and Primary Care Partnerships in Northern Ireland. Despite this coverage, there is an increasing trend towards private care and coverage, with 12% of the population contracting additional private health insurance.

Healthcare Facilities, Services & Staff

Throughout the UK, there is a coexistence of public hospitals, private non-profit hospitals and private for-profit hospitals. While hospitals are mainly publicly owned and independently operated, they are organised as hospital trusts with three hierarchical levels: community hospitals, district hospitals, and regional or inter-regional hospitals, as well as a number of specialised hospitals offering advanced treatment.

Primary care services are provided mainly by General Practitioners (GPs), who also act as "gatekeepers" in providing access to secondary care. Across the UK, there are approximately 3.1 million healthcare and social assistance employees, representing 11% of national employment and 1.4 million employees in the hospital sector, with 67% of all physicians working in hospitals.

Administration

Regulation of the healthcare system is decentralised; also carried out at the constituent country level by: the Strategic Health Authorities in England, the Area Health Boards in Scotland, the Local Health Boards in Wales and the Health and National Services Boards in Northern Ireland.

The Role of IT

The NHS has been undergoing drastic changes in the way it operates in order to improve the services it provides and give patients more control over their healthcare. On 1 April 2005 the Department of Health created NHS Connecting for Health – which is responsible for the delivery of the National Programme for IT. Tasked with creating a multi-billion pound IT infrastructure in order to increase efficiency and effectiveness in healthcare services across the UK, the National Programme for IT is responsible for:

+ creating an NHS Care Records Service to improve the sharing of patient records across the NHS with their consent;
+ making it easier and faster for Gps and other primary care staff to book hospital appointments for patients;
+ providing a system for the electronic trans mission of prescriptions, and
+ ensuring that the IT infrastructure can meet NHS needs now and in the future.

More information on the NHS Connecting for Health Programme is available on their website at www.connectingforhealth.nhs.uk

The UK at a Glance

Population:	59.3 million
Live births:	11.3%
Death rate:	10.2%
Life expectancy:	77 years for men / 81 years for women
GDP:	1,590 billion euros
GDP per capita:	26,800 euros
Total healthcare expenditure:	7.7% of GDP
Healthcare expenditure per capita:	2,200 PPP euros
Inpatient care expenditure per capita:	880 euros
% of healthcare system financed by public funds:	83%
Number of equipment & scanners per million population:	4.6 MRI 4.9 radiology equipment 6.2 scanners
Number of hospitals:	481 hospital trusts and 230 private institutions
Number of beds:	230,000 acute care beds (public beds 96%, private beds 4% of all beds)
Number of beds per 1,000 population:	2.4%
Rate of occupancy:	81%
Length of stay:	5.0 days
Number of acute care hospital admissions:	214 admissions % population
Waiting list:	Significant: 1.1 million patients on waiting lists

Centre for Health Informatics and Multiprofessional Education (CHIME)
University College London

Interview with David Ingram, Director

PLEASE TELL US A LITTLE BIT ABOUT CHIME. WHAT ARE YOUR CURRENT TOP 3 RESEARCH PRIORITIES?

CHIME, situated at the Whittington Hospital Campus of the Medical School of UCL in North-Central London, is founded on the principle that close contact with real health care requirements and services must underpin its research and teaching. CHIME enjoys a strong track record in national (Department of Health) and international research (EU Framework Programme), as well as in international standards activities for the field (CEN, ISO, HL7, openEHR). Our work is also grounded in innovation and the implementation of practical information systems and services required for health care and for the education, quality and governance frameworks within which these operate.

Our current research priorities include:

- devising a sustainable personal health record architecture (MRC CLEF project) that can be implemented;
- representation and management of patients' access to knowledge on inherited genetic disorders (ApoGI and Pegasus projects within CHIME WHO Collaborating Centre in Community Genetics), and
- evaluating the evidence base of current e-health services and their organisational development (Department of Health Projects).

WHAT IS THE UK CONNECTING FOR HEALTH PROGRAMME (CfH) AND WHAT ROLE DOES CHIME PLAY IN ITS DEVELOPMENT?

CfH is an agency of the Department of Health, charged with the specification, commissioning and delivery of a strategy for a health care information infrastructure for the National Health Service in England. The Programme, first called the National programme for IT (NPfIT), arose from a government White Paper published in the late nineties, entitled "Information for Health." This paper set out a strategic case that the management of a modern health service is now critically dependent on good quality information services. It concluded that harmonisation of key clinical, managerial and technical systems and standards was necessary and that this required national mandate and coordination.

CHIME, as such, is not a contracted part of the programme, although it has many working connections with different aspects of its work. CHIME is seeking to make indirect contributions, in building human expertise and communities and creating the longer term underpinning health informatics discipline required to enable any health care information infrastructure to become a rigorous and sustainable entity, fit for purpose in the rapidly changing worlds of medicine and health care, internationally.

Areas of CHIME's work relevant to and contributing indirectly into CfH are:

- its teaching programmes, such as the graduate programmes in health informatics and risk management;
- its participation in health and bioinformatics research programmes of the national Science Research Councils, the Department of Health, the EU and the national eScience programme, and
- its leadership roles in international standards (CEN, ISO) and open source software initiatives (openEHR).

TO DATE, WHAT HAVE BEEN THE BIGGEST SUCCESSES OF THE CONNECTING FOR HEALTH PROGRAMME?

The programme is envisioned on a very large scale and is sometimes described as the largest IT programme in the world. It has pioneered new government contracting arrangements for the procurement of major national IT systems and services. These contracts have been constructed and implemented at great speed and have been influential in Whitehall's efforts to improve its effectiveness and achievement of value for money in the commissioning and delivery of government IT-based services, generally.

At this stage, CfH is engaged in innovation on a wide canvas, working for example with Microsoft on defining a common clinical user interface and with BT on implementing a core electronic health record for every citizen. It is implementing a major new national broadband network and an electronic booking system, for use in clinical referrals among practitioners, to provide choice of the where, when and with whom, in selecting the investigation, treatment and care they need. On the clinical applications side, it has implemented a great deal of software and achieved some, albeit limited, operational successes, in areas such as PACS.

There are many problems, though, in sustaining legacy systems while introducing new standardised systems in many areas of care delivery across all provider organisations. For these purposes, the NHS has been divided into five national regions, each under contract from a major Local Service Provider (LSP), a large company able to take on projects on the scale of

hundreds of millions of pounds and made responsible for leading a consortium to deliver the infrastructure in that area. The feasibility and willingness of large systems suppliers to align and harmonise products within a national framework of standards is being severely tested, on all sides.

Of course, CfH has multiple stakeholders and each has different perceptions and dependencies on IT. There is, in simple terms, a triangulation of clinical and health care, management and technical dimensions to the framing of the Programme. Working across these boundaries at a national level is a new territory for all the players, both within the service and in the industries and consultancies engaged in delivering the IT solutions. Amongst CfH's more significant accomplishments has been the initiation of a major national experiment in this area, bringing to the fore, at a national level, often hitherto hidden issues about the nature of the disciplines of medicine and health care services and of how well they are represented and communicated, in terms of information. This is a complex and often chaotic and fraught process, notably, now, for the clinical and management communities - where learning a practical sense of what being a good customer who is able to use IT well, really means for them and their roles and responsibilities. As such, this is an important area of learning and culture and organisational change.

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This gaining of new insight is, though, extraordinarily hard to accomplish alongside all the other daily pressures of sustaining health care. Many senior people still hope to be able to look the other way and leave the challenge to someone else. CfH is now of such national priority and focus that this is less an option, and that is progress of a kind, too! It is arguable that without a CfH-like initiative - leaving aside issues of cost – the health care information infrastructure would have continued to fester and deteriorate. But CfH is a very high-risk strategy and urgently needs balancing, now, with a more bottom-up driven, iterative process of evolution of systems, anchored on meeting local needs and developing local practical capacities.

FROM A CLINICAL RESEARCH PERSPECTIVE, WHAT HAVE BEEN THE BIGGEST IMPLEMENTATION BARRIERS OF THE CONNECTING FOR HEALTH PROGRAMME?

The barriers relate to data standards, security and confidentiality and multiple competing systems developments which lack coordination. There is a great keenness in the research community to have an interface to the national health care information infrastructure. The focus for CfH is very much upon the implementation of systems and services for health care delivery. Important though research is to the scientific evidence base and quality improvement of services, these have taken a back seat. A secondary uses service is currently under development, whereby it is expected that researchers will, within nationally determined governance, have access to operational clinical data collected by CfH.

Clearly, the provenance of this data makes it an attractive proposition for both clinical and pharmaceutical research, provided that acceptable and effective governance can be implemented and the concomitant risks of unintended disclosure and use can be managed acceptably. There are currently inadequate resources devoted to studying and building this research interface, but new initiatives such as the national Clinical Research Collaboration (CRC), which will oversee clinical trials and research within the NHS and its relationships with academic, industry and patient groups, is expected to play a leading role here.

IN THE DEVELOPMENT OF ANY HEALTHCARE INITIATIVE, A PRIMARY CONCERN IS THAT OF ENSURING THE QUALITY OF INFORMATION AND

David Ingram

INFORMATION SERVICES FOR PATIENTS. IN WHAT WAYS IS THIS BEING ADDRESSED BY INITIATIVES IN THE UK?

There are multiple initiatives within the NHS. Through telephone and web-based services, such as NHS Direct Online, citizens can gain advice on a variety of health problems. Through the National Electronic Library for Health, which is mainly focused on professionals, there is an intention to provide and update reviewed sources of useful knowledge about health and health care. Developments in knowledge discovery services go far beyond health, of course, and getting answers to many questions asked will involve using these wider resources. There is, however, a danger in health putting too much resource into developing its own domain and not enough into aligning it with wider initiatives in data curation and knowledge management.

An emerging concern is that the rhetoric and the reality of government information services for citizens are too far apart, as pioneering initiatives such as Starthere, focused on bringing together information resources across the voluntary sector and all media of dissemination, have shown. A more bottom-up driven approach to information services is needed, locally contextualized and built around what people actually ask about and the problems they experience in gaining help. Different services provided by different agencies across government are often very far from joined up, in terms of cover, consistency and coherence. More worryingly, the will to partner all stakeholders, including those

across the voluntary sector, to tackle these problems in a cost-effective manner, seems, too often, to lose out to self-protecting agendas of one group or another to control information tightly. Seeking progress in isolation, or on one's own terms, is neither effective nor sustainable - but vested interests are powerful.

IN DEVELOPING A HEALTH CARE INFORMATION INFRASTRUCTURE, WHAT ARE THE BIGGEST AREAS FOR POTENTIAL MISTAKES?

The task of creating and sustaining a health care information infrastructure is one of the class now known as wicked problems, characterised, amongst other things, by never being completely solved, and by not having clear ownership of the problem, permission to experiment or right to judge. Such problems require innovative, iterative experimental approaches because their true nature is not understood until they are tackled and, in any case, change over time.
There are not right and wrong answers to such problems and solutions to them require change in human behaviour. There are multiple stakeholder perspectives and governments are notoriously ineffective and wasteful in tackling them since, almost by definition in politics, getting such things wrong is not an option!

On the other hand, top-down coordination and resources are essential for a problem of this scale within a national service. We know that good practice can evolve from the bottom up, in well-defined and bounded practical contexts. However, it does not, typically, disseminate and generalise, in terms of interoperability and acceptable governance, from the bottom up alone.

The CfH Programme has to build an organisational culture that can combine top down with bottom up; in situ innovation with national commercial contract, and national standards with the local custom and practice needed to meet local need.

Many of the issues of the health care information infrastructure are international. Achieving international coordination, focused on implementation effectiveness and what matters to patients and not on abstract and lengthy argumentation about the vested interests of the many stakeholders in the enterprise, is both the greatest challenge and the greatest risk.

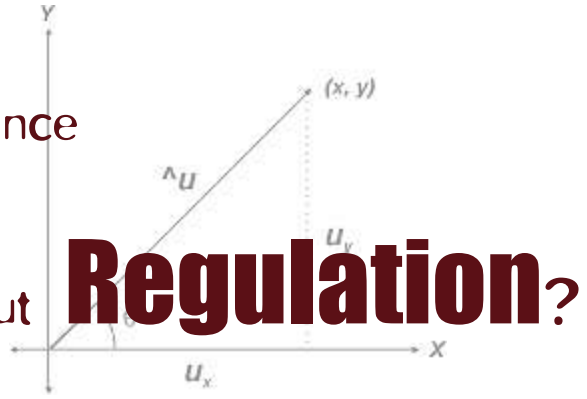
WHAT IS THE EMERGING SCOPE OF THE UK HEALTH CARE INFORMATION INFRASTRUCTURE?

From my perspective as an interested observer, loyal to the goals of the programme, but not in any sense as a spokesman for it, I see the emerging scope to include: a life-long and evolving electronic health record for every citizen, and the capture and communication of information needed at all levels of health care and service delivery, such that it is trusted, accurate, relevant, timely, safe, accessible, securely and confidentially managed, sustainable and affordable.

Quite a challenge.

Country Focus: UK

Quality, Safety and Performance in European Healthcare IT: Should we be Thinking About Regulation?



By: Benedict Stanberry

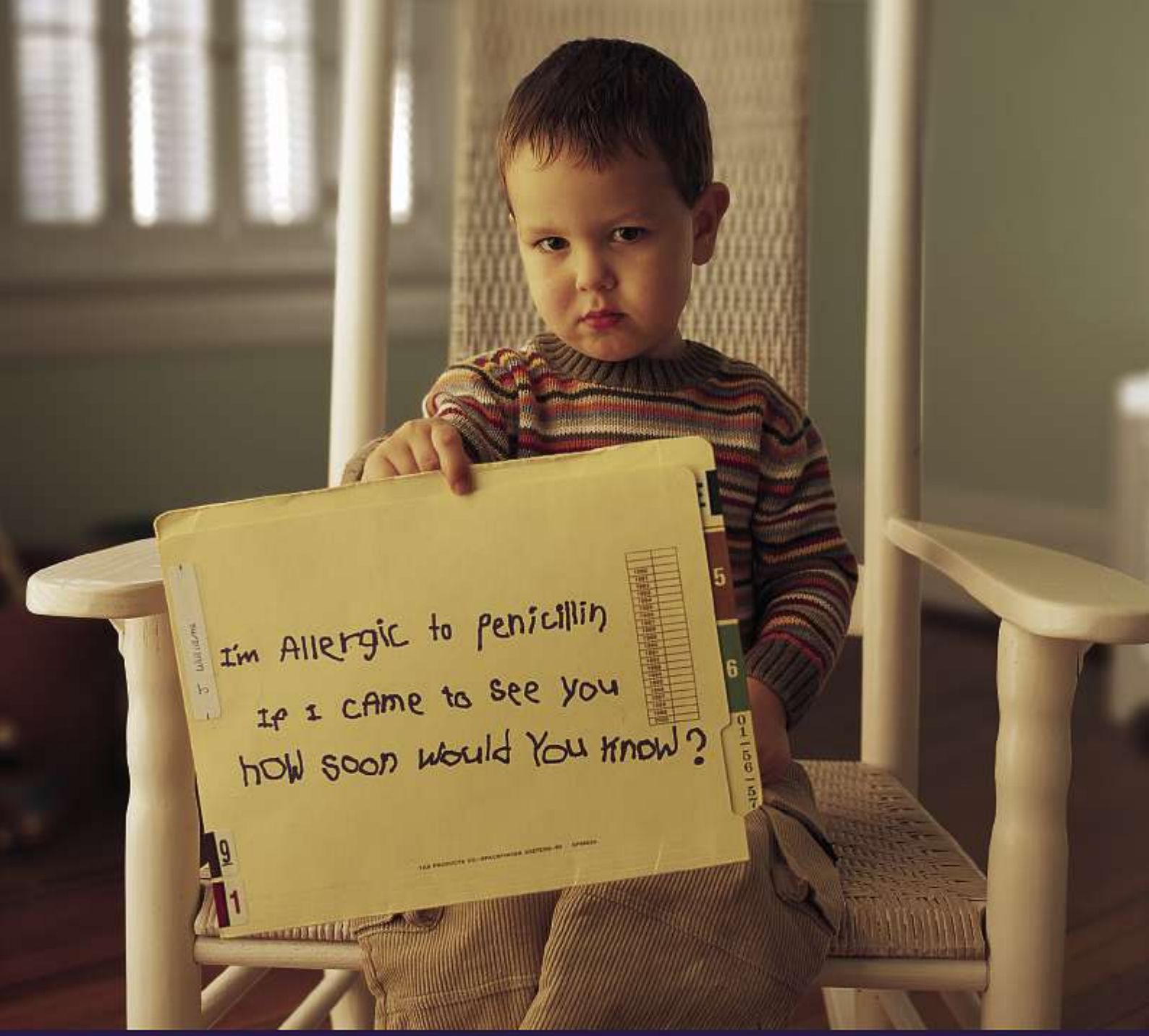
Introduction

The UK's Connecting for Health (CfH) programme for information technology in the National Health Service (NHS) aims to put in place, through the use of new technology, information systems that give patients more choice and health professionals more efficient access to information and therefore ensure delivery of better patient care. Core elements of the programme will include the NHS Care Records Service (NHS CRS), which will provide a live, interactive patient record service accessible 24 hours a day, seven days a week[1].

CfH is just one of a number of initiatives by European Member States that have enabled healthcare IT – for so long the "Cinderella" sector of the European healthcare industry – to achieve substantial growth over the past five years. Healthcare IT is already a €83 billion (£57 billion) business worldwide, comparable in scale to a Latin American economy, and is predicted to grow at a near double digit rate for at least the next decade[2].

Despite this, the European healthcare IT market continues to be highly fragmented. Unlike the pharmaceutical sector – where the top ten firms accounted for roughly half of all pharmaceutical sales in 2002 – no single vendor of healthcare IT software, consulting or data management services has more than 1.7 billion (£1.14 billion) in worldwide healthcare revenues[3]. Though the widespread fear that many established European healthcare IT suppliers would fold has turned out to have been overstated, some of the weaker players have indeed left the market while some well-established local players have in fact become even stronger[4].

However, continuing market fragmentation is not the only sign that the healthcare IT sector isn't quite as mature as it sometimes pre-



Misys Optimum

IN THE MIDDLE OF AN EMERGENCY, THERE'S NO ROOM FOR ERRORS. MISYS CONNECT™, THE WEB-BASED DATA SHARING SOLUTION FROM Misys Healthcare Systems and only one of the Misys Optimum™ family of clinical products, enables immediate access to patient data across hospitals and GP surgeries — resulting in better outcomes, reduced medical errors and time saved for patients and busy clinicians alike. Seamlessly integrating best practices with essential patient information pulled from Misys' industry-leading products or those from other vendors. Misys Healthcare Systems. Supplying easy-to-use, reliable, high-quality systems and services to healthcare providers for 25 years.

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tends to be. While the established sectors of healthcare innovation – principally pharmaceuticals and medical devices – are subject to a significant level of regulation and control as regards the quality, safety and performance of their products, healthcare IT in Europe remains largely unburdened by such requirements. This could have far reaching consequences for both patients and users, in at least three important respects.

Where's the evidence?

The first significant problem is that presented by the shortage of evidence-based research to support the many claims made for healthcare IT applications: particularly claims regarding cost and clinical effectiveness[5]. Put simply, the standard of proof of efficacy that IT has been required to meet as a pre-condition of large-scale deployment has not been as high as that which medical devices and pharmaceutical products have had to reach before achieving similar status. Unkind observers might go so far as to argue that the potential of IT for transforming the delivery of health and social care is, as yet, unproved and that any claims made for it at present are mere speculation.

"the European healthcare IT market continues to be highly fragmented...no single vendor of healthcare IT software, consulting or data management services has more than €1.7 billion (£1.14 billion) in worldwide healthcare revenues"

Despite the expert consensus that there is not enough hard, research-based evidence to support all of the clinical and cost effectiveness claims made for healthcare IT, the UK's National Institute for Health and Clinical Excellence (NICE) – the independent NHS organisation responsible for validating whether or not pharmaceuticals and healthcare products are safe and do what they are supposed to do – has never received a request, either from local users or from the Department of Health, to appraise a healthcare IT application. Little wonder, perhaps, that it is some of NICE's most senior experts that are most critical of the poor evidence base for healthcare IT[6].

What is best practice?

The second consequence of the privileged status that healthcare IT has been accorded in comparison with other sectors of healthcare innovation is a natural, knock-on effect from the first. Automating healthcare using IT is the most demanding and dangerous task in the modern economy, because health services are the economy's most complex and safety critical products. Yet because there is an absence of in-depth assessments of how well healthcare IT applications (and the organisations that use them) work in practice, there has been no consequent activity aimed at capturing, describing and then disseminating "best practices" – that is, how to implement and use healthcare IT applications safely, smoothly and responsibly.

In fact, we presently have a dangerous situation in which healthcare IT systems are being installed and implemented at breakneck speed whilst the nature of these systems means that users have to accept a much greater degree of responsibility for their effective and safe use than in other comparable service sectors. The velocity of change is so fast that the different professional groups present in a modern urban hospital – administrators, doctors, nurses, IT managers – have such different and conflicting views of the rightful role of IT in the care process that there is now a very real potential for anarchy.

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For a copy of the references contained in this article, please contact k.ruocco.me@eahitm.org.

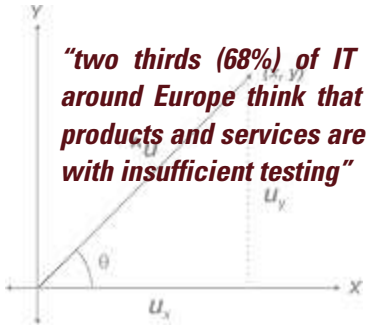
Safety first or last?

A third illustration of the uniquely privileged position of healthcare IT among all the sectors of healthcare innovation is provided by a comparison of the times taken to develop a healthcare IT application and a pharmaceutical product. The typical time span for a new drug is between ten (at best) and 17 (at worst) years. During this period, three to five years will be spent on safety studies (phase I) and an equivalent period on efficacy studies (phase II). It is quite typical for the bench-to-bed programme of development for a single drug to span at least a dozen years before the first sale is earned.

By contrast, healthcare IT systems and applications, because they do not require the grant of a marketing authorisation before they can be sold or distributed (which in turn requires the compilation of significant evidence of a product's safety, quality and performance), can be placed on the market as soon as they are ready - or sometimes even sooner.

A recent report by the Anglo-Dutch IT firm LogicaCMG entitled "Testing Times for Boardrooms" concludes, for instance, that two thirds (68%) of IT managers around Europe think that too many products and services are launched with insufficient testing. NHS Trust managers were included among the respondents to the survey, 89% of whom said that they had problem-ridden systems just 48 hours after going live with a new application[7].

"two thirds (68%) of IT managers around Europe think that too many products and services are launched with insufficient testing"



This kind of situation simply would not be allowed with pharmaceuticals and medical devices. Both types of products come under the supervision of a competent authority in each European Member State (such as the Medicines and Healthcare products Regulatory Agency (MHRA) in the UK) which provides marketing authorisations and administers the system by which medical devices are approved and given a "CE" mark, prior to being placed on the market. Perhaps most importantly, these competent authorities - or their designated representatives - inspect the manufacturing of both medicines and medical devices to ensure that regula-

tions are being complied with and operate a system for receiving reports of problems with products, investigating those reports and subsequently issuing warnings to users. Healthcare IT applications are not covered by any of these systems for independently inspecting and monitoring safety, quality and performance. Is it time that this situation changed?

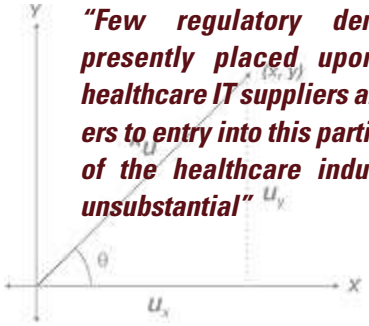
Time for regulation?

Everyone involved in using or supplying healthcare IT systems in Europe should be concerned by the present situation. If other sectors of healthcare innovation are subject to the sometimes heavy burden of clinical trials and regulatory compliance and yet still experience incidents where patient safety is compromised and reputations damaged, then we should be extremely concerned by the temptation to recklessness that the lack of regulation in healthcare IT presents.

Indeed, with so many small and medium-sized enterprises competing in such a highly fragmented marketplace which makes so few formal efficacy and safety demands, it would be little short of miraculous if, within the next few years, none of them have supplied an application which contains some intrinsic design flaw which it is wholly foreseeable could cause harm to a patient.

One of the major barriers to changing attitudes is the oft-repeated mantra that healthcare IT is, in itself, a risk-reducing system. The latest review document from the UK's Connecting for Health programme describes, for instance, the NHS CRS as "a means to improve care through better safety and outcomes"[8]. On the one hand this is, of course, true. Ensuring that healthcare professionals have timely access to relevant information, whenever and wherever it is needed, will indeed help prevent decisions that may cause harm or risk of harm. However, it will not eradicate them entirely and, given the lack of benefits evidence already discussed, it is particularly disingenuous to believe that information technology is going to be a cure-all for every kind of medical harm.

"Few regulatory demands are presently placed upon European healthcare IT suppliers and the barriers to entry into this particular sector of the healthcare industry remain unsubstantial"



That same review document also contains a frank admission that the service needs to be subjected to a comprehensive risk assessment: particularly as regards the issues associated with the use of "sealed envelopes" by which patients can limit access to some or all of their record. Elsewhere, we are seeing early implementations of decision-support systems failing to have any impact at all on prescribing errors[9] and clinical information systems failing to prevent the unlawful disclosure of patient-identifiable information[10]. We will only start to prevent these kinds of failures when we are able to contextualise IT in healthcare in exactly the same way as we would in other safety critical fields, such as aviation or nuclear energy generation: as an engineering problem in its own right.

Conclusions

Few regulatory demands are presently placed upon European healthcare IT suppliers and the barriers to entry into this particular sector of the healthcare industry remain unsubstantial. While there is no compelling evidence to suggest that healthcare IT applications are so scandalously unsafe that they should immediately be subjected to a regime similar to that used for pharmaceuticals and medical devices, the gulf between healthcare IT and its sister sectors is dramatic enough to indicate a market that, while no longer in its infancy, is still not a fully grown adult.

As healthcare IT applications cease to be the sole preserve of a limited number of trial-blazing sites and become more and more deeply embedded in routine care throughout the NHS and the independent sector, considerations of patient safety and liability reduction will surely necessitate the imposition of a more structured, formal system of clinical trials, regulatory approval and product licensing for IT systems. It is difficult to disagree with the suggestion, already made by other respected commentators, that the now adolescent European healthcare IT market might greatly benefit from a more disciplined approach to quality, safety and performance[11].

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in real time when an ER was used, in comparison with Holter, for monitoring palpitations. For this reason, it is believed that ERs should replace Holter monitoring for this purpose whenever possible.

SERVICE FOUR:

call centre services for hospitals

The fourth service now available as a result of this project is that terminals have been implemented in 21 University and public hospitals, functionally linked with the Service Centre and configured to share the application program interface of the Central Station with an "on site/ on line" license. The Service Centre then provides the technological and organisational support, while health activity is managed by the Cardiologists and nurses of the hospital.

THE RESULT

of the project

Currently, the Boario Home Care Project is eight years old and has demonstrated its value for increasing access to health care services, improving the quality of care and a reducing costs for the National Health Service in Italy. A main characteristic of the project is that it can easily be transferred to another context with different accessibility and quality requirements of local services. While the Boario Home Care Project has yet to reach maturity, evidence indicates that many objective results can be achieved - even if they are considered preliminary. In fact, in the field of telemedicine, although claims about the utility and the efficacy of new telecommunication systems have been widely made, these are not founded on strong evidence. The research published on this has shown some deficiencies in the design and is often not controlled[11]. In attempting to solve these problems, it is necessary to plan some controlled studies hoping that these new results will be able to give some answers to the main open questions in the field of telecardiology.

Movers & Shakers: Industry Interview

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Web: www.agfa.com

Dr. Jonathan Elion, CMO, Agfa HealthCare

In this issue's Industry Interview, we asked Dr. Jonathan Elion, the new CMO of AGFA Healthcare, about the challenges and opportunities of cardiology image management and what the future of imaging management looks like.

What do you feel are the biggest challenges when integrating radiology, cardiology and other information management systems into a single, manageable architecture?

The "back end" portion of the architecture is not much of an issue today, assuming that sufficient storage, expansion capabilities, speed and reliability are in place. The real challenge comes in maintaining the differentiation at the workstation level. After all, the features and underlying workflow behind the design of a mammography reading station is not normally a good match for the cardiac catheterization laboratory. The image and information needs in each target area must continue to be optimally addressed by their respective client workstations.

What is the most popular form of data storage that you see your customers using in cardiology image management today?

Just a few years ago, my answer would have been host-attached RAID storage with online tape or DVD systems. This moved rapidly to Network Attached Storage (NAS) and, most recently, to Storage Area Networks (SAN) or NAS-headed SAN. Most image management systems use high-speed disk for primary image access. While DVDs are use less frequently for primary storage and online review, they continue to have an extremely valuable role in disaster recovery and "downtime procedures". By this, I mean the ability to continue to function even in the event of catastrophic failures such as the loss of a hospital network.

Do you see a trend towards keeping larger amounts of images online for longer periods of time?

Absolutely! This is especially true as we see the cost of disk storage continuing to fall. A review of previous studies for the patient (even from several years ago) is often needed on an emergency basis, where a delay of even a few minutes is not acceptable.

What are the key security requirements to consider when implementing a cardiology information system?

The security issues for Cardiology Information Systems are basically the same as for any Hospital Information System. There are a few special things worth noting, however. One of these is a warning about "Patient Synchronized Applications" (PSA). With PSA, two computer programs can synchronize so that they each present their respective information on the same patient. For example, if you are reviewing laboratory data results, you might want to start an image viewing application and have it start up by presenting the images on the same patient. While this sounds convenient, it actually makes it much more difficult to control and track access to patient information, as each program must be assured to conform to access control policies.

A better approach is to have all access to patient information through a single program (often called a portal or Physician's Portal). Specialised viewing (such as full-motion images) are best done as a "plug-in" to the portal rather than as a separate program, thereby keeping all security and access control issues centralised into one program. Another important feature of security relates to the frequent need for information to care for a patient in an emergency situation. In this situation, the needs of security need to be balanced with the need for information access.

What are the biggest challenges when adapting cardiology information management solutions for different medical cultures around the globe?

I have found it more helpful to focus on the similarities, rather than the differences. The heart is pretty much the same throughout the world (although some would claim it is much warmer in many

parts of Europe!). There are not significant regional differences in cardiovascular physiology or in the approaches to cardiac care. However, what I do find is differences in percentages. Let me explain by giving a few examples. In the U.S., it is common for an echocardiography technician (sonographer) to perform the imaging study, with the echocardiography physician involved only in reading the study. However, some U.S. cardiologists still handle the transducer and perform the study themselves. In many areas of Europe, these percentages are reversed, and it is more common for the physician to perform the study.

This doesn't introduce a new concept; it just reflects differences in what might be more common or less common practices. In the U.S., it is common for a Cardiologist to have several allied health professionals assisting in the gathering and recording of information (patient history, hemodynamic findings, etc.), whereas in other countries, there might be fewer people available for such data gathering and recording (or in some cases, only the physician performs this role). In some countries, dictation and transcription are common, in others, it is rarely available. Perhaps the one single greatest challenge that the industry has had to face is the need for multi-lingual capabilities of software within one institution.

What do you feel are the most significant challenges and opportunities in cardiology information management in the coming years?

The medical community is still learning how to use information for real-time decision support and for the improvement of its processes. The business community discovered "Business Process Re-Engineering" many decades ago, but healthcare is just now coming around to realising the importance of re-engineering its healthcare delivery processes. We need to continue to refine our ability to gather and store information that is coded based on international standards, and to analyse and use this information to continue to drive towards improving quality and controlling costs.

DESIGNING A HIGH PERFORMANCE TELEMEDICINE SYSTEM

CONTINUED FROM PAGE 31

outside the CPO, and the remote transfer and archiving of ultrasonic probes (US), in particular, echocardiographies. It represents especial interest in view of the fact, that CPO in regions are equipped by the same devices of ultrasonic scanning having the option of telemetric data transmission.

Another objective is the successful remote testing and reprogramming of implanted artificial rhythm drivers (electro-cardiostimulators or pacemakers). According to information from the Leningrad Regional Cardiologic Dispensary (LRCD), acting as the Regional Centre of Surgical and Intervention Arhythmology in Russia, there are about 1,300 patients with implanted pacemakers in the Leningrad region alone. There are approximately 150-160 pacemakers implanted annually (without taking into account the replacements), i.e. the intensity of implantation is about 100 in one million of the population per year. Thus, the number of patients continuously increases. The majority of patients with heart blockage, at which pacemakers are implanted, are elderly. The transport availability of cardiologic clinics for these categories of patients is rather low.

Existing techniques of patient monitoring provide for the testing of pacemakers once in half a year. Therefore, approximately 2,600 persons per year would need to visit centres testing such devices. However, the actual number of visitors to specialists in the testing and programming of pacemakers seldom exceeds 100 in a month, and the number in a year is about 1,000 (holidays considered). These figures demonstrate that more than half of patients do not regularly check the functioning of their pacemakers! In many respects, this is connected with the fact that patients often cannot travel to St. Petersburg for these procedures.

SERIES ON DEVELOPING A HIGH PERFORMANCE TELEMEDICINE SYSTEM:

This article:
Designing the system

Volume 1, Issue 2:
Building a telemedicine Internet portal

Volume 1, Issue 3:
Creating the telemedicine system architecture

Work practice shows that nine out of ten people do not require any changes in their pacemaker parameters after testing. In these cases follow-up visits are carried out not under medical indications, but through a clinic survey, thus, the consulting polyclinic of the LRCD carries out only clinical supervision.

As a result, the cardiologic cabinet of the local polyclinic that should carry out supervision is actually removed from the process. The organisation of remote testing will bring this type of medical aid to patients in remote territories. In doing so, it will allow for performing these test procedures on patients who did not visit experts in the LRCD for many years, as well as improving the quality of prophylactic medical examinations on patients with pacemakers.

Finally, the fifth objective is the development of a medical server with a distributed database that contains data not only about consulted patients, but also that actively reveals the early stages of BCS illnesses, for example arterial hypertensia, with the possibility of the automatic measurement of blood pressure, growth and weight, tracking in dynamics, etc. This makes it possible to decrease the death rate from a sudden heart attack and insult due to performing preventive actions.

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directly at European level by correspondence with the European Commission, either on a service level, i.e. by mail to the unit heads in a relevant DG, or on political level through correspondence to the responsible Commissioner. For more information on the relevant DGs for Healthcare IT Managers, please see "Your relevant DGs" on page 13). .

The appropriate Commissioner is often the easiest to identify and forwards all correspondence to the responsible persons within the Commission. Through such correspondence, an idea can be presented or a meeting requested, etc.

Alternatively, if individuals or organisations establish a relationship with a Member of the European Parliament, this channel can be used to address a question to the Commission, i.e. via the European Parliament. In this case the Parliament requires a formal institutional answer from the Commission.

Other roles

As the European Union's executive body, the Commission is also responsible for managing and implementing the EU budget and the policies and programmes adopted by Parliament and the Council. Most of the actual work and budget expenditure is managed by national and local authorities, but the Commission is responsible for its supervision.

The Commission moreover acts as "guardian of the Treaties". This means that the European Commission, together with the Court of Justice, is responsible for ensuring that EU law is properly applied in all the Member States.

Finally the European Commission represents the European Union on the international stage, for example negotiating international agreements on its behalf.

Series on European Institutions
- This article: the European Commission
- Volume 1, Issue 2: the European Parliament
- Volume 1, Issue 3: the Council of European Union
- Volume 1, Issue 4: the European Court of Justice

SELECTING AN ELECTRONIC HEALTH RECORD

continued from page 21

Finally, the budgeting requirements for an EHR project should focus on the total cost of a complete implementation; not solely on the cost of the software plus hardware required.

EHR selection must include clearly matched requirements and features

The actual process of selecting an EHR can be divided into two phases. The first is problem-based and focuses on matching the organisation's stated goals and objectives directly to product features and functions. The second phase is feature-based and emphasizes a side-by-side comparison of competing EHR products.

Problem-based selection ideally begins with a review of the organisation's stated goals and objectives. Using this information, a formal systems analysis should be conducted to review information flows, job functions and the overall efficiency of the clinical operation. Once this systems analysis has been completed, a formal list of requirements can be generated - usually referred to as a "requirements document" or "requirements specification".

The requirements specification serves three purposes. First, it provides a listing of the required features and functions that any product must have in order to meet the needs of the organisation. Secondly, it provides an objective set of criteria for comparing products. Its final use is for creating a formal request for proposal (RFP) which is then sent to vendors that may wish to bid for the project. The requirement specification is also very important to the implementation phase of the project because it provides, in one document, cross-referenced goals, objectives, features, and functions which can be quite handy when used as a metric to track project progress during an implementation.

Feature-based selection is straightforward - assuming that a requirement specification has been created. This is simply a side-by-side comparison of two or more products to determine which offers the greatest number of required features and functions. When doing the feature-based comparison, required features and functions should be prioritized from essential to wish list. Using this method, all key objectives and goals are sure to be addressed with any product selected. Many organisations use a point-based, numerical system to calculate a final score for each product, with the highest scoring product winning the competition.

Conclusion

A successful EHR implementation requires the selection of a product that meets all the needs of the organisation. Therefore, the selection process begins with a thorough review of the goals and objectives of the organisation followed by a detailed analysis of current functioning along multiple axes. This information is then used to create a requirements document that allows the organisation to realistically select the ideal EHR product. In most organisations the entire process, from the statement of goals to the selection of the final product, requires six to nine months.

There are no shortcuts.

Industry Events

May

eHealth 2006
High Level Conference and Exhibition
10 - 12 May 2006
Malaga, Spain
www.ehealthconference2006.org

TEPR 2006
Towards the Electronic Health Record:
20th Annual Conference
20 – 24 May 2006
Baltimore, USA
www.tepr.com

IteG 2006
International Forum for Healthcare IT
30 May – 1 June 2006
Frankfurt, Germany
www.mesago.de

June

Tromsø Telemedicine and eHealth Conference
12 – 14 June 2006
Tromso, Norway
www.telemed.no

CARS 2006
28th Conference of Computer-assisted Radiology & Surgery
28 June – 1 July 2006
Osaka, Japan
www.cars-int.org

ICT for Biomedical Sciences 2006
Organised by the European Commission
29 - 30 June 2006
Brussels, Belgium
www.europa.eu.int/information_society/events/ict_bio_2006/index_en.htm

August

MIE 2006
20th Annual Conference for the European Federation of Medical Informatics
27 – 30 August 2006
Maastricht, Netherlands
www.mie2006.org

Nordic Conference on eHealth & Telemedicine
6th Annual Conference
31 August - 1 September 2006
Helsinki, Finland
www.nceht2006.org

September

ESC Congress 2006
European Society of Cardiology
2 – 6 September 2006
Barcelona, Spain
http://www.escardio.org/congresses/esc_congress

DMS Expo
Digital Management Solutions Conference
19 – 21 September 2006
Cologne, Germany
www.dmsexpo.de

Medmatic@
Advanced telemedicine conference
28-30 September 2006
Fiera di Vicenza, Italy
www.medmatica.it

October

The World of Health IT
2006 Conference & Exhibition
10 – 13 October
Geneva, Switzerland
http://www.worldofhealthit.org

MedNet 2006
11th World Congress on Internet in Medicine
13 – 20 October 2006
Toronto, Canada
www.mednetcongress.com

November

MEDICA 2006
World Forum for Medicine
15 – 18 November 2006
Dusseldorf, Germany
www.medica.de

IST 2006:
Strategies for Leadership
European Commission's Annual IST Event
22 – 24 November 2006
Helsinki, Finland
www.ist2006.fi

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health management
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HMI
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Programme Preview

Wednesday 30 August 2006 - Pre Congress

EAHM Meetings
Hospital Visits (By arrangement with the Organising Committee)
"The Health Services in Ireland" (Department of Health and Children Presentation)
Pre - Congress Tours (By arrangement with the Organising Committee)

Thursday 31 August 2006 - Congress

09.00 - 10.30	General Assembly of EAHM
11.00 - 12.30	Opening Ceremony
14.00 - 16.00	Session 1: Innovation in Hospital Practice and Organisation
16.30 - 17.45	Session 2a : Developing Best Practice in Service Development and Quality
19.00	Reception - In the historic setting of Dublin Castle with its medieval tower and splendid State Apartments

Friday 1 September - Congress

09.15 - 11.00	Session 2b : Developing Best Practice in Service Development and Quality
11.30 - 12.30	Session 3: Leadership and Change Management
14.00 - 15.00	Session 4: Best Practice in Integrating Care
15.15 - 16.45	Session 5: Health Systems Perspectives
16.45 - 17.15	Session 6: Close of Congress
19.00	Gala Dinner in the magnificent Round Room of the Mansion House, Dawson Street, official residence of the Lord Mayor of Dublin since 1715.

Saturday 2 September - Post Congress

09.30 - 14.30 Post Congress Tour

Preliminary Programme is now available on the Congress Website:

www.eahm2006.ie

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