

HEALTHCARE IT MANAGEMENT

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THE OFFICIAL JOURNAL OF THE EUROPEAN ASSOCIATION OF HEALTHCARE IT MANAGERS

IT@NETWORKING AWARDS 2012

WINNING PROJECTS

The Systematisation of E-Health

Digital Pathology Software

E-Prescribing

Country Focus: Greece



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THE WORLD OF THE iREVOLUTION

Dear Reader,

This year's HIMSS 2012 Las Vegas conference has once again highlighted the key importance of IT in successful healthcare deployment. Despite the fact that European IT solutions level up and even out-perform American counterparts, the US seems miles ahead in terms of information exchange amongst IT professionals and openness towards innovation. Therefore it is more than ever one of the key responsibilities of HITM to push IT into a pan-European level of understanding. We must move away from the local, national mindset and set our sights on Europe.

We, as healthcare IT professionals are in a powerful position, we are the ones calling the shots. We are changing the healthcare world and others will have to listen to us. Our strategic vision and consistent implementation demands will push the industry to finally deliver open, interoperable systems like during the iRevolution. Apple has shown us how to do it. For decades running a Mac meant being deprived of different applications. Today, iPhone and iPad have changed their strategy, making them to the most successful IT company on the globe, by allowing others to create and sell applications running on these devices. It is up to us to create a similar situation in the world of healthcare.

This year's IT @ Networking Awards were proof of the power of healthcare IT and hinted that a revolution could well be on its way. Yet again we were spoilt for choice with great entries from across the globe. Projects varied from EMRs and telemonitoring to 3D PACS and whole genome sequencing. After two days of fierce competition, Ian de Vega took home first place with his South African primary healthcare information system.

In this issue of Healthcare IT Management you can find in-depth articles on the three top prize winners of IT@2012 as well as information about all our finalists and nominees. Each of these projects strive for top quality in healthcare delivery and we hope they will be an inspiration to you.

Other articles in this issue include an extensive report on the Systematisation of E-Health in Hungary from healthcare informatics expert Gyula Király and a look at The Use of Digital Pathology Software to Improve Breast Cancer Diagnosis and Therapy.

We delve into E-Prescribing in the ICU with an interesting article from Scotland. Katie Went and her team explain the benefits of using an inter-disciplinary team made up of experts both in interactive systems and healthcare design and consultant anaesthetists, nurses, and pharmacists to design a new system. Another Scottish team introduce us to a new technology used for combating infection, Continuous Disinfection of the Hospital Environment Using High-Intensity Narrow-Spectrum Light (HINS-light).

This issue's country focus is on Greece. Written before the current economic situation in the country, Prof. Nikos Maniadakis provides an overview of the healthcare system as a whole and Efstratia Mourtou looks specifically at health informatics in Greece.

For comments, suggestions and criticism, please contact me at any time.

Best regards,

your CM (Christian Marolt)
Secretary General and Editor-in-Chief

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of the European Association of Healthcare IT Managers**

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References

References are available upon request to: editor@hitm.eu.



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THE SYSTEMISATION OF E-HEALTH

E-Health is a difficult term to define and so the systemisation of e-health in Hungary is a huge task. Health informatics in Hungary are quite advanced and this article looks at the different relationships between actors in the e-health sector: Doctors, Patients, Institutions, Administrations and Infrastructures.

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E-PRESCRIBING IN THE ICU

An interdisciplinary team, comprising experts both in interactive systems and health-care design and consultant anaesthetists, nurses, and pharmacists, was formed and authentically participated in the design and development of an electronic prescribing and administration system tested in the ICU at Ninewells Hospital, Dundee.



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INTRODUCING THE WINNERS, FINALISTS AND NOMINEES

The European Association of Healthcare IT Managers is proud to present the Winners, Finalists and Nominees *IT@Networking Awards 2012 (IT@2012)*. These medical technology and healthcare IT projects travelled to Brussels on the 18-19 January to battle it out to win the coveted *IT@2012* trophy and prize money. A South African primary healthcare information system took the top prize.



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COUNTRY FOCUS: GREECE

This issue we look at the Greek healthcare system and health informatics in particular. The Greek healthcare system is characterised by the coexistence of a National Health System (NHS), compulsory social insurance and a strong voluntary private healthcare system. Health informatics is insufficiently developed in Greece but progress in this field could lead to significant improvements in the healthcare system.

THE EUROPEAN ASSOCIATION OF HEALTHCARE IT MANAGERS (HITM)

The European Association of Healthcare IT Managers

The European Association of Healthcare IT Managers (HITM) is a non-profit 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, HITM is committed to increasing the professional authority and responsibility of healthcare IT managers and representing their interests to international institutions and associations.

HITM is strategically based in Brussels, for easy access to the European institutions and associations.

HITM's Mission

- To establish common healthcare IT standards; best practices, cross-border collaboration, unifying policies and strategies at EU and international levels;
- To increase the visibility, role and importance of IT management in healthcare facilities;
- To educate key policy-makers, industry players and the general public about the benefits of healthcare IT;
- To promote cross-collaboration in different healthcare sectors, and
- To promote the efficient, cost effective use of IT.

For more on HITM and information about membership, please contact: office@hitm.eu

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LITHUANIA

NATIONAL SNOMED CT TERMINOLOGY MANAGEMENT CENTRE ESTABLISHED

The new National SNOMED CT Terminology Management Centre at the Lithuanian Medical Library officially commenced activities in early January.

The introduction of standardised clinical languages for medical information systems is a step forward in improving healthcare quality and safety. More and more countries are giving priority to implementing SNOMED CT (Systematized Nomenclature of Medicine-Clinical Terms), the most comprehensive terminology and classification system in the medico-clinical field worldwide.

SNOMED CT consists of a systematically organised computer processable collection of medical terminology for diseases, procedures, lab tests, medicines, micro-organisms, diet, topographic, geographic, environmental and social factors, and other aspects of medical codification.

The National SNOMED CT Terminology Centre project team will translate the SNOMED CT terminology sets in Lithuanian, so as to use them in national information systems, in line with Lithuanian eHealth priorities. A pilot integration of these terms in a Medical Dictionary will also be conducted. The Lithuanian Medical Library prepared a draft 'uniform classification of medical terms for the creation of quality eServices in healthcare' under the eHealth System Development Programme 2009-2015. Funding for eHealth projects comes under the Operational Programme 'Economic Growth', priority 'Information Society for All'.

UK

UK PATIENT GROUPS DECLARE SUPPORT FOR SUMMARY CARE RECORDS

A year on from a Ministerial review that confirmed the importance of Summary Care Records in supporting urgent and emergency care, patient groups are advocating its use to improve care for the millions of people with long term conditions they represent.

The Muscular Dystrophy Campaign recently recommended that their patients consider adding important information about their conditions to their Summary Care Record to improve their experience of hospital care. Mencap, Asthma UK, Diabetes UK and the British Lung Foundation are also now looking to raise awareness among their members about how the record could benefit patients when they are being treated by doctors and nurses in an emergency who may be unfamiliar with their particular condition.

The Summary Care Record is a secure, electronic patient record which is currently being introduced in England. Last October's review, commissioned by Health Minister Simon Burns, restricted the record to carrying basic information about medications, allergies and bad reactions to drugs. So for example, patients with asthma would no longer need to be asked to repeat their medical history while struggling to breathe. Patients can however speak to their GP about adding extra information they may want the NHS to know about them in an emergency to their Summary Care Record.

The main issue identified by patient groups which the SCR could help remedy is patients having difficulties communicating their needs; whether it is a nurse not knowing how to tell if a patient with learning disabilities and limited verbal skills is in pain to ensuring a doctor unfamiliar with neuromuscular conditions does not deliver inappropriate treatment that could leave a patient permanently needing to use a wheelchair.

Following the Ministerial review, patients can easily opt out of having a Summary Care Record if they wish to by using the opt out form and freepost envelope included in letters being sent to patients or by consulting their GP. As an added safeguard, patients will always be asked their permission before their SCR is viewed.

For more information, please visit: www.dh.gov.uk

FRANCE

FRENCH MEDICAL INFORMATICS COMMUNITY CONTRIBUTES TO FOSTERING HEALTH INFORMATION SYSTEMS INTEROPERABILITY

After an agreement between the government Agency for Shared Health Information Systems (ASIP Santé) and the French Association for the Applications of Medical Informatics (AIM), the latter is working to develop technical and semantic interoperability between health information systems (HIS).

Such interoperability is an essential condition for populating patients' electronic health records (Dossier Médical Personnel - DMP, in French) with information. The agreement defines cooperation terms between the Agency and the Association. It was signed by Prof Marius Fieschi, AIM President and Jean-Yves Robin, head of ASIP Santé.

The first steering committee convened at the beginning of July 2011; participants approved collaboration projects relating to the contribution of AIM to enhance the content

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of the Health Information Systems Interoperability Framework and the National List of Reference Frameworks.

In order to improve the coordination of healthcare between professionals, a common language and therefore, the production of semantic reference frameworks, is required. The jointly defined specifications will be published in the Interoperability Framework and they are meant to be integrated in the DMP, in a way to enable business software to share and exchange information without prior recapturing of data, among other effects.

The agreement also makes provisions for AIM to support change by designing training modules and to represent France in international standardisation organisations the field of health informatics.

This contractual cooperation is sought to turn the intentions of the health informatics community - gathered in the AIM - into concrete actions towards the development of health information systems in France. The AIM community will thus bring their scientific, methodological, technical, pedagogical and innovation expertise to this important process.

For more information, please visit: <http://esante.gouv.fr/>

Ireland

MINISTER LAUNCHES FIRST NATIONAL ELECTRONIC GP REFERRAL SYSTEM

The Minister for Health, Dr James Reilly TD launched Ireland's first national electronic GP referral system on Friday 27 January. A joint collaboration between the National Cancer Control Programme and the Irish College of General Practitioners, the new system is already in use with over 4,000 patients referred into breast, prostate and lung rapid access services in the designated cancer centres last year through the electronic process.

Aiming to eliminate the use of GP letters and faxes for the purpose of referring patients, the new system is already increasing efficiency and improving the experience for the patient.

With over 42,000 referrals into the NCCP breast, prostate and lung rapid access clinics annually, the addition of an online system provides GPs swift and safe access to the designated cancer centres.

For the NCCP, the development of the GP referral process has been an important feature in the ongoing work of the programme. The NCCP initially developed a suite of national referral guidelines and forms for a range of specific cancer types in conjunction with GPs and Consultants.

However, in recognition of the focus placed on the development of information systems by the 2006 National Cancer Strategy, and knowing the very real advantages of moving to online systems, the NCCP also moved to develop an online referral process.

The objective was to develop an online system for GPs to allow them to refer patients directly into the designated cancer centres. In collaboration with a broad range of medical professional and representative bodies, the NCCP began developing electronic cancer referral processes for breast, prostate and lung cancer in 2008.

The groups involved with the NCCP in this project were the Irish College of General Practitioners, the National Healthlink Project, the HSE ICT Directorate and the GPIT group (Part of the ICGP).

The project was delivered in two phases – the first involved the development of site specific cancer referral forms via Healthlink (who provide an electronic messaging service to GPs in over 900 practices). Referral guidelines and forms already developed were adapted for online use by Healthlink. Phase two involved the development of direct referral to the cancer services via the four ICGP accredited GP practice management software systems (Complete GP, Helix Practice Manager, Health One and Socrates)

Having started with breast cancer referrals, the NCCP subsequently moved to make prostate and lung cancer referrals available online. By the end of 2011, approximately 10% of all referrals were being carried out online. Within the twelve month period from January to December last year, over 4,000 referrals nationally in breast, prostate and lung cancer had been completed online.

The electronic system establishes a direct online link between each GP practice and the designated cancer centre. The swiftness of the process means the GP does not have any paperwork to complete, post or fax. The entire process is carried out online with the patient present. With an automated receipt facility, the GP knows for certain that the referral has been received and that their patient will be offered an appointment within the appropriate timeframe. It clearly reduces the risk of communication difficulties or issues and eliminates an element of cost.

Overall, it allows for a streamlining of the cancer referral process. It provides for greater efficiency in providing rapid access for patients – especially for those urgent patients being seen within two weeks of referral. As a result it allows for a greater number of patients being diagnosed at an early stage and maximises the potential for cure.

For more information, please visit: www.hse.ie



Save The Date

7-9 May 2012

Copenhagen, Denmark

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ADVANCED COMPUTER SOFTWARE GROUP

'ONE STOP SHOP' FOR MOBILE WORKING SOLUTIONS IN COMMUNITY CARE

Advanced Computer Software Group, a leading provider of software and IT services to the UK health, care and business sectors has announced that it now supplies mobile devices inclusive of airtime as part of its iConnect and iNurse mobile working solutions - providing a complete "one stop shop" for mobile working in the community care sector.

Advanced's iConnect and iNurse are mobile solutions for health and care applications, which support high quality care in patients' homes. Benefits include improved service delivery, reduced costs and the provision of both data security and lone worker safety. The UK market opportunity for iNurse and iConnect currently stands at approximately 465,000 users.

Advanced's iConnect provides a mobile point of care solutions to carers in the community. In addition to delivering real-time task lists and care recipient data to care workers via their mobile phones, the solution records actual arrival and departure times. To prove attendance, care workers simply touch in and out at each visit, using their NFC-enabled mobile devices coupled with radio-frequency identification (RFID) tags fitted within service users' homes.

Advanced's iNurse is a mobile patient management system, which enables community clinician and nursing teams to record and communicate patient care information using handheld Windows Mobile and BlackBerry devices. iNurse allows health-care professionals to access, record and communicate patient care information and records, using a Smartphone at the point of care, thereby allowing them to increase both the time spent with patients and the number of patient visits.

For more information, please visit: www.advancedcomputersoftware.com

HELIX HEALTH/FIRST DATABANK

HELIX HEALTH AND FIRST DATABANK PARTNER TO PROVIDE IRELAND'S LEADING ADVANCED PHARMACY SOLUTIONS

First Databank (FDB), provider of drug knowledge bases and clinical decision support, has announced the continuation of the successful partnership with Helix Health. The contract provides Helix Health with FDB's clinical databases for the next three years. Helix Health is continuing to use FDB's information within their product suite in the Republic of Ireland and UK, targeted towards hospital pharmacies and other health-care sites. FDB's drug knowledge forms a core part of Helix Health's QicScript product range which is tailored to the community pharmacies both in the UK and Republic of Ireland.

Crevan O'Malley, group commercial manager at Helix Health explains why they decided to extend the contract; "We have dealt with First Databank for over 10 years, and they have provided us with an unfailing, high-calibre service over this period. Our customers rely on our products and services and First Databank's clinical databases form a core component to our offer. First Databank is a trusted partner of ours."

FDB's drug knowledge is featured within the QicScript product range delivering information on more than 10,000 pharmaceutical products to Helix Health's customers. Helix Health's QicScript.net product is a dispensary management system that helps pharmacists to deliver efficient, safe and cost-effective patient services. With advanced clinical support, QicScript.net allows the user to record detailed patient notes. First Databank's drug knowledge provides users with immediate access to comprehensive electronic drug information at the point-of-care which has a number of documented benefits including reduction of medication errors; reduction of costs associated with medication related harm, improved patient care, and improved efficiencies in workflow.

The partnership between FDB and Helix Health will ensure the continued

development of innovative solutions and delivery of first-class services to customers in the Republic of Ireland and the UK.

TUNSTALL

COUNTRYWIDE APPROACH TO TRANSFORM THE LIVES OF THREE MILLION PEOPLE WITH TELEHEALTHCARE

'3millionlives' will enable more people with long-term conditions and social care needs to be supported by telecare and telehealth. Tunstall Healthcare is supporting a new approach that aims to transform the lives of three million people with long-term conditions or social care needs, utilising telehealth and telecare within health and social care services.

Launched by the Minister of State for Care Services, Paul Burstow MP, '3millionlives' will enable millions of people to receive the significant benefits derived from a recently completed telehealth and telecare pilot, known as the Whole Systems Demonstrator (WSD) programme. The Minister re-affirmed his commitment to working with industry to improve the lives of millions of people by publishing a Concordat with the four trade associations representing the telehealth and telecare industry.

The WSD programme was established by the Department of Health (DH) to evaluate how the use of telehealth and telecare services can support people with long-term health and care needs to live more independently. The three-year research project aimed to create the largest evidence base for telehealth and telecare in the world. Key findings from the WSD programme include a 15 percent reduction in A&E visits, a 20 percent reduction in emergency admissions, a 14 percent reduction in elective admissions, and a 45 percent reduction in mortality rates.

The 3millionlives website is now live, and anyone interested in finding out more or becoming involved can find details at www.3millionlives.co.uk

INNOVATIVE CAMPAIGN MANAGEMENT

MINDBYTE COMMUNICATIONS (MB) FACILITATES THE FULFILMENT of your goals with modern, innovative communications campaigns. MB helps disseminate the right information to targeted groups and encourages

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UPCOMING EVENTS

EHEALTH WEEK/ WORLD OF HEALTH IT 2012 7 – 9 MAY, COPENHAGEN, DENMARK

eHealth Week 2012 brings together two main events: the High level eHealth conference co-organised by the European Commission and the Danish Presidency of the Council of the European Union, and WoHIT (World of Health IT Conference & Exhibition) organised by HIMSS Europe. The event, now hailed as the largest annual pan-European eHealth conference, not only brings together industry partners and providers from across Europe, but also important government and regional decision makers.

The tagline of this year's conference is "The continuity of care and patient centric health services through the use of innovative ehealth solutions"

The eHealth week 2012 will concentrate on the continuity of care from the home to hospital and back to home demonstrating how information can flow between these different settings. It will include topics like patient empowerment and chronic diseases management involving investment and business opportunities in healthcare IT.

Who should attend?

- CIO and other C-suite executives
- Senior managers
- High-level government officials
- Academics
- Healthcare practitioners, including doctors and specialists; and
- IT professionals

eHealth Week 2012 Highlights will include:

mHealth Symposia – Monday 7th May

eHealth week will host a one day symposia focusing on the challenges and solutions mobile health offers. Best practice stories of use of mobile devices and technology by clinicians in care delivery, examples of ROI and successful busi-

ness solutions will be presented alongside an insight into what is out there and what works (separate registration applies).

SME Village

The SME village is a new initiative at eHealth Week 2012, where small to medium enterprises (SME) will exhibit and bring new ideas, solutions and products to the healthcare IT industry. This is a great opportunity to showcase their products and gain visibility amongst international leaders and investors.

SME Competition

With the endorsement of the ICT for Health Unit at the European Commission, TICBioMed is organising a Competition for rewarding the best eHealth solution of 2012 produced by an European SME.

Dedicated CIO Track Sponsored by HIMSS Analytics Europe

The economic crisis has changed how senior leaders must justify health IT investments. The 2012 CIO track is designed to give you the tools and information to navigate a changing landscape for top leaders from healthcare IT. The event will feature educational sessions offering intensive knowledge exchange and exclusive networking opportunities at the most senior level.

Social Event

eHealth week will not just be presentations, there is also time to relax. Open to all, the social event is a great opportunity to continue networking with colleagues and make new contacts whilst enjoying an evening of live music.

For more information, please visit:
<http://worldofhealthit.org/2012/>



MIHEALTH FORUM HEALTH MANAGEMENT AND CLINICAL INNOVATION

24-25 MAY, BARCELONA, SPAIN

The first ever MIHealth Forum will take place in May of this year. A forum focused on health management and clinical innovation, it aims to:

- Provide a multi-sector, across-the-board response to the present and future challenges facing the healthcare sector;
- Provide genuine experiences in the field of new technologies applied to clinical management that might contribute or are already making a decisive contribution to achieving better efficiency; and
- Build a global platform that brings together supply and demand in terms of companies and healthcare professionals and organisations respectively.

The forum will bring together the top specialists, researchers and professionals working in the healthcare sector. It offers a unique opportunity to learn about real experiences in the field of new technologies applied to clinical management that might contribute or are already making a decisive contribution to achieving greater efficiency.

Through conferences, discussions and personalised meetings the forum will cover issues such as clinical knowledge and innovation management: From the idea to the market; technologies for the healthcare system transformation; innovation in the management of healthcare organisations and sustainability of health systems.

The MIHealth Forum is aimed at healthcare professionals, managers, directors, purchasing managers, process managers, unit managers, doctors in charge of diagnostic teams, medical collective, nurses, health sector personnel and administrative staff.

For more information, please visit:
www.mihealthforum.com

DANISH PRESIDENCY OF THE COUNCIL OF THE EUROPEAN UNION PROGRAMME AND PRIORITIES

The programme for the Danish presidency was officially presented on the 6th of January at a press conference in Copenhagen. The four fundamental priorities for the Danish Presidency are:

- A responsible Europe;
- A dynamic Europe;
- A green Europe; and
- A safe Europe.

By working for a responsible, dynamic, green and safer Europe, the Presidency will prepare Europe for the future economically, socially and environmentally.

The Danish Presidency will work towards ensuring a responsible European economy. Europe must be brought out of the crisis, the EU must prevent new crises and focus on strengthening growth and job creation in the time ahead. All EU Member States must implement the necessary measures to consolidate public finances and carry out the necessary reforms. The objective of enhancing fiscal discipline is well in line with the Danish Presidency's priority of a responsible Europe. The Danish Presidency will focus on implementing the new and stronger ground rules for the benefit of public finances, growth and job creation in Europe.

Revitalising growth and employment in Europe is another

key goal. The Single Market is one of the greatest EU successes. The Presidency aims to create a more dynamic European economy by further developing the unexploited potential of the Single Market through efforts regarding the 12 key priorities of the Single Market Act. The Single Market is, among other things, to be brought into the digital age by making it easier and safer to trade on-line and by lowering roaming prices across borders. Innovative companies will be promoted to ensure greener and more sustainable growth. Strengthening of research and innovation efforts must also contribute to this.

The Presidency will, furthermore, set a proactive agenda for promoting green and sustainable growth. The aim and objective is to create growth without increased resource and energy consumption. A key objective will be to adopt measures improving resource and energy efficiency in Europe.

Lastly the Danish Presidency wishes for a safer Europe. In a globalised world, we must cooperate in Europe if we are to ensure the security of European citizens and solve cross-border problems. Denmark will work to ensure a more effective fight against international crime and terrorism as well as a well-functioning Common European Asylum System and stronger Schengen cooperation, thereby achieving more secure control at the EU's external borders.

EUROPEAN ROBOTICS WEEK

For more information, please visit: <http://eu2012.dk/>
The first European Robotics Week was held from November 28 to December 4, 2011. More than 130 organisations and institutes in 19 European countries organised over 360 robotics related activities. Based on initial estimates about 80,000 people have been reached across Europe.

In the near future robots and devices with robotic functions will be used almost everywhere. Creating an energy and resource-efficient production with economies of scale, creation and retention of equal-opportunity and high-quality employment, coping with an ageing workforce by keeping the ageing workforce with valuable work experience in the production process, independent living for elderly people, affordable healthcare, protection against external and internal threats to security – without robotics these goals are very hard to achieve. Robotics will help European manufacturing

stay competitive against global competition.

A considerable share of research in robotics in Europe is focused on medical and rehabilitation research, such as robotics surgery and patient rehabilitation, for example with stroke patients who need constant monitoring and regularly adjusted support.

Robotics is a thriving sector expected to create one million jobs worldwide in coming years, including in the Germany auto industry and Danish shipbuilding industry. In 2010 more than 118,000 industrial robots were sold worldwide – almost twice as many as in 2009. For 2011, 18 percent growth is forecast. In particular professional service robots are expected to enjoy sales increase of 60 percent by 2014.

Aimed at the general public, the first European Robotics Week focuses on inspiring Europeans of all ages to pursue careers in Science, Technology, Engineering and Maths,

or learn about the role robots can and will play in daily life. Events included school visits, open labs, exhibitions, challenges, robots in action on public squares, and much more.

ECHORD

One of the projects which took centre stage during Robotics week is ECHORD, the European Clearing House for Open Robotics Development. ECHORD's unique approach brings together 53 universities and 80 industrial companies (including many SMEs and start-ups) to put the EU robotics industry in a global leadership position by improving the technology transfer between academia and industry. ECHORD's experiments include those geared towards joint enabling technologies (develop new robots, components, networks, etc.); others towards application development (use of robots and components in new areas and scenarios, such as using robots in agriculture); and others towards feasibility demonstration (showing that prototypes can actually be deployed in specific

industrial settings which do not yet use robots).

ECHORD is financed partly by the European Commission and partly by its participating partners. The total budget is 24.9 million euro with the European Commission contributing 18.9 million euro. The EU supports more than 100 projects in the area of robotics and cognitive systems with 400 million euro of funding between 2007 and 2011.

"European Robotics Week was the product of a successful cooperation between the leading companies, robotics institutes and universities all keen on educating the public about the growing importance of robotics. Many different robotics activities simply brought the wonder and genius of robotics to the people inspiring especially the youth to study science, technology, engineering, and math subjects.," stated Henrik Schunk, Chairman of EUnited Robotics European Robotics Association and Managing Partner of Schunk GmbH, Germany.

For more information, please visit:

www.eurobotics-project.eu

E-HEALTH ACTION PLAN PUBLIC CONSULTATION RESULTS PUBLISHED

A final report on the public consultation on the eHealth Action Plan 2012-2020 has been published. The consultation, which involved a range of stakeholders including NGOs, academic institutions, enterprises, health and social care providers and public authorities from many Member States, aimed to validate four proposed objectives and to explore possible actions to be undertaken in the coming years. More than 90 percent of the stakeholders agreed with the four main objectives of the eHealth Action Plan and concluded that the main benefit of eHealth solution is to improve the quality, the efficiency and the sustainability of the available healthcare services.

The four objectives were:

- To increase awareness of the benefits and opportunities of eHealth, and empower citizens, patients and healthcare professionals;
- To address issues currently impeding eHealth interoperability;
- To address issues currently impeding eHealth interoperability;
- To support research and innovation in eHealth and development of a competitive European market.

Therefore, the lack of interoperability, user awareness (both patients' and healthcare professionals') and reimbursement

schemes as well as inappropriate legal frameworks, were identified as constituting the key barriers preventing the large scale deployment of eHealth solutions. As a way of addressing such barriers in the context of the eHealth Action Plan 2012-2020, the consultation participants proposed that the European Commission contribute by:

- Supporting systematic evaluation of benefits, costs and usefulness of eHealth solutions;
- Providing guidance for achieving EU wide interoperability (e.g. the use of common standards, profiles, terminologies); and
- Supporting deployment of eHealth services/solutions based on evidence facilitating cooperation between Member States and/or regions to address common challenges.

The implementation of the relevant actions had initially been foreseen for the end of 2011. However, in light of the launch of a number of initiatives relevant to the development of the eHealth agenda at the European level, the Commission intends to postpone the adoption of measures related to the eHealth Action Plan in order to make sure that measures are built on consolidated views and visions from Member State representatives, stakeholders and experts.

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ANOTHER SUCCESSFUL IT @ NETWORKING AWARDS

AUTHOR

Lee Campbell
Managing Editor
HITM

The European Association of Healthcare IT Managers is proud to present the Winners, Finalists and Nominees for the IT@Networking Awards 2012 (IT@2012). These fifteen medical technology and healthcare IT projects came to Brussels on the 18-19 January to battle it out to win the coveted IT@2012 trophy and prize money.

Yet again the sheer number and quality of submitted projects surpassed our expectations. This year projects ranged from EMRs and telemonitoring to whole genome sequencing and predictive software. Competition was fierce but in the end Ian de Vega took the top prize with the South African primary healthcare information system. This issue's cover story showcases the top three projects and presents each project that made it through to the finals.

How it Works

The *IT @ Networking Awards 2012* is an open competition for fully implemented, operable healthcare IT and medical technology solutions. *IT @ 2012* identifies some of the finest and most innovative departmental, institutional, local, regional and national healthcare solutions.

Intelligent medical technology and IT increase cost-effectiveness, productivity and safety and *IT @ 2012* is designed to help healthcare facilities identify proven medical technology investments. It is an event to promote healthcare IT innovation and collaboration on a European and even global level.

The competition spanned over two days. The first day saw each nominee introduce their project to their peers and the expert panel of judges in a short MindByte presentation in the hope of winning votes and progressing to the second round of more detailed WorkBench presentations. Interactive in nature, each presenter was cross-examined by the audience, expert judges and their fellow competitors in question and answer sessions after each presentation. As always attendees did not hold back in their questioning!

To ensure cross-departmental understanding and facilitate comparison between projects, each presentation must adhere to our strict presentation criteria. After each presentation and Q&A session the audience and expert judges (CEOs, CIOs, CMIOs, hospital and IT managers, radiologists, policy makers and physicians) also cast their vote according to this structure.

Presentation Criteria

1. THE IMPORTANCE OF TECHNOLOGY

What technology was used and how was it integrated in the workplace?

2. BENEFITS

Has the project helped those it was designed to help?
Has the project changed how tasks are performed?



The three winning projects and Secretary Generals of HITM and EAHM. (left to right: Christian Marolt, Anthony Vipin Das, Ian de Vega, Peter van der Spek, Willy Heuschen)

What new advantages or opportunities does the project provide?

3. ORIGINALITY

What makes the solution special?
Are there any original features?
Is it the first, the only, the best or the most effective application of its kind?
Is it an improvement on existing implementations?

4. DIFFICULTY

What important obstacles had to be overcome?
Were there any technical or organisational problems?

5. SUCCESS

Has the project achieved or exceeded its goals?
How do you see the project's success affecting other applications, your facility or other organisations?
How quickly would the users accept the implications of this innovation?

6. IMPACT

What is your overall impression of the project?

For more information, please visit:
www.itandnetworking.org

PREVIOUS IT@NETWORKING WINNERS

WINNER 2009

2009: The Health Information System of the Rhône-Alpes region (SISRA) and the Shared and Distributed Patient Record (DPPR), Dr. Pierre Biron

The very first *IT@Networking Awards* took place in 2009 and was won by Dr. Pierre Biron and his team for The Health Information System of the Rhône-Alpes region (SISRA) and the Shared and Distributed Patient Record (DPPR).

Rhône-Alpes is a French region with 6 millions inhabitants. SISRA connects 55 hospitals (33%), and 66 % of its hospital beds. Founding partners are the three University hospitals of Lyon, Grenoble and Saint-Etienne, the Cancer Centre Léon Bérard, the regional cancer network ONCOR, and a private practice association (ADSIMIL).

The system is founded on a strong identification access only, with health ID patient's cards and Professionals ID cards. All tools are approved by the French commission of IT and freedom. SISRA is a unique data capture and storage network, available securely and confidentially when and where needed. This system shows, since 3 years, an exponential increase in patient records, data and connections: 27,000 a month.

After winning in 2009, Dr. Pierre Biron came back to Brussels for *IT@2011* as part of the panel of expert judges.



WINNER 2011

Healthcare for the Rural Poor – A WHP Initiative, Prachi Shukla

In 2011 the *IT@Networking Awards* expanded its remit to include healthcare IT and medical technology products from across the globe and Prachi Shukla took first prize with her inspiring healthcare for the rural poor project in India.

The project combines technology with village entrepreneurs acting as facilitators to connect rural communities with formally qualified urban doctors, enabling them to access timely and quality healthcare close to their homes. It is done through VSAT/ADSL connectivity coupled with a device – ReMeDi – that runs on two watts of power. The Remote Medical Diagnostic, integrated with audio-video conferencing software, enables getting real time diagnostics such as BP, Auscultation, Temperature and ECG. This runs at 64 Kbps and can be run over a telephone line as well.





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SUCCESSFUL DEVELOPMENT AND IMPLEMENTATION OF A PRIMARY HEALTHCARE INFORMATION SYSTEM

AUTHORS

Rosemary Foster
South African Medical Research Council
Ian de Vega
Western Cape Department of Health



It is globally recognised that the only way to effectively support continuity of care is to implement an electronic health record (EHR) system on a large scale. The implementation of a national EHR is a high priority in the e-health strategies of most countries, regardless of whether they are first world or low- and middle-income countries. In South Africa, this has been successfully achieved in the Western Cape province.



Photo by Jasper Stupart

Occupying 129,462 square kilometres, the Western Cape is home to more than 5.7 million people. The province is famous for the beautiful city of Cape Town set against the backdrop of Table Mountain, and for its wine and fruit, exported all over the world. But in a country where 86 percent of the population has no medical insurance cover and life expectancy for men and women is 53 years and 55 years respectively, staff in public sector health facilities struggle to provide quality care to long queues of patients. In the Western Cape, more than 15 million patient visits are made to primary healthcare facilities each year. HIV/AIDS and TB co-infection, injury caused by violence and road accidents, childhood diseases and chronic diseases such as diabetes and hypertension all contribute towards the high burden of disease experienced in the province.

Although South Africa has had some active health information systems implementations, only about a third of all public sector hospitals have some form of electronic medical record system. There is little or no integration between these systems and network and Internet access is not commonly found in public health facilities, especially primary healthcare facilities (community health centres and clinics).

Prior to 2004 in the Western Cape, none of these primary healthcare facilities were computerised. In 2004, there was an initiative to connect the fifteen largest community health centres to the provincial WAN. Computers were also installed

but only provided email capability. For registry staff who were struggling to process more than 1,000 patients a day, for doctors who had to see up to 100 patients a day and for patients, who had queued outside from 4am, ill and often collapsing, this was of little help. Registry staff battled under chaotic circumstances, often using up to four different filing systems in the same facility.

PHCIS

A small team within the provincial government had designed and implemented a successful centralised system called CRADLE for use in the midwife obstetrics units (MOUs), public sector facilities where women receive ante-natal care and deliver their babies. It was proposed that CRADLE be adapted for use in all primary healthcare facilities, particularly making use of the patient registration functionality. The resulting system would be known as PHCIS (Primary Healthcare Information System).

In 2003, the South African cabinet announced that anti-retroviral treatment (ART) for HIV/AIDS would be introduced in the public sector. It would be essential to monitor the roll-out of ART and to provide regular reports to the national Department of Health. The decision was taken to use the same CRADLE patient registration capability and to develop this ART module in-house, with guidance from the University of Cape Town Health Sciences Faculty. The ART module, called

eKapa, was therefore to be part of the PHCIS suite and the development was done in parallel.

The decision to enhance the CRADLE system was taken because it had the necessary foundations to suit the unique requirements and the cultural context. The CRADLE system had already been proven in the MOUs. Several commercially available systems were investigated but it was felt that, besides being very expensive, they were generally not suitable. There was considerable pressure at the time to use an open-source database and development tools. However, it was felt that the existing CRADLE team was skilled in the development language and it would be easier to find reliable skills in this language. The CRADLE system already used a commercial database management system and there were economies of scale in expanding this.

From the outset the vision was to take a step-wise approach, i.e. not to proceed to the next level until the foundations were in place. This is illustrated in Figure 1.

Step 1. Connecting facilities to the WAN, giving staff basic computer literacy training and enabling them to use the computers to support administration of the facilities, e.g.

email, access to the transversal financial system, BAS.

Step 2. Providing the capability of registering the patients on a centralised database, recording and updating demographic details, both on the PHCIS database and the provincial Patient Master Index (PMI) which is maintained in the Clinicom system (a centralised system used in provincial hospitals). At this stage staff could print labels that could be used by the pharmacy and to label specimen containers.

Step 3. Allowing more details to be recorded so that specialised registers could be maintained, e.g. for ART or TB treatment.

Step 4. Begin to add clinical details onto the patient record and proceed gradually until a comprehensive, longitudinal health record is maintained.

Step 5. Use the PHCIS database as a source for management reporting and business intelligence applications.

An Agile Tailor-Made Solution

The philosophy and methodology used for the design and

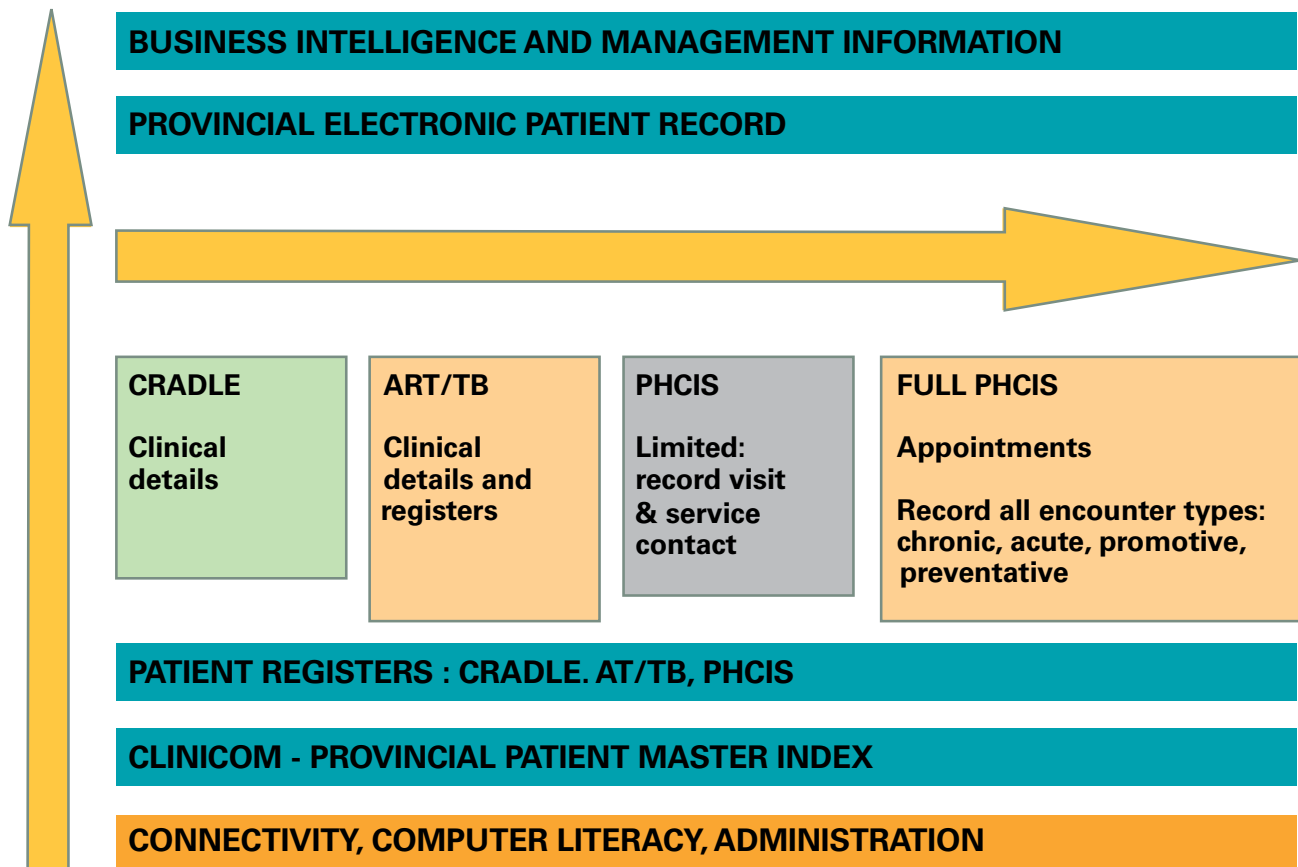


Figure 1. PHCIS development and implementation – a step-wise approach.



development of PHCIS can be described as “agile”. The development team worked very closely with the project manager and the business analyst, who in turn, dealt with the users on a daily basis. The roll-out began in 2006, using the approach described above. Two weeks after each “go-live” an on-site review was held where the users communicated openly about the system with the entire team, giving useful feedback to the developers.

Besides regular project meetings, the project manager and business analyst met regularly with facility staff and managers in a forum where they discussed the project, the system and its impact on clinic workflows. The team also spent a considerable amount of time visiting the facilities and speaking to staff and patients. This close relationship with the users and the patients continues and the result is that the “design reality gap” for PHCIS is very small, i.e. it is tailored to the needs of the users, the patients and the managers, closely fits the socio-cultural context, and has an improved chance of being adopted and retained.

The System

The hardware used for this system is very basic. All hardware procured must conform to the standards laid down for the provincial government, must be affordable as the budget is constrained and must be easy to support. Equipment used consists of standard network cabling for the LAN and WAN, compact workstations with flat screens, specialised high-speed label printers and laser printers for reports. In addition, bar-code scanners are used in the registry to scan the patient’s card on arrival in order to open the electronic record. Barcode scanners are also used to record details about a patient visit, with minimum effort on the part of the clinician or clerk.

Logically PHCIS has a three-tier architecture: The database is housed by the State Information Technology Agency



An example of barcode scanning

(SITA) which also provides DBA services. The business logic resides with the DBMS while the executable system is installed on each workstation. Each day when the users sign on, a check for a new version of the software is made and the update done automatically, if necessary. There has been some criticism of this client-server architecture as it depends on a minimum 256Kb WAN connection. However, with 113 facilities using PHCIS and hundreds of users on-line, the system currently performs well. Having the business logic in the middle tier will allow easy migration to a web-based application in future.

One of the impressive features of the system is that it accesses a central PMI (provided by Clinicom and described above) via web services. This PMI is used for all patient-based systems in the province - at hospitals, MOUs, ART clinics and 100 clinics serviced by the City of Cape Town. The City of Cape Town system has also been developed in-house by the city’s ICT services.

PHCIS has an SMS capability which allows reminders to be sent e.g. to patients who have missed appointments, or to parents to bring their children in for their next immunisation dose. On-going work with facility managers and users has ensured that PHCIS is an integral part of clinic workflows. Most facilities are not modern and were not built with computerisation in mind. It has been challenging to adapt workspaces, already cramped and ergonomically unsuitable, for the use of computer technology while at the same time taking into account high volume workflows.

Challenges

When roll-out of PHCIS began in 2006 the project team had to overcome several challenges:

- There was very little funding for this project;
- There was considerable resistance and lack of buy-in, especially at the outset. The behavioural patterns of staff and patients had to be changed. Staff were accustomed to chaotic workflows and facing long queues of frustrated patients. Patients were used to spending a full day in the facility each month in order to collect repeats of chronic medication;
- There was a shortage of skills for support of the system;
- The network infrastructure was not adequate and/or accessible;
- There was a lack of reliable and affordable connectivity;
- Processes for procurement of network infrastructure and hardware were complex and slow;
- Buildings were not designed for computerisation;
- Electrical supply to the facilities could be unstable;
- There were security and access issues. In some areas gang warfare raged outside the facilities at the time of “go-live,” several sites had all computers stolen, electricity supplies were disrupted when underground cables were stolen for their copper content, and on more than one occasion workers were involved in national strikes; and

- The organisational structure did not include the roles necessary for the success of this project, i.e. information officers and data capturers.

Over the past five years these challenges have been overcome through innovation, teamwork and buy-in from the provincial department of health's top management. The original goal of the project, to implement a patient management system in 33 community health centres, has far been exceeded. Today PHCIS has been implemented at 113 facilities and the roll-out continues. The aim is to include 126 more sites within the next year. The system tracks more than 5.6 million folders and the PHCIS database alone (apart from the provincial PMI) holds information for over four million patients. This means that approximately 90 percent of all the uninsured citizens in the province have an electronic record on PHCIS. The PMI has records for over 80 percent of all citizens in the province.

Patients and Staff

This success has resulted in tremendous benefits for the patients, the users and the managers. Patients are benefiting from improved quality of care resulting from informational continuity, i.e. their records may be accessed at any PHCIS facility. Improved organisation and quicker throughput means that they do not have to queue for so long. They do not have to arrive early to secure a place in the line as those who must make repeat visits are given appointments. Patients who "walk in" for acute visits are also processed faster. Overall this gives the patients respect and dignity – the system knows them and recognises them, their files are retrieved rapidly. Patients can plan their time better and do not have to lose a day's work in order to pick up medicine.

The users can be divided into two groups – the clinicians and the administrative staff. The clinicians benefit because the environment is now generally less stressed. Their workload is better paced and, knowing their schedules ahead of time, they can plan their own time better. They are able to deliver a better quality of care because they have better information about the patient. The administrative staff has become empowered through computer literacy. The staff at the registry windows experience less stress as the patients are happier and the waiting room is less crowded. They have more job satisfaction as the job is more skilled and more is required of them.

Both user groups benefit from the simple but innovative use of barcode scanners to record visit details. By scanning three times – the patient's barcode, the clinician's barcode and the reason for the visit, the user triggers the rapid creation of an encounter within the patient's electronic health record. The patient encounter holds the following essential information – which patient was seen, when the patient was seen, where the patient was seen, who attended to the patient and what was the reason for the visit (e.g. BCG first dose).

Managers are benefiting from the easy availability of high quality and accurate information. They are able to base strategic planning and decision-making on information reported or extracted from the system. Regular reports with the indicators they are required to provide are also easily obtained. They are able to monitor staff activities and workload as well as perform patient profiling for improved chronic disease management. The system has also put an end to a costly practice called "clinic hopping". Previously patients could move around, collecting medicines from several facilities for sale or for substance abuse purposes. Now the user is able to see where the patient has been and what pharmaceuticals have been dispensed.

The implementation has also resulted in employment for people on the roll-out team. This has provided opportunities and new skills for people who were previously unemployed.

Conclusion

There is no doubt that PHCIS is a major success. In 2008 the PHCIS project won the African ICT Achiever's Award for the best ICT project in Africa. In the same year the project won the silver award in the Premier's Service Excellence Awards. The system has been demonstrated and discussed with Health Ministries from several other African countries with very positive responses. In South Africa, the ART module of PHCIS has been mandated as the national electronic medical record system for the monitoring of treatment of HIV/AIDS in public healthcare facilities.

Currently the PHCIS development team are researching the potential use of virtual desktops and cloud computing, the use of RFID to track folders and monitor workflows, and the possible development of a Soundex to search for African names. Work on PHCIS is ongoing and the team is always looking for ways to improve the system. In the words of Claudette Ruiters, the dynamic PHCIS project manager: "The question you have to ask yourself is 'would you like to be a patient in this facility'? And if the answer is 'NO' – then you have to do something about it!"

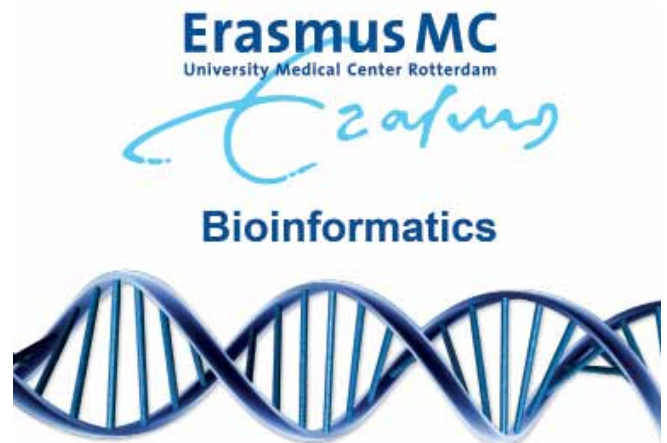


INDIVIDUALISED PATIENT STRATIFICATION USING WHOLE GENOME SEQUENCING

AUTHOR
Dr Peter van der Spek



As the cost of sequencing the human genome falls, medical use of whole-genome sequencing in the clinic is rapidly approaching academic medical centres. In order to support the foreseeable flood of genomic information in the clinic an Oracle based database and business intelligence solution to detect genomic variants has been built at Erasmus University Medical Center (ErasmusMC), Rotterdam, the Netherlands.



Introducing Innovation in Healthcare

These advances in genomic medicine are only possible due to the equal progress in the information technology sector. The diagnostic opportunities also bring new challenges to medical centres regarding privacy in general and the necessary ICT infrastructure to secure this privacy at the individual patient level.

Clinical genetic testing in adults is at present typically done for a few patients who, as a result of family history or clinical indications, are considered at risk of carrying genetic variations that are linked to a particular disease or disease predisposition. This is going to change and in the near future, when at relative low cost, all variants in coding and non-coding DNA is mapped at once. The vast amount of knowledge that is offered by whole-genome sequencing means that informed consent for this procedure is more complex than that for existing genetic testing.

The ICT Solution

In order to facilitate this genomics project an Oracle Exadata server was installed as the initial component for the ErasmusMC Translational Research Center (TRC) personal cloud architecture. The aim of this next generation sequenci

ng data storage and analysis project is being used as proof of concept to evaluate outsourcing of IT services.

Additionally, the bioinformatics team is using this environment to benchmark the performance of the Exadata technology against an existing standard IT architecture. The project is a success in that the genomics solution started by the team of professor Peter van der Spek at ErasmusMC has attracted interest for adoption by organisations worldwide and now needs to be managed by an external company. To grow this solution to an international standard the support of Oracle is required.

Impact of the Project

As the focus in the clinic shifts from sequential testing of individual genes associated with a particular disease, to mapping all variants within an individual's whole genome to all known information on all diseases and traits, the consequence is the need for massive parallel processing and high volume data storage.

The added value to the clinic is for higher efficiency in diagnosis, with decreased time to delivery and a view of the whole genome not just the individual genes. Increased knowledge can result in medical or lifestyle chang-

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Conclusion

- Oracle Powered Hardware, DB Standards & Methods -



→
New opportunities for
disease management

- Expression based classification of biological subgroups
- Identifying novel DNA variants relevant for Dx and therapy
- Companion diagnostics for targeted therapy
- Assessing and managing risk

es that reduce risks, or it can affect the patient's life decisions or strategies for coping. Risks of genetic testing also centre on the accuracy of the knowledge that patients (or others) take away from the tests and how that knowledge is used. Over time our knowledge will rapidly expand and new ways to re-annotate the genome data will be developed. Historical data for both the clinician and patient, which has an updated diagnosis should be made available via a secure web based application. Genome sequencing will have its major impact in three areas listed below:

- ↳ Genetic testing of inherited conditions;
- ↳ Cancer diagnostics; and
- ↳ Pharmacogenetics.

Every individual will learn that he or she is a heterozygous carrier of more than one serious or lethal autosomal recessive disease. This information might affect a patient's lifestyle decisions, and have implications for existing children or other relatives.

Education

This technological solution offers a platform for training medical professionals (physician scientists) to deal with large volumes of sensitive patient related data and learn to diagnose clinical relevant variants within the genome. These actionable items will help reducing costs by providing the right drug to the right patient in therapy. To make informed decisions about whole-genome sequencing, patients will need to have the opportunity to ask questions and get accurate answers from knowledgeable and trained professionals.

The Erasmus MC team is proud to have won the 2nd place at the IT @ Networking Awards 2012.

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PRESENTER
Anthony Vipin Das



The LV Prasad Eye Institute (LVPEI) was established in 1986-87 at Hyderabad as a not-for-profit, non-government, public-spirited, comprehensive eye care institution. From its very beginning, it set forth as its core values the "Three E's": Equity, Efficiency and Excellence. Equity translates as treating all patients (paying for services or not, rich or poor) with the same high-quality, no-compromise care. Efficiency means using the best available tools and technology, translating results of research into clinical practice, and evolving or changing policy as needed. Excellence is an ever-ascending goal that LVPEI attempts to achieve.



LVPEI operates out of 106 locations, 86 of them being primary eye care centres located in remote rural villages. For the past 24 years, it has served over 14 million people, over 50 percent of them entirely free of cost, irrespective of the complexity of care needed. Till date, LVPEI has trained over 13,000 eye care professionals; its faculty been awarded 22 PhDs with over 1,000 research papers publications, its sight enhancement and visual rehabilitation services served over 100,000 people, and its eye bank services has harvested about 34,000 donor corneas and transplanted more than 17,000 of them to needy patients.

The LVPEI care model, called the Eye Health Pyramid encompasses service delivery at four different levels ranging from tertiary care to primary care in the villages. In the Village Vision Complex (VCC), ten Vision centres connect to a Secondary Centre which then refers patients requiring further evaluation and management to the Tertiary Centres linked to them. This ensures a permanent infrastructure to deliver high quality eyecare services to the needy at all levels.

eyeSmart: How it Works

eyeSmart is a revolutionary national award winning ophthalmic Electronic Medical Record (EMR) and Hospital Management System developed in-house by L V Prasad Eye Institute, India. We have embarked on networking the entire eye health pyramid of LVPEI on digitised medical records.

The goal is to enable electronic documentation for faster retrieval and research purposes, and to transform the entire

network into a paperless eco-friendly environment. We have used an EMR concept of totally integrating all functions of a hospital from a common point, namely the patient. All functions, including clinical and administrative, are interlinked in a single EMR and HMS system and through a single patient record. We have made use of different flash tools, document viewers, etc., to intelligently assist our doctors in managing patient data at the convenience of a click anywhere, anytime. Doctors can access case sheets on mobile phones, and have appointment details 24/7, 365 days a year. The application is enabled for various platforms like iPads, iPhones and tablets. The EMR has now evolved into an effective educational tool for our students and fellows who train at the institute. The standard procedures, classifications, evidence based medicine protocols integrated into the system help to deliver more effective care and also aid in teaching.

LVPEI Eye Health Pyramid



Figure 1. LVPEI Eye Health Pyramid

The project started as an in-house exercise with the task of building an application for a smaller urban centre at Madhapur, Hyderabad. The centre started on 16 August 2010 and since then has grown to be adapted for use in three other branches in three cities. We then moved on to upgrade the system and its functions in a tertiary centre that had sub-specialities in ophthalmology. We started our first tertiary centre on EMR at KVC Campus, Vijaywada. We then started our first secondary center on EMR at Paloncha, which saw challenges in terms of connectivity and power but these were resolved. We then

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proceeded to connect the primary care vision centre to the secondary centre through EMR. Currently, our patients can move anywhere in the vision centre complex without having to physically carry their medical records with them.

Difficulties

Problems related to connectivity and power, as can be anticipated in rural hinterlands, have been addressed and alternative backup plans put into place. Training and monitoring the centres in real time has been made possible with the formation of an EMR Support and Installation Team (ESIT). The ESIT caters to live and remote support for the staff and users and gathers essential feedback on the application. It is also responsible for enforcing protocols of quality data documentation. ESIT members are currently based across four cities with 12 full-time employees catering to eight centres running on EMR. New centre installations, support and maintenance is also handled by the ESIT. We have a fully equipped office and simulated training centre based in Hyderabad, India.

A Unique Concept with Proven Results

The concept is unique as we are currently implementing a revolutionary connectivity solution with our vision centres located in remote rural villages. The broad framework of our operations is to seamlessly connect our care delivery and make our model digitally inclusive. In keeping with this mission, we have begun integrating all the 106 eyecare centers of LVPEI, spread across two states of India, in a phased manner, and hope to complete the task over the next two year.

EMR Statistics (from August 2010)

Winner – EDGE 2011 Award (Information Week India)

- Total no. of Patients – 59,815 New Patients
- Total no. of Appointments – 92,147 Appointments
- 150 unique users

No. of EMR Centres – 8

- City Centre – Hyderabad
- KVC Campus – Vijayawada
- NBEC Secondary Centre – Paloncha
- City Centre – Vizag
- City Centre – Vijaywada
- KAR Extension - Hyderabad
- Secondary Centre – Cherukupalli
- Vision Centre – Manuguru Village

Cost Savings

- Manpower costs for Medical Record Department;
- Paper printing/ storage costs;
- Man hours saved in preparing elaborate reports; and
- View reports and status of any center, anywhere, anytime!

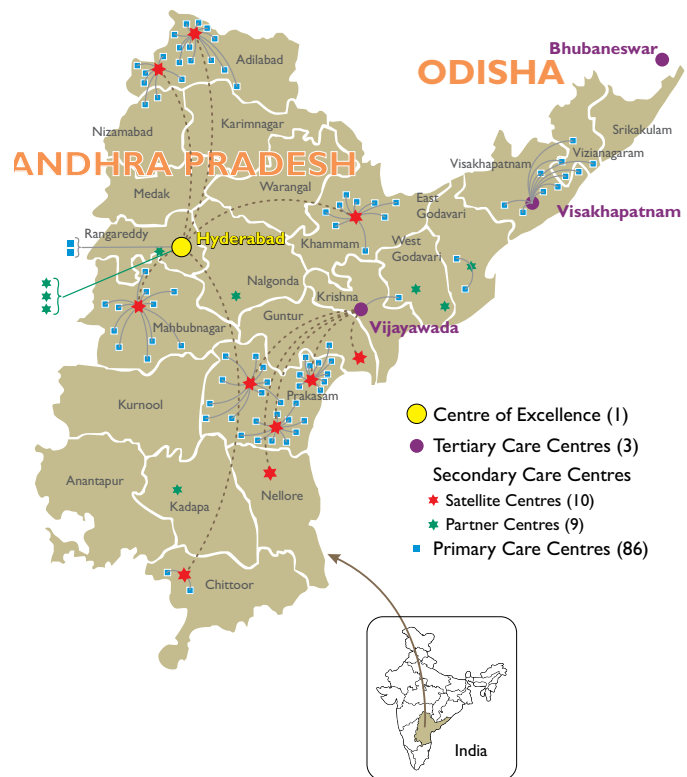
Improving Customer Service

- Accurate, comprehensive medical reports in a single click;
- Digitised prescriptions for medicines and glasses;
- Shorter waiting time for patients;
- Online booking of appointments;
- Personalised SMS alerts; and
- Enabling better efficiency in patient flow in centres.

Employee Productivity

- Less time spent on written records (30 percent less time);
- Faster processing of information of patient statistics (90 percent less time);
- Reports at a click (100 percent time saved);
- LIVE patient status displayed dynamically to administrators (100 percent time saved);
- Faster entry of patient medical records;
- Faster printing of prescriptions, refraction records (90 percent time saved); and
- Assessment of employee specific functions (80 percent time saved).

The LVPEI Network



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Figure 2. The LVPEI Network

BEDSIDE DETECTION OF AWARENESS IN THE VEGETATIVE STATE



Detecting signs of awareness in patients recovering from coma is still a huge challenge for clinicians. Indeed, a high rate of misdiagnosis was highlighted in this population showing that up to 40 percent of vegetative patients are in fact conscious (i.e. minimally conscious state). Clinically, the assessment of consciousness is based on behavioural responses. However, motor and verbal functions can be impaired following a severe brain injury, limiting the assessment. As early detection of signs of consciousness is crucial not only for daily management (particularly pain treatment) but also for end-of-life decisions, we suggest the use of electroencephalography (EEG), in order to detect signs of consciousness at the bedside of severely brain injured patients.

With this paradigm, we were able to detect signs of consciousness in 19 percent (3/16) of patients unable to show any motor response at the bedside. This technique offers clinicians a new tool for improving the detection of conscious patients. Moreover, on the contrary to fMRI, EEG is a cheap, portable and objective technique, which is commonly used in hospitals and can hence be easily used by clinicians.



PRESENTER
Camille Chatelle

As the detection of consciousness is usually based on behavioural assessment, this study is a real breakthrough and transforms the way diagnosis may be performed. This technique also seems more efficient than previous studies using fMRI and reporting 10 percent of “vegetative” patients showing voluntary activity. In our study, we were able to detect consciousness in nearly twice more patients (19 percent).

Working with patients with disorders of consciousness is challenging as their vigilance is fluctuating and as they are easily exhausted. In our study, we had to make sure patients were awake (eyes opened) during the recording even if we had to perform a second recording session. The EEG signal may also be influenced by ocular and motor artifacts. We had therefore to make sure the signal was clean before including it in our analyses.

With this technique, we showed that nearly one out of five “vegetative” patients are able to respond commands involving motor imagery (imagine squeezing your right hand versus moving all your toes) and, hence, are able to show high-level residual cognition. This result suggests that we currently under-estimate these patients’ cognitive abilities. The next step will be to test at which point this technique may be used as a communication device. Finally, this novel technological means may change the existing behaviourally defined boundaries between the various consciousness disorders and provoke a discussion regarding the creation of a new clinical entity where the diagnosis of consciousness can be based on paramedical tool and not only on behavioural assessment.

3D PACS THROUGH VIRTUAL REALITY (SISOPACS)- SISOFT



A special system is projected to perform PACS software (Sisopacs CE Certified, IHE Compliant) with the contribution of academicians, radiologists, physicians and R&D software and hardware specialists, in a 3D environment via



PRESENTER
Nejat Ünsal

3D glasses and mechanical gloves that are being uniquely designed by Sisoft's R&D team for pre-surgical operations in order to examine and analyse medical data and images through virtual reality. The surgeons, physicians and radiologists will be able to perform early diagnosis before surgical operations with less cost and true diagnosis.

Virtual reality (VR), also known as virtuality, is a term that applies to computer-simulated environments that can simulate physical presence in places in the real world, as well as in imaginary worlds. Most current virtual reality environments are primarily visual experiences, displayed either on a computer screen or through special stereoscopic displays.

By means of this technology, physical contact and virtual perception will be implemented to 3D applied medical data. The system works via client – server structure. As it is known that the medical education and the training are so hard medical students can also be trained with that virtual environment like making researches in a cadaver. There is

a free licensing model for academicians and medical researchers in worldwide universities.

The target of this ongoing project is to help and make a huge contribution to physicians, researchers, academicians, radiologists and healthcare professionals. *It is called the future of healthcare...*

POLYTECHNIC UNIVERSITY HOSPITAL “LA FE” IN VALENCIA, SPAIN – MOBILITY SYSTEM TO GUARANTEE CLINICAL SAFETY AND OPTIMISE BEDSIDE PROCESSES, SAVING COSTS



PRESENTER

Serafin Arroyo

This specialty care centre is part of the Spanish public hospital network, with 1,300 beds, 39 operating rooms and more than 4,000 patients/day. Taking advantage of relocating to a new hospital, an innovative RFID and Wi-Fi system has been implemented to guarantee clinical safety and provide identification, location and tracking of patients and assets in real time. The project started in March 2011 and has been developed in three phases: "Opening, Adjustment and Full-Implementation"

The importance lies in the autonomy offered for nursing carts, allowing the automatic secure identification of patient bedside, obtaining and including all data on its clinical records in real time, as well as patient and asset location and traceability.

This project saves time on daily tasks that do not add value, minimises errors, saves cost, collects data automatically and is integrated

with the Hospital Information System.

82 mobile units (nursing carts) include ZigBee technology (2,4GHz) for 823 hospitalisation beds to provide automatic patient identification, integrated with bedside clinical processes. Each patient wears a bracelet, providing unique identification to the system in real time (every 1.5 seconds), locating and tracking them. Vital sign monitor, electrocardiograph and other devices are integrated with secure identification and hospital information system.

The project's implementation was not without difficulties: The adjustment period to new infrastructure and the training of professionals on new technology (considering average age of 52 years old) took some time.

The mobility system is successfully installed in 100 percent of the hospitalisation units providing secure identification, location and tracking of 80 percent of patients per day in real time. Aspects like communication infrastructure and integration are currently being finished (80 percent completed). 100 percent of professionals and new staff received training in three months and the technology is already incorporated in the daily work.

The future impact of the project is improvement on clinical safety and return on investment, saving time and resources.



THE MYHCL PROJECT (LYON PUBLIC HOSPITALS, FRANCE)

PRESENTER
Cecile Dolla



Hôpitaux de Lyon



Hospices Civils de Lyon (HCL) is made up of 14 public hospitals, 123 surgical units and handles 900,000 medical appointments every year. The MyHCL project aims to facilitate the lives of our patients and increase their loyalty by offering online services like appointment requests, admissions, meetings or follow-up.

MyHCL is a web application with a rich user interface created with the Microsoft .NET Framework, Javascript, Ajax and Microsoft Lync. Security required by the process of personal medical data is obtained through https protocol, one time passwords, distributed databases and data encryption. Interoperability with local hospital networks is provided by the WCF technology and SSIS transfers from local network to the MyHCL servers.

The benefits of MyHCL include:

- Secretaries are less disturbed by phone calls (-20 percent) and they don't print and send appointment confirmations and summaries (100,000 mails saved per year).

- Chronic patients don't need to fax their laboratory results or queue up for admission. They send e-requests instead (30 percent less people waiting at admission desks).
- Physicians keep in touch with their patients at home and can decide to adapt a treatment or meet a patient earlier if they detect worrying symptoms.

MyHCL is unique because it is generic enough to be used by any hospital but is also customisable so any care unit can design their own specific MyHCL feature, like the "Memory troubles follow-up" or "Prostatectomy follow-up". Patients can subscribe to these features in the "MyHCL Store".

The main obstacle was to change healthcare professionals' minds. The bigger technical challenge was to imagine the most intuitive application that is still secure and precise enough to meet medical needs. The project achieved its goal by connecting hospital to home and allowing organisational improvements. MyHCL sheds new light to the hospital information system by involving the patient in it.



Jeffrey Charles Bauer, delivering his presentation



The IT@2012 expert audience listen to a presentation

PRESENTER

Jeffrey Charles Bauer



A NEW SYSTEM FOR CONTINUAL DEFENSIVE MONITORING AND RAPID RESPONSE: SAVING LIVES AND REDUCING COSTS BY EXTENDING BEST-PRACTICES IN SURGERY AND CRITICAL CARE ACROSS THE ENTERPRISE



Nihon Kohden America
Transforming patient care with technology.

The Prefense® project uses a miniaturised, ergonomic, body-mounted monitor that transmits real-time patient data to computerised records via an HL7 interface. A customised algorithm reduces false alarms and mobilises life-saving care teams when changes in vital signs indicate a medical crisis.

It eliminates delays of traditional practices that record vital signs every few hours. It initiates many treatments before conditions deteriorate. Automatic notification frees clinicians from routinely reviewing retrospective data and allows them to devote more time to patient care. Its advanced algorithm reduces false alarms approximately 90 percent, eliminating "alarm fatigue" that hinders existing systems. Saved time and money can be reallocated to productive use.

Prefense® identifies serious problems (e.g., sleep apnea, respiratory distress) seldom detected when vital signs are measured every few hours. It reduces caregivers' stress by

providing continuously reliable information, in contrast to inaccuracies in readings made by different personnel.

This technology uses a body-mounted, wireless data transmitter and unique algorithms to extend best preventive practices beyond the OR and ICU. Resulting patient mobility improves outcomes by reducing blood clots, bedsores, and other iatrogenic problems.

Prefense® is the only surveillance system continuously reporting vital signs of ambulatory patients, summoning rapid response when changes indicate a life-threatening event and creates the market for defensive monitoring.

The obstacles were gaining caregivers' confidence in reliability of alerts, developing facility-specific implementation plans with realistic timetables, and understanding patient acceptance. The main problem was overcoming caregivers' hesitancy to use an automated system for decision support. Network connectivity problems also required resolution.

Expectations have been exceeded with this project. Evaluations indicate 60-80 percent reductions in ICU transfers, declines in morbidity and mortality, and reductions in avoidable readmissions. The project's success will generate similar improvements in electronic health records and home care. Early adapters installed Prefense® in 1-2 clinical units; they are now moving to enterprise-wide deployment. Initial projects took 6-9 months. Impressions are highly favorable: Better quality and lower costs. In addition, nurses and physicians demand the system be retained after a trial period.



President of HITM, **Josep Manuel Picas** delivering his keynote speech



NOMINEES ÁGORA - LIGHTWEIGHT EHR VIEWER

PRESENTER

Juan Abenza

The EHR viewer (Ágora) in the Murcia Health Service displays real-time patient clinical information that is distributed across diverse and heterogeneous data sources in less than three seconds. Acting as mediator between its various information systems, Ágora

simulates data centralisation without large-scale data storage. Ágora is the first project that does not attempt major software overhaul across the health enterprise, only collecting the pointer of the information source in the departmental applications.

The benefits of Ágora have already been demonstrated in the aftermath of the earthquake that took place 11 May, 2011 in Lorca, Spain during which emergency workers had patient data available while attending the wounded.

GNU HEALTH : BENEFITS OF FREE SOFTWARE IN PUBLIC HEALTH

PRESENTER

Luis Falcon

GNU Health is a Free, modular, and highly scalable Health and Hospital Information System with the three functionalities: Electronic Medical Record (EMR); Hospital Information System (HIS); and Health

Information System. The project's originality lies in how it incorporates the human factor in health informatics. Combines state-of-the-art technology (Genetics, LIMS..) and family medicine (socioeconomics, lifestyle, nutrition...).

GNU Health has been a tremendous success. The United Nations (UNU-IIGH) is using it to teach health professionals and to implement it in health centres all over the world.

VENETO-ESCAPE PROJECT

PRESENTER

Federica Sandri

Veneto ESCAPE project deploys the digitalisation of the clinical document lifecycle, matching international standards as HL7, LOINC and focusing on IHE and W3C guidelines, and achieves long term flexibility and scalability integration of several systems placed all over the region.

A secured availability of the clinical reports on platforms allows patients to access their record avoiding unnecessary travels, reducing waiting times and helping the LHAs to save money. The project represents a means for digital lifecycle

management and methodological clinical pathways standardisation through more targeted patient records. No matter where the solution is to be placed, it will bring the basis of the healthcare digital revolution.

SCHIZOPHRENIA PREDICTION: ITAREPS SYSTEM

PRESENTER

Jan Hrdlicka

With the ITAREPS system patients have standard mobile phones capable of sending sms messages on a weekly basis. The communication server, which stores the patients' and observers' messages also determines whether an alert email message will be sent to the outpatient psychiatrist. To achieve the decision,

various machine learning tools and algorithms are used.

The patients participating in the ITAREPS system have 70 percent hospitalisation rate reduction, thus significantly improving patient life quality and at the same time reducing fi-

nancial costs. Outpatient psychiatrists have more frequent contact with the patients through the sms messages and have a better overview of patients health status. The project can save about 16 million euro per year in the Czech Republic, only. This means it saves 2,000 euro per patient per year.

THE EUROPEAN PROJECT RENEWING HEALTH

PRESENTER

Silvia Mancin

The telemonitoring services for chronic diseases provided in Veneto allow the remote control of chronic patients using Personal Health Systems, connecting the patient with all the main actors in the healthcare system. By using wearable biomedical devices at home, patients measure clinical parameters and transmit

them to an external telemonitoring centre, where trained operators keep information under control.

The European Project RENEWING HEALTH will allow for the first time a multidisciplinary assessment of large-scale telemonitoring services, facing different issues: Organisational, economical, clinical,

patients' and professionals' perspective. The Project will give multidisciplinary evidence on the performance of the telemonitoring services and consequently encourage their further deployment in other European regions. The results obtained will enable the improvement of the existing pilot applications, scaling them up and evolving them into real life services.

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ences informally. In the lack of more serious control or validation, the pieces of information gained here are difficult to evaluate. Since neither the source nor the genuineness of the information can be controlled, such a method of gaining information is quite unsafe. Faulty or malicious information cannot be excluded either. There are also websites operated by patient organisations controlled professionally where the inquirers can receive expert guidance but it is worth inspecting in this case, too, whether there is any pharmaceutical factory or other supplier that utilises the lack of information of the exposed inquirer with a hidden advertisement. Health can also be found in community media. For example, Twitter, Facebook and MySpace provide possibility for anybody to give information about his condition, share it with others, and receive opinions, remarks or reactions.

Patient-to-Doctor Relation (P2D and D2P)

Currently the main focus of the health industry, this is the field where the commercial business area sees the greatest possibility of market expansion and the research and conviction of the effective demand is the most efficient. Although the doctor should also be involved in this relation, if the patient "worked up" by marketing trusts in it and asks his/her doctor, then the latter will not oppose it if the solution is not harmful. Proper state regulation is important in this field as well similarly to the ethical code of drug manufacturers, since the resources used or engaged unnecessarily will decrease efficiency in the field of curing or recovery. We may support and finance only devices and solutions considered to be really effective.

Patient-to-Institution (Hospital) Relation (P2H and H2P)

Owing to the increase of institutional costs as well as traffic, transportation and mailing costs, this is the field where we can experience the greatest interest on a hospital level (service providers). In addition, the service providers have become interested in finding the cheapest connection with the patient due to Performance Volume Limit (PVL). It is important for the patients too. To be absent from work for as short period as possible in cases when they travel only for an examination, or go to a surgery unnecessarily because of the change of the booking. As a matter of fact, direct electronic patient booking has become popular in private hospitals and private surgeries since here quality of service is determined by the need and the demand instead of the order of booking.

Various business service providers that create a proper solution between the patient and the private institution also appeared in this field. These are the patient-guiding websites, or service providers selecting portal solutions, which connect patient and institution through a complex information chain using several components. There has been a recent development of institutions sending back signals to patients about results and examinations, which indicates also the improvement of the standard and culture of health services.

Patient-to-Administration (State) Relation (P2A and A2P)

We can and should be proud of this field. We have proper experience and numerous solutions that could be utilised by any European country. In Hungary, we can enjoy the convenience and fastness provided by the electronic transaction of affairs within the framework of the services accessible through the so-called "Client Gate" (www.magyarorszag.hu). The Electronic Governmental Centre prescribed that the services should be offered for the inhabitants in each sector gradually on higher and higher levels. As a part of this process, the own legal relation data and the data of the services, medicine subsidies and pecuniary allowances used under own health public financing have been accessible for more than ten years now in health[6]. We are in a leading position in this field since such a transparent (as a result of the dominance of public financing, almost full) patient history is rarely accessible to citizens of countries. There is an unexploited opportunity in this field for the dissemination of public health information through electronic correspondence (screening and prevention programmes, invitations for vaccination etc.).

Patient-to-Business Relation (P2B and B2P)

This is the field of classical e-business solutions. Nowadays patients can buy anything at any time through the Internet in various web stores. Our electronic mail boxes are flooded with advertisements for dietary supplements and books necessary for safeguarding our physical and mental health. However, the bidirectional connection means that not only are we looking for these products but those selling the product also find us with their ads. In many cases these sellers are not real people but virtual traders; I will discuss it in the part explaining the I2P relation. Unfortunately, the unrequested electronic ad messages (spams) telling us to buy Viagra, other potency pills, anti-aging creams, blood pressure meters or offering special relaxing massage services in luxurious hotels and spas are the most frequent in this field. We cannot even imagine how enormous this market is. I have never met someone who buys medicine via the Internet, but if those sending the ads did not have any income from it, they would have already stopped it long since. We should fight against it with suitable enlightening campaigns, if information technology solutions are not sufficiently effective.

Patient-to-Infrastructure Relation (P2I and I2P)

It is a matter of interpretation that in the event of a certain relation the person making the infrastructural element available or the virtual solution, device itself is considered the main player. While the state really stands behind the electronic and automatic service accessible through the Client Gate, an expert system (operated anywhere and by anyone) which was created and developed continuously by numerous experts from around the world is rather an infrastructural element than a real player. The intelligent databases to which the service providers, doctors and decision-makers turn to are able to help effective medical care, establish suitable capacity and determine optimal patient paths.

The best domestic example is the Internet Hungarian Health Data Store (IMEA) created and operated by the Health Strategic Research Institute (ESKI), in which anybody can receive any information automatically from a depersonalised data set of statistical level. A rarer and not really supported tendency is when a certain element of the virtual space addresses the citizen in an unrequested way. Luckily, these malicious systems do not have the knowledge to address actual patients in an orientated way; however, they cause very great societal and material damage.

Doctor-to-Doctor Relation (D2D)

This is the relationship in e-health that should receive the most attention in the near future since the attending physician (family doctor) has a key role in optimisation of patient paths. The doctor-to-doctor IT relation is advantageous to both society and the individual. In many cases it is a process occurring within the relation between the institutions (H2H) where the technical solution consists of almost the same or very similar components. It includes videoconferencing, remote diagnosis through teleradiology, etc. Within the field of radiology, these applications are used routinely in the Hungarian attendance system since there is no simpler and cheaper solution for bridging the local lack of labour or competency.

Doctor-to-Institution (Hospital) Relation (D2H and H2D)

The establishment of the relation discussed previously within the framework of the institution requires the appearance of an actual economic interest or central coordination. An example with the widest functionality in Hungary is the Inter-Institutional Information System of Medical Institutions (IKIR) (hospitals, clinics, family doctors, pharmacies, etc.) which was prepared within the framework of the HEFOP 4.4 project out of EU resources. During its several years of operation it became clear that its extension to nation-wide level couldn't be achieved without central coordination and support. Experience shows that informatics solution providers have already created several alternatives for its continuance but we cannot expect a real breakthrough in this issue until central decisions are made in the matters of cost distribution, responsibility and data protection. Nevertheless, the elaborate technical solutions have already been built in the products and solutions of health informatics suppliers. This advantage also belongs to the domestic IT industry only and it could also be shared with other European countries.

Doctor-to-Administration (State) Relation (D2A and A2D)

The doctor reports his/her performance to the National Health Insurance Fund, which arranges the public financing and controls the day-to-day legal relation. These electronic solutions save time and money for both the doctor and the state. These cases of data forwarding create basis for other central electronic services so it is very important that this activity is recognised both materially and ethically. The state will provide proper back signals about these reports (list of mistakes); what's

more, the family doctors' quality indicator system was initiated recently for evaluating the work according to various parameters, sometimes providing extra financing to the family doctor.

Doctor-to-Business Relation (D2B and B2D)

This system of relations is incidental. It is still not common practice for family doctors to order medical devices, materials and services electronically. Some physicians use the Internet to purchase electronically but not to a significant extent. In the business area however, health software suppliers operate the family doctors' software programmes predominantly through remote surveillance and remote management and update the central databases. The provision of remote surveillance is a cost- and risk-reducing factor for both parties.

Doctor-to-Infrastructure Relation (D2I)

In the case when a physician turns to a community expert system accessible via Internet or uses a community service provided for several players, this relation is live. I include in this relation when a doctor writes an electronic prescription, prepares, sends or receives an electronic case-sheet. The doctor uses such infrastructure which keeps, operates several players because of a certain joint interest or necessity. During the transactions, the family doctor may communicate with an institution (pharmacy, hospital) another doctor, patient, state (financer), but this relation does not mean direct connection but the communication is achieved by means of infrastructure constituting an intermediary condition which coordinates, controls, stores and forwards the proper information in space and time.

Institution (Hospital)-to-Institution Relation (H2H)

In actual fact, it is the same as those described for the Doctor-to-Hospital relation, including the examples. Earlier solutions were prepared for supporting regional cooperation. Now these are used for improving efficiency of division of capacity and labour on the regional or county level. It is the interest of the joint owner or the same maintainer to use its resources, opportunities in an optimal way. Rationality means proper ground for the informatics solutions to become widespread, and it is just the same for the solutions which extend to regional cooperation and which legal form the economic company representing it has.

Institution (Hospital)-to-Administration (State) Relation (H2A and A2H)

This is the other field which I do not feel ashamed of repeating what I wrote last year. We have decades of tradition in this field. Since the introduction of performance-based financing, the institutions have been reporting electronically to the single public financing body (OEP or GYOGYINFOK). The set of uniform electronic records was soon formed and these records are known and used by all software development companies. The financing is built on it, the various institutional

medical systems convert the patient history through it and the monitoring of the patient life path was also built on it during the years of the operation of the Managed Care System. When the Internet appeared, these reports became classical H2A applications. The electronic accounting with the pharmacies and the control of legal relation concerning all medical service providers also belong to this category. We can find the most advanced solution here, too. The Virtual Electronic Purse supporting the public drug benefit system may serve as an example (best practice) for the EU countries in that it has been operated with full coverage for several years (all pharmacies, all patients concerned by the public drug benefit system). As a matter of fact, we can state the penetration is 100 percent in this field H2A in Hungary.

In these fields, the relation is two-directional; interactive in most cases. As a result of the developments, intelligent systems communicate with each other on both sides; however, I range these relations here since the operating player is clean-cut.

Institution (Hospital)-to-Business (H2B and B2H)

Electronic solutions are becoming more and more widespread in the field of procurement for health institutions. Many suppliers maintain web stores and the possibility of electronic auction is also gaining ground. In the field of public procurement, the possibility of purchasing the product at the most favourable price (with or without tender) has existed for years. The business tries to adapt itself to the features of the sector but a real break-through has not yet been made in this field due to the strict rules of management. In regards to the institutions, the realisable logistic advantages have not yet been proportional to problems caused by the lack of liquidity. We can speak of regular and extended use only in the case of pharmacies and medicine wholesalers. Since both parties are profit-orientated, the electronic business culture was soon established, independently of that it was enforced to the retailers' network by the wholesalers.

Institution (Hospital)-to-Infrastructure (H2I), Administration (State)-to-Infrastructure (A2I) and Business-to-Infrastructure (B2I) Relation

In addition to the opportunities offered by WEB 2.0, numerous health expert systems accessible in Hungary and worldwide, link picture and video sharing sites, forums, blogs, knowledge and information repositories and community sites. The state also ensures that the sector has an appropriate knowledge repertory. The newest project in Hungary on this subject is the "Catheter-Monika" project, which is a medical capacity analysis and planning software programme. Among other things, this system is able to support selection of alternatives favourable from the aspect of allocation efficiency by representing the pieces of information gained by the data systematisation on a digital map. This knowledge repertory can be used by any health institution, the appropriate bodies of the governmental decision-makers as well as the business players interested in the health industry.

Administration (State)-to-Administration (A2A)

The state sets an example by trying to use and make electronic transaction of affairs as widespread as possible. The electronic data exchange among governmental bodies and offices was enforced by the office gate, the single-window transaction of affairs. The electronic governmental main network (EKG) has been available for several years and the bodies of the central administration are obliged to communicate through it. Nowadays we can observe more significant centralisation in this field. The functional concentration into the county governmental authorities can make the utilisation of resources more effective, accelerate transaction of affairs and reduce the redundancy as well as the time necessary for the office work.

Administration (State)-to-Business (A2B and B2A) and Business-to-Business (B2B) Relation

These fields have relations operating independently of the health sector. Within the electronic relations kept with the state, the company foundation, tax returns and various labour and social insurance reports are not sector-specific. As a matter of fact, business players have long since been using electronic procurement, logistics services monitoring, information sharing and financial settlement (e-invoice, e-banking, etc.), with its volume increasing continuously.

Infrastructure-to-Infrastructure (I2I) Relation

Infrastructure-to-infrastructure may be the most difficult relation to describe and imagine, but development seems to be moving in this direction. We can create more and more intelligent expert systems which can perform more and more complex tasks without human intervention. Already, we only supervise and validate the transactions but the time will come when these systems will make individual decisions. Now the health sector has process control systems which on the basis of parameters measured by certain devices can change parameters in another device and sometimes correct faulty human decisions. The concept of the formation of the authentic central sector records made known recently includes a "central validation device and data distributor" which is already such a component which performs the coordination among the various institutional master data systems.

Conclusion

I hope the classification of e-health described in this article and the brief review (far from being complete) show the successes and future potential of health informatics in both Hungary and across Europe. I ask everybody to consider my article as a basis for discussion and I wait contributions, remarks, opinions and modification proposals.

References available upon request, editor@hitm.eu

DIGITAL PATHOLOGY SOFTWARE TO IMPROVE BREAST CANCER DIAGNOSIS AND THERAPY

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Its reliance on biomarker evaluation for diagnosis and treatment decisions makes breast cancer care a good example of personalised medicine. In addition to breast cancer biomarkers such as the oestrogen/progesterone receptor and the Ki-67 proliferation marker, HER2 (Human Epidermal growth factor Receptor 2) has received particular attention in the recent years. 20 - 30 percent of women with breast cancer test positive for the HER2 protein, associated with an especially aggressive breast cancer variant. HER2 positive patients usually respond poorly to conventional chemotherapy, but benefit from therapy with Herceptin®, a humanised HER2 antibody that costs on average approximately 100,000 dollars per patient. Because this approach does not help HER2 negative patients, doctors need to reliably detect and quantify the expression of this biomarker in breast cancer patients or else risk prescribing expensive and ineffective therapy.

Biomarker detection and analysis is the responsibility of a hospital's pathology department, which follows standardised protocols to score each sample as objectively as possible based on visual criteria. While the ability of pathologists to interpret histomorphological characteristics, such as whether a tissue is cancerous, is extremely reliable, human interpretation of quantitative image features appears more difficult. Measuring the number of cells positive for a specific biomarker and, even more so, visually quantifying the intensity of biomarker stains, may suffer from significant inter-observer variability. However, objective and accurate assessment, especially in case of the predictive biomarker HER2, is highly relevant because therapeutic decisions rely on the quantitative scoring result.

Background

Breast cancer is among the most prevalent cancers in the world. World Health Organization (WHO) data indicates the disease strikes more than one million women every year, and kills more than 500,000 annually. Screening with novel imaging technologies can lead to earlier detection, and in turn improved prognoses and survival rates. However, there are numerous subtypes of breast cancer, and physicians must identify a patient's specific disease state to ensure proper treatment. Biopsies with (immuno-) histopathological and in-situ genetic biomarker analysis are the most common and effective ways to understand the molecular characteristics of a patient's cancer.

Therefore, pathologists and clinicians now cite a growing need for accurate biomarker quantification tools that can support treatment decisions. Employing software to automate image analysis of histological sections can enhance doctors' understanding of breast and other types of cancer by providing insights into functional and molecular genetic characterisation of

tumours. Charité Berlin is working on such a project, which is designed to provide pathologists with access to reliable, objective and standardised information that can inform treatment decisions around breast cancer. This project also has implications beyond pathology into radiology as both fields rely on

Charité Berlin

Charité University Hospital is organised in 17 centres comprising 103 medical departments with over 3,200 beds located in four locations in Berlin. More than 3,700 scientists and physicians work at the Charité, covering a broad range of subspecialties in biomedical research and clinical medicine. The Charité Institute of Pathology was founded by Rudolf Virchow and is one of the largest pathology university departments in Europe.

visual analysis to understand patient disease states. Seeking to arm its physicians with the best possible information about their patients' health, the Institute of Pathology at the Charité began working with Definiens, a provider of image and data analysis technology, to develop a software solution for automated scoring procedures for breast cancer patients. Based on previous healthcare projects, Definiens has shown the capability to provide robust quantitative image analysis solutions. Both organisations focus on developing a prototype that could be integrated into the pathology department and ensure oncology teams receive reliable information about patient disease states.

Overcoming the Challenges of Conventional Image Analysis

As pointed out above, the analysis of stained sections can vary between pathologists, affecting the reliability of such scores. Automated scoring algorithms are subject to no such inconsistencies, but image analysis technology is constrained in other ways. Pixel-based approaches often cannot determine the morphological features important in a tissue section, and are thus of limited value for most histopathological applications. Definiens' approach, however, unlike other technologies, is designed to analyse structures within the sample, and can understand the relationship of tissue structure, cellular components and subcellular features. These features are particularly important for histological biomarker analyses because they are the basis not only for accurate quantification but also for the reliable discrimination between tumour and healthy tissue.

The computer-assisted diagnostics systems the physicians and scientists from Charité pathology and Definiens conceived integrates different histopathological modalities (similar to different imaging sequences in MRI), analysing the tissue morphol-

ogy with conventional H&E (Hematoxylin and Eosin) staining; quantifying the protein markers ER (estrogen receptor), PR (progesterone receptor), Ki-67 (cell proliferation), and HER2 with immunohistochemistry; and assessing the HER2 (Human Epidermal growth factor Receptor 2) gene amplification status with SISH (Silver In Situ Hybridisation).

Together, this allows the software to correlate the different tissue features within their spatial context and derive reliable, reproducible scores. While the current scope of the prototype is for research purposes only, the goal is to offer pathologists a comprehensive and objective basis for therapy recommendation, improving breast cancer treatment by selecting the appropriate therapy for the individual patient.

"Given the need for more reliable, objective scoring regimens in pathology, it represents what Charité Berlin expects will be among the first in a new generation of image analysis programmes"

Scoring Mechanism

The software is designed to compute scores based on a wide range of clinically significant variables, particularly morphology and multiplex biomarker expression. In practice, scoring of the tissue section images according to the established algorithms - Elston-Ellis for H&E, Allred for nuclear IHC markers and HercepTest for membrane — allows the pathologist to communicate with clear and well-documented recommendations for targeted therapy. With respect to HER2, cases with a low expression (scores of 0 and 1+) are not suitable for further investigation for inhibitory treatment, while a high HER2 expression (score 3+) is predictive of the efficacy of Herceptin therapy. Cases that score 2+ are followed up with a measurement of the amplification of the HER2 gene using SISH, and, in case of amplification, Herceptin therapy is recommended.

To develop and validate a software prototype that can present a simple numerical score to physicians, Charité Berlin provides Definiens with 150 samples. For each sample, seven sections are stained: One for H&E, one each immunohistochemically stained for biomarkers HER2, ER, PR and Ki67, and SISH analysis for HER2 and Chromosome 17 (Chr17). All these data are fed into a three-level hierarchical classifier. First, relevant features are extracted from the image data for each slide. The programme then determines a score for

each modality examined. Finally, the individual scores are combined into a total score to be reviewed by the pathologist and presented to the attending physician. Pathologists manually score half the samples as reference points.

Interface Development

The new prototype works with many different platforms because a pathologist's working environment is marked by a heterogeneous hardware and software environment. On the hardware side of the equation, slide scanners from Aperio, Leica, 3DHistech and Hamamatsu are common. A recently developed system from Philips promises even higher throughput and automation. The data management is often independent but connected to the hardware; companies such as Roche, Aperio and Nexus are the most common such data management providers in pathology labs.

To develop the software as an intuitive component of a pathologist's workflow, Charité Berlin and Definiens are paying special attention to the graphical user interface (GUI), implemented in a web browser with Web 2.0 technologies such as XHTML, Javascript and Ajax. This allows the pathologist to perform different jobs and access data and analysis with a variety of hardware (whether from a desktop, a laptop or a tablet) and operating systems (Microsoft Windows, Apple OS, Linux). The GUI is often similar, if not nearly identical, to radiology applications. The web-based GUI will also allow pathologists to perform remote work (e.g. telepathology) or to consult with other experts using the internet. The system may also be used for education purposes to train students for manual scoring and tissue examination.

Broader Implications

Collaboration between research and clinical disciplines enables physicians to draw upon new findings in predictive molecular pathology, where pathologists not only diagnose a certain disease but also provide molecular characterisation and recommend a particular therapy. In this regard, image analysis promises to provide insights into functional and molecular genetic mechanisms of tumours, and helps translate this knowledge into clinical practice. Furthermore, the software prototype provides a new, image analysis-based evaluation algorithm that considers a range of immunohistochemical factors in recommending treatment decisions. Given the need for more reliable, objective scoring regimens in pathology, it represents what Charité Berlin expects will be among the first in a new generation of image analysis programmes.

Such an image analysis approach can work similarly for radiology as for pathology. Given the convergence of the two fields, one can expect the development, implementation and benefits of new programmes to track Charité Berlin's experience with the breast cancer-oriented software thus far. In this case, software may well provide quality improvements that could augment physicians' clinical effectiveness and help patients receive the best treatment possible.

E-PRESCRIBING IN THE ICU

Engaging Authentic User Participation

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The healthcare sector is subject to great technological change in an effort to improve current practice and patient safety. While the use of information technology has been encouraged as a solution to improve patient safety and reduce medication errors, appropriate methods must be applied to the design and development of such systems to ensure they are usable. An interdisciplinary team, comprising experts both in interactive systems and healthcare design and consultant anaesthetists, nurses, and pharmacists, was formed and authentically participated in the design and development of an electronic prescribing and administration system tested in the ICU at Ninewells Hospital, Dundee.

Introduction

Information Technology has been encouraged as a solution to improve patient safety. However, there is a lack of evidence about the impact of information technology in the healthcare sector with many healthcare systems under evaluated. Although there is potential for the introduction of information technology to improve healthcare, badly designed systems can compromise patient safety. Usability problems have been found to frustrate end-users and have an adverse impact on patient care. The focus of this project was to facilitate safer medication prescribing within intensive care through the use of electronic systems, aiming to create a usable system, which reduces the likelihood of non-compliant prescriptions.

Interdisciplinary Working

There is often a tendency to work in parallel in multidisciplinary projects that link the computing and medical domains. To overcome the silo approach and to guarantee interdisciplinary collaboration, a project team was formed at the outset of the project, consisting of clinicians from Ninewells Hospital, Dundee and a group from the School of Computing, University of Dundee. Prior to forming the team, a lead clinician at Ninewells Hospital Intensive Care Unit (ICU) had identified a need for creating an electronic prescribing system and approached the University of Dundee about a possible collaboration. The involvement of the senior clinician facilitated the recruitment of clinicians to the project team.

The team comprised two consultants in anaesthesia and intensive care, the principal clinical pharmacist for critical care, the intensive care specialist liaison nurse, a nursing education specialist, a professor of interactive systems design, a professor of assistive systems and healthcare computing and a PhD student. Some of the individuals on the team changed during the three-year period but the professional composition was unaffected.

System Development

The multidisciplinary team were engaged and involved in the design and development of the prototype electronic prescribing and administration system. The interface was designed to actively enhance the compliance of medical prescribing, be highly usable and not have a negative impact on patient care.

The main advantage of the paper medication chart used in Ninewells ICU was its accessibility; it could be accessed by nurses, doctors and pharmacists and could be viewed by multiple users simultaneously. The electronic system needed to replicate this and also be portable to prevent restricting the normal interaction process that was observed with the paper system e.g. nurses taking the paper chart to the doctor if they had a query about a prescription or passing the chart between the team in the morning ward round. This led to the decision to use a tablet PC.



Figure 1. A typical bed space in the intensive care unit

The system was designed as a client server application, allowing several client machines to be connected to the server, providing each patient with a tablet machine, a tablet stylus for input and an incorporated barcode scanner to allow users to log on to the system. The tablet PC could be mounted at the end of the patients' bed to provide easy viewing and be easily removed from the mount. It was roughly the same size as the paper chart. A rugged tablet PC was required to survive the Intensive Care environment, enduring extensive cleaning and being dropped. A tablet stylus was used for input instead of a keyboard for portability and to further reduce the risk of infection.

The electronic prescribing and administration system was intended to emulate the original paper medication chart with the additional functionality of confirming that medication had been administered (which was previously recorded on the paper Medicine Recording Sheet). The interface was organised into two sections, similar to the paper system, with the top section displaying regular prescriptions and the bottom

section displaying the “once only” prescriptions. Within the regular prescription section three subsections displayed “discontinued”, “current” and “future” prescriptions.

Within the regular prescriptions, continuous infusions were grouped together as a result of nursing staff feedback to make the administration process easier and to reflect the sequence for administering medication. The interface was designed to minimise free text input, to avoid frustration and save time entering text via an onscreen keyboard.

Evaluation

An evaluation of the electronic prescribing and administration system was conducted in a clinical setting over a sustained period to identify the extent to which:

1. The electronic prescribing and administration system had an effect on levels of non-compliant prescriptions prevalent in the ICU.
2. Users found the electronic prescribing and administration system usable.

The system was evaluated without the experimenter being present and over a prolonged period, to reduce the risk of any Hawthorne or novelty effects. The absence of the experimenter eliminated any pressure to use the system, indicative of the level of enthusiasm amongst users. The electronic prescribing and administration system was introduced into the ICU, Ninewells Hospital over a five-month period (14th January – 5th June 2008), and tested on 16 patients. Paper and electronic prescription charts were run in parallel on the ward.



Figure 2. The electronic prescribing system

To measure the effectiveness of the electronic prescribing system, deviations made in the prescribing process were compared using the two different systems: The electronic prescription and administration system and the paper prescription chart, for 16 different patients over the five-month period. A retrospective re-

view was conducted where both types of chart were checked against 15 standards for prescription compliance derived from the Safe and Secure Handling of Medicines Policy.

To evaluate the clinicians’ perceptions of the electronic prescribing system, qualitative methods were used to collate feedback. From a total population of 62 clinicians who had used the system, a sample was interviewed, comprising nine doctors, ten nurses and a clinical pharmacist.

Evaluation Results

The electronic prescribing and administration system almost doubled the level of prescription compliance (from 46.73 percent with the paper system to 91.67 percent with the electronic) and significantly reduced prescribing deviations (from 51 to 8.5 percent).

The results of the interviews demonstrated that overall the electronic system was preferred.

“(I prefer the electronic system) because it’s made life a bit easier from our point in administering drugs to be able to read straight away what’s been happening” (Staff nurse)

“One thing is it’s definitely safe, ... Patient safety - I think it’s immensely improved and the other thing is it’s very legible... and everybody can understand what’s happening very clearly” (Specialist registrar)

The users’ experience was on the whole positive. Generally they found the system intuitive, easy to learn and they were comfortable using it.

Conclusion

Previous studies have shown that inappropriate designs can lead to the introduction of errors or to systems, which are not viewed positively by the users. There was no evidence of these issues in the Ninewells study, demonstrating the importance of involving clinicians in the design and development of an electronic system to produce an effective and workable solution, in this case an interface that successfully improved the compliance of the medication prescribing process.

Future Work

The approach taken to create a usable electronic prescribing and administration system, which enhanced compliance with the medical prescribing process, may be capable of wider application in other healthcare application areas. Funding has been secured, in collaboration with NHS Tayside and Knowledge Transfer Partnership to take a user-centered approach to the design and development of an IT system in the surgical high dependency unit (SHDU). The system will enable real-time data to be entered on certain healthcare processes, the environment in which these processes are occurring, and the outcomes from these processes whilst providing real-time feedback on this information to enable early intervention if a problem is identified.

CONTINUOUS DISINFECTION OF THE HOSPITAL ENVIRONMENT USING HIGH-INTENSITY NARROW-SPECTRUM LIGHT (HINS-LIGHT)

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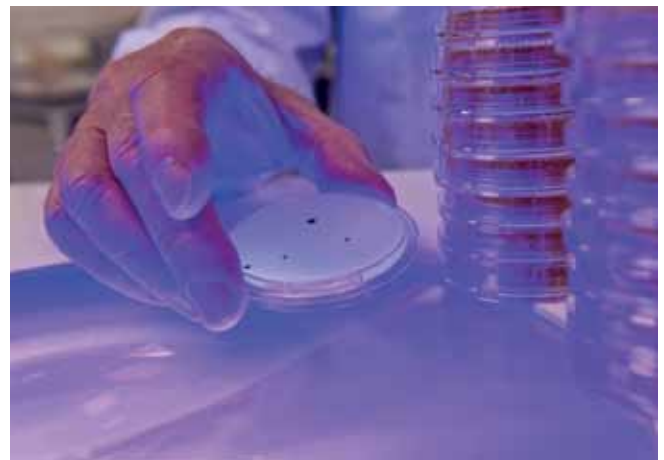
Increased awareness of the importance of the hospital environment as a potential source of nosocomial pathogens has led to an upsurge of interest in hospital cleaning and decontamination procedures and technologies. It is now known that certain pathogens, such as MRSA and Acinetobacter can survive for many months on environmental surfaces within the hospital environment. Although conventional surface cleaning and disinfection will always be essential for both aesthetic and functional reasons, many current practices and procedures have limited effectiveness for pathogen removal.

Inevitably there will be some areas that are either not cleaned or only ineffectively cleaned. Also because microorganisms are continuously shed and dispersed from patients and staff, routine cleaning procedures may not be sufficiently frequent to effect timely removal. It is also the case that some of the most frequently touched and heavily contaminated surfaces are those least frequently cleaned. Domestic cleaning staff are not allowed to clean electronic equipment or items attached to patients and these cleaning tasks may be left to nurses who are often too busy. These limitations have led to calls for enhanced investment in more effective conventional cleaning as well to encourage the development of new technologies that might be used to supplement conventional cleaning and disinfection procedures.

A new technology, developed at The Robertson Trust Laboratory for Electronic Sterilisation Technologies (ROLEST) at the University of Strathclyde, has been introduced to provide a unique new approach to help address these problems. This is a new light-based disinfection method based on the use of what the ROLEST research group have termed "High Intensity Narrow Spectrum Light (HINS-light)" which is a violet coloured light from within the visible spectrum that is highly bactericidal. This has formed the basis for the development of the High-Intensity Narrow-Spectrum Light Environmental Decontamination System (HINS-light EDS) specifically designed for the reduction of environmental bacterial contamination in hospitals and other areas of the healthcare environment.

How Does HINS-Light Kill Bacteria and Which Bacteria are Susceptible?

The High Intensity Narrow Spectrum (HINS) Light is a narrow bandwidth of high-intensity visible violet light with peak output at 405nm. These specific light wavelengths exploited by



the HINS-light EDS technology photo-excite molecules which induce the production of free radical molecules, such as the highly reactive singlet oxygen, within the exposed bacteria. This photodynamic reaction ultimately leads to irreversible inactivation of bacterial cells. This approach to antimicrobial treatment is effective against a wide range of bacterial pathogens including those that are commonly associated with HAIs. The disinfection treatment can be continuously applied to air and all exposed surfaces.

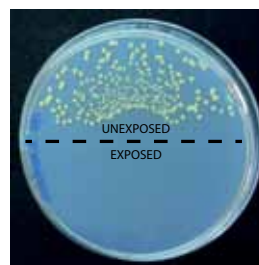


Figure 1.
 Inactivation of *Staphylococcus aureus* on a nutrient agar surface after exposure to HINS-light.

Top half of plate was covered (unexposed)
 Bottom half of plate was exposed to HINS-light

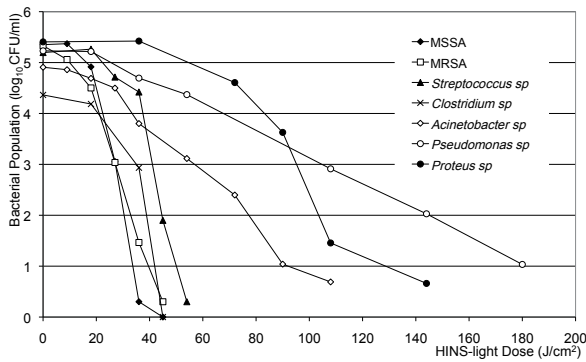


Fig 2. HINS-light inactivation of a range of bacteria commonly associated with healthcare-associated infections

Deployment to Inactivate Hospital Bacteria

The HINS-light EDS units are ceiling mounted light sources that are typically operated continuously during daylight hours (in synchrony with hospital lighting) within the ward or isolation room to provide ongoing environmental decontamination with no disruption of normal day-to-day hospital procedures. Whilst HINS-light is highly bactericidal, safety analysis of the complete wavelength emission spectrum of the light from the HINS-light EDS, with reference to relevant international guidelines, confirms the safety of the HINS-light EDS sources for clinical use.



Figure 3. HINS-light EDS installed in a hospital

Operational benefits of the HINS-light EDS include:

- Continuous disinfection;
- Treats the visible environment (air and surfaces);
- Safe for use in the presence of people;
- Effective against a wide range of pathogens;
- Little/no operational requirements;
- No user training;
- No problems with staff/patient compliance; and
- No chemicals or chemical pre-treatments.

Clinical Evaluation Results

Since mid 2008, the ROLEST Group in collaboration with Infection Control Experts from Glasgow Royal Infirmary (GRI), have been engaged in clinical evaluation of the HINS-light EDS. Most of this work has been funded by a substantial Scottish Enterprise Proof of Concept Award that enabled the ROLEST researchers to develop the HINS-light EDS from concept to practical application, culminating in its clinical evaluation.

The clinical evaluation was designed to assess the effectiveness of the HINS-light EDS for the reduction of environmental bacterial contamination on surfaces at various sites in hospital isolation rooms within the Vascular Ward, the Burns Unit and the Intensive Treatment Unit (ITU). Within the isolation rooms, the HINS-light EDS units were installed as ceiling mounted LED lighting systems, with the output level of the HINS-light EDS being set to provide effective environmental decontamination whilst being non-disturbing to patients and staff. During the evaluations the HINS-light EDS was used as a complementary disinfection procedure, being operated continuously during daylight hours in occupied rooms, under conditions where normal clinical care and infection control measures were implemented.

The effect of HINS-light EDS was assessed through contact-plate sampling of bacterial levels on a wide range of frequently touched contact surfaces (e.g. bedside locker, bed table, bed rails, chair, bin lids, light switches & door handles). In each of these studies the principal objective was to assess the percentage change in bacterial contamination level in the isolation room, and whether it significantly increased or decreased following switching on or switching off the HINS-light EDS.

The findings of the clinical evaluations show clear evidence that HINS-light EDS treatment causes a reduction in bacterial counts, and that when the HINS-light EDS treatment is withdrawn, bacterial counts increase. The mean percentage reduction in total staphylococcal counts and presumptive *S. aureus* counts arising from the use of HINS-EDS was 57 percent with 95 percent confidence interval (45 to 69 percent), and 60 percent with 95 percent confidence interval (50 to 70 percent), respectively. The mean percentage increase in total staphylococcal counts and presumptive *S. aureus* counts arising from withdrawal of the HINS-light EDS treatment was 162 percent with 95 percent confidence interval (46 to 278 percent), and 168 percent with 95 percent confidence interval (-2 to 339 percent), respectively.

Additional studies carried out to further validate the efficacy of the HINS-light EDS included a study on an unoccupied isolation room in which the total staphylococcal environmental contamination level was reduced by more than 90 percent, and a study which used the HINS-light EDS over an extended period in an occupied isolation room, resulting in 86 percent reduction in staphylococcal contamination. Further studies have continued to generate convincing evidence of the decontamination efficacy of the HINS-light EDS in both isolation room settings, and additionally in out-patient clinic settings.

as “efficacy indicator” bacteria because of both their importance as a cause of HAI as well as the availability of an accepted and well-tested contact agar evaluation protocol that could be applied for the accurate assessment of levels of these organisms on contact surfaces in the clinical environment. In more recent testing of the microbiocidal efficacy of HINS-light it has been established that, in addition to broad spectrum bactericidal effects, HINS-light also has biocidal effects on mould and yeast type fungi, organisms which can also cause serious problems in the clinical environment.

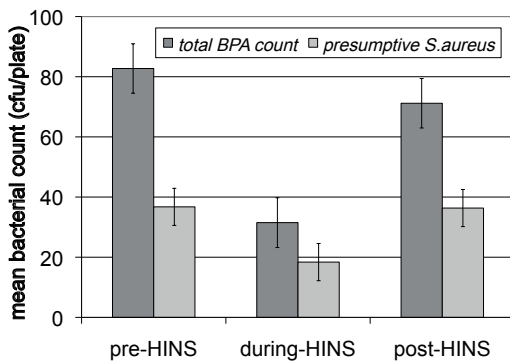


Figure 4: Environmental bacterial levels in an occupied isolation room were successfully reduced during use of the HINS-light EDS

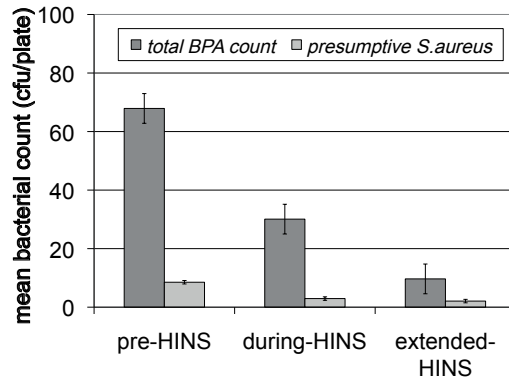


Figure 5: Environmental bacterial levels in an occupied isolation room were reduced to very low levels after extended use of the HINS-light EDS

Conclusions

Findings of the clinical evaluations have provided rigorous evidence that HINS-light EDS used in the treatment of occupied hospital rooms reduces total staphylococcal and presumptive *Staphylococcus aureus* contamination levels. The findings reflect consistency across the to a range of statistical having been conducted under hospital management conditions, where

The study results and associated statistical analyses show clear evidence that use of the HINS-light EDS causes a reduction in environmental bacterial contamination and that the benefit derived from the treatment is lost after the HINS-light EDS treatment is withdrawn, with the bacterial contamination levels increasing over time to at least the pre-treatment values. It should be borne in mind that these results were achieved under a range of clinical conditions within a busy city hospital environment, and it is important to stress that the bacterial reductions obtained were over and above those achieved by the hospital’s normal stringent infection control procedures which remained fully in place throughout the study. Results from some of the studies representative of this clinical evaluation have recently been published in *The Journal of Hospital Infection* (Maclean et al, Environmental decontamination of a hospital isolation room using high-intensity narrow-spectrum light, 76, p247-251, 2010).

It is also important to note that whilst the studies described above focused on the reduction of staphylococcal bacteria, levels of other contaminant bacteria will also have been concurrently reduced due to the broad spectrum bactericidal effects of HINS-light. Extensive laboratory studies by the ROLEST group have established that the HINS-light EDS is an effective technology for the inactivation of a wide range of bacterial pathogens. Staphylococcal bacteria were chosen

contamination levels are variable and are constantly being driven down by normal infection control procedures, the HINS-light EDS findings are externally valid and indicate that HINS-light EDS can make an additional significant contribution to bacterial decontamination in clinical environments.

A particular advantage associated with the use of HINS-light EDS is that it can be used continuously in the presence of patients and staff including during periods of high bacterial dispersion as can be associated with activities such as bed making and bandage changing. The pervasive nature of light permits treatment of all exposed surfaces and these are surfaces that are most likely to be contaminated through aerial dispersal and hand touch. The facility for continuous application is also advantageous since technologies such as deep cleaning procedures which, although highly appropriate for terminal cleaning operations, are ineffective as a means of continuous decontamination as rapid recontamination of the environment follows within several days after deep cleaning.

Whilst the results achieved with the HINS-light EDS are highly promising it has still to be established, as is the case with all other environmental decontamination procedures, whether long-term use of the HINS-light EDS can have a significant impact on clinical outcomes such as infection and colonisation rates.

AN OVERVIEW OF THE HEALTHCARE SYSTEM IN GREECE

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The Greek healthcare system is characterised by the coexistence of a National Health System (NHS), compulsory social insurance and a strong voluntary private healthcare system. The NHS provides universal coverage to the population and in addition, the entire population is covered by social insurance funds and 15 percent of the population maintains complementary voluntary health insurance coverage, which, together with out-of-pocket payment, funds a quite large private healthcare market.

Historically, like in many other countries, social insurance played an important role in the development of Greek healthcare services. In particular, the Social Insurance Fund (IKA) established in 1937 and the Farmers' Social Insurance Fund (OGA) established in 1961 contributed significantly to the development of the healthcare system.

However, despite early efforts by the government and other parties, the healthcare system in Greece remained one of the least developed amongst OECD countries until the beginning of the 1980s, with many gaps in the delivery, organisation and funding of healthcare. The system was characterised by lack of infrastructure or adequate funding, with great inequalities in access to healthcare.

In this context, the healthcare reforms introduced in 1981 were much needed. At that time, a National Health System (ESY) was established, aiming at providing free, equitable and comprehensive health coverage to the entire population. The 1980s were primarily devoted to the implementation of the reforms and saw significant improvements in the capital, human and technological infrastructure of the public healthcare sector.

In the period between the early 1990s and today, investment in the public sector continued, with greater emphasis placed on managerial and organisational reform to increase the efficiency of the system. An important development in this period was the evolution of the private healthcare sector, which now accounts for more than half of health-

care expenditure. Today, therefore, the healthcare system in Greece is a mixed one where the NHS, public insurance funds and the private sector are all involved significantly in the funding and provision of healthcare services.

“The healthcare system in Greece is moving towards greater privatisation”

Organisation

The NHS includes around 130 general and specialised hospitals, totalling about 40,000 beds financed by the state budget and social insurance funds and provide emergency, outpatient and in-patient care. There are also approximately 13 military hospitals and two university hospitals managed and funded by the Ministries of Defence and Education respectively, with a total capacity of about 4,000 beds. The public healthcare system also comprises about 200 Primary Care Health Centres and 1,500 Rural Medical Surgeries which provide primary care services in rural areas free of charge and are funded by the state budget.

This primary, secondary and tertiary public healthcare system is managed by seven Regional Health Authorities, run by Executive Officers who report to the Ministry of Health and Social Solidarity. The latter has responsibility

for developing health policy and coordinating healthcare delivery. The Ministry also supervises bodies such as the National Drug Organisation, the National Emergency Service, the National Centre for Communicable Diseases, and various other specialised institutions.

Role of Social Insurance Funds

Around 30 social insurance funds purchase healthcare services for their covered population from the NHS but also from private providers. The majority of the funds are independent entities covering different occupational groups supervised by the Ministry of Labour and Social Affairs. Each provides different benefits and coverage.

The IKA covers 50 percent of the population, the OGA covers 20 percent of the population, the Fund for Merchants, Manufacturers & Related Occupations (OAEF) covers 13 percent of the population and the Fund of Civil Servants (OPAD) covers 12 percent of the population. Apart from purchasing services, the funds also provide healthcare services through their own centres.

Finally, the private sector, which comprises physicians, practices, diagnostic centres, laboratories and hospitals has seen significant growth over the past decade-and-a-half and the healthcare system in Greece is moving towards greater privatisation. This trend is influenced by economic growth, the dissatisfaction of the public with access to and quality of public care and the oversupply of doctors and other private services which enhance the demand for healthcare through supplier-induced demand phenomena.

Financing and Expenditure

The public healthcare system is financed through a mixed system, in which the salaries of personnel are covered directly by the state budget, while the rest of the expenses are supposed to be covered by service charges to the insurance funds and patients. Charges are calculated on the basis of a complicated reimbursement system, which in some cases accounts only for the duration of hospitalisation, in others for the consumables and medications dispensed and in others on a pre-fixed fee for the intervention undertaken.

In other words, several different reimbursement methods coexist depending on the case. Personnel exclusively employed in the public sector are not allowed to pursue parallel private activity. As the reimbursement fees for the services delivered have not been updated for some time, hospitals and other public services are running huge deficits which are covered by the state budget every few years.

The healthcare budget is set annually by the Ministry of Finance. Taxes account for 70 percent of the financing of the NHS and the rest comes from social security and out-of-pocket payments. The healthcare services of public sickness funds are directly financed by them and physicians are also allowed to pursue private practice. The private sector is financed through charges to the sickness funds, private insurances and patients themselves. OPAD for instance has contracts with 20,000 doctors and laboratories to cover the healthcare needs of its beneficiaries.

Human, Capital and Technological Resources

There are more physicians per capita in Greece than in any other OECD country. During the past

decades, the number of doctors per capita increased rapidly to reach 4.9 practising physicians per 1,000 population. It should be also noted that there is a very large number of specialised physicians in comparison to other countries and that only 5 percent of doctors are general or family practitioners. On the other hand, there are only 3.8 nurses per 1,000 population, much lower than the average of 8.6 in the OECD countries.

In this context the country has the lowest ratio of nurses to physicians among OECD countries. As in most OECD countries, the number of hospital beds per capita in Greece

has fallen over time. This reduction has coincided with a reduction of average length-of-stay in hospitals and an increase in the number of surgical procedures performed on a same-day (or ambulatory) basis. The average length of stay is six days and the occupancy rate of hospitals stands at 79 percent. In conclusion, the healthcare system nowadays has the same infrastructure as in other OECD countries, but it is characterised by an over-supply of doctors and a shortage of nurses, which causes operational and service distortions and supplier-induced demand phenomena.

Greece vis a vis OECD average in regards to health and healthcare indicators	OECD	GREECE	DIFF
Insurance Coverage			
Public insurance coverage of population	93%	100%	7%
Private insurance coverage of population	28%	16%	-13%
Demographics			
Share of population aged 65 and over	15%	18%	3%
Fertility rates, number of children per women (15-49)	1,6	1,3	-0,4
Risk Exposure Indicators			
Alcohol consumption in litres per capita	9,5	9,0	-0,5
Overweight rates, population aged 15 and over	33%	35%	2%
Obesity rates, population aged 15 and over	15%	22%	7%
Percentage of adult population smoking daily	24%	39%	14%
Health Indicators			
Life expectancy at birth	78,6	79,3	0,7
Infant mortality rates	5,4	3,8	-1,6
Suicide mortality rates	12,1	2,6	-9,5
Road accident mortality rates	10,3	16,4	6,1
Low birth weight, percentage of total live births	6,6	8,8	2,2
All cancer, age-standardised mortality rate, per 100,000 people	171	153,7	-17,3
Ischemic heart disease mortality rate, per 100,000 population	102,3	82,9	-19,4
Stroke, age-standardised mortality rate, per 100,000 population	60,45	98,5	38,1
Hospital Infrastructure			
Acute care hospital beds per 1,000 population	3,9	3,8	-0,1
Long-term care hospital beds in hospitals, per 1,000 population aged > 65	5,7	5,0	-0,7
Occupancy rate of acute care hospital beds, in percentage	75%	79%	3%
Average length of hospital stay	6,3	6,0	-0,3
Technology Infrastructure			
Number of CT scanners per million population	20,6	25,8	5,2
Number of MRI units per million population	9,8	13,2	3,4
Number of Mammographs per million population	19,9	36,5	16,6
Human Resources			
Practising nurses per 1,000 population	8,9	3,8	-5,1
Practising physicians per 1,000 population	3,0	4,9	1,9
Growth in practising physician density, 1990 - 2005	1,60%	2,60%	1,0%
Ratio of practising nurses to practising physicians	3,0	0,8	-2,2
Economic Indicators			
GDP per capita, dollars PPP	\$30.149	\$29.578	-571,0
GDP annual growth rate 2000-2005	1,7%	4,0%	2,3%
Healthcare Expenditure Indicators			
Total expenditure on health as % of GDP	9,0%	10,1%	1,1%
Public expenditure on health as % of GDP	6,5%	4,3%	-2,2%
Private expenditure on health as % of GDP	2,5%	5,8%	3,3%
Percentage of public expenditure on health	73%	43%	-30%
Percentage of private expenditure on health	27%	57%	30%
Annual growth rate of total expenditure on health	4,0%	4,7%	0,7%
Healthcare Expenditure			
Total expenditure on health, per capita USD PPP	\$2.759	\$2.981	\$222
Public expenditure on health, per capita USD PPP	\$2.005%	\$1.277	-\$728
Private expenditure on health, per capita USD PPP	\$748	\$1.703	\$956

HOSPITAL INFORMATICS IN GREECE

Situation Today and Future Conditions

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The current trend in innovative healthcare provision is the use of information and communication technology (ICT). ICT is totally affiliated with the development of added value. The implementation of informatics for the production and diffusion of intra-hospital medical information, where the collision between technology's rationalism and bureaucracy is usually met, is focusing on modernisation and improvement of healthcare systems. The basic unit of ICT in hospitals is the Department of Informatics (DI) but in most hospitals it is inefficiently developed, resulting not only in inadequate qualitative and quantitative profitability, but also limitations in the role of expediting or participating in outsourcing services, while in many "small" hospitals, DI does not even exist.

This article focuses on the problems of the hospital informatics department personnel. The lack of job description, which in combination with the resilient rule enforcement of hospital administration and the low implementation of statutory and organisational interventions, incur the demerit of informatics scientists as well as the information impact.

In the current era of increasing investments by European hospitals in the bid to become digital (the European Union expected that by 2010 five percent of national health budgets would be invested in electronic healthcare and services) the DI is going to have a significant contribution in the improvement of the technological organisation with hospitals.

ICT in Public Sector Hospitals

The usage of ICT applications in Greek hospitals started via the Mediterranean Integrated Programmes, carrying on with the second and third Community Support Framework (C.S.F.). The key point of the coherent actions was the great effort in bringing forward information systems in public hospitals. In addition, the development of the seven decentralised Greek Regional Health Divisions (DYPE) and the introduction of integrated hospital information systems that also include health centres, promised to change to a great extent the existing environment in the sector of public health.

Successful statistical analysis has been developed over the past decade about the adoption of computer science in public health sector. For example, statistical data of the Greek Information Society has shown that in 80 percent of Greek public Hospitals (GPH) DI do exist, but unfortunately they are inefficiently developed, while only five percent of GPH have upgraded the ID in Informatics Service, as they should, according the Greek legislation.

On the other hand a research that included 112 hospitals indicated that only 48 Informatics Professionals are graduates, 37 have studied in the technological sector institutes, and 141 are high school graduates. Likewise, recent research that took place in 41 GPH had the following results:

- The development of the ICT in GPH has been very slow. The largest percent of applications are totally concerned with administration actions, which are mostly text based and limited bandwidth, depending on the size of hospitals. More precisely, approximately 39.02 percent of hospitals are more likely to use isolated administration applications, resulting in many problems, such as: Multiple patient records, as well as multiple invoice registration by the pharmacy, financial department and medical and surgical equipment and supplies (M&SES) office.
- There is a lack of technical service applications.

- Patient diet applications have been developed up to a 4.1 percent of hospitals.
- In a very limited number of hospitals, approximately 3 percent, the processes involved in the M&SES and the consumables consumed by the patient during the daily transactions that occur in wards are handled. This results not only in the deficiency of the control system for these transactions, but also in the insufficient estimation of statistics based on the existing data, since charges of public insurance companies are still manually calculated.
- Merely 14.63 percent of hospitals have developed databases for inpatients which unfortunately have no interface with the hospital information system.
- Electronic medical record (EMR) is only deployed in 4.87 percent of hospitals
- Only 15 percent of physicians use computers in their daily work.
- 46.34 percent of hospitals partly use laboratory applications, while only 19.51 percent of them have implemented a laboratory information system (LIS).
- There is a lack of radiology information systems (RIS), as well as picture archiving and communication systems (PACS) in approximately 87.8 percent of hospitals.
- Only 12,19 percent of hospitals have adopted telemedicine technologies and remote monitoring systems, such as home-based

care management. However it is very important to stress HygeiaNet strengthens healthcare in the region of Crete guided by the principles of universality, accessibility, comprehensiveness, portability and public administration.

health ICT projects, emphasising the need to provide their know-how in public hospitals. For example, the diagnostic and therapeutic centre of Athens Hygeia via a collaboration agreement with Harvard Medical International has developed an electronic medical

of all information within the hospital information system, being sufficiently staffed with administrative personnel consisting of employees who provide secretarial and technical support services for the operation of the department, as well as for outsourcing.

Personnel Issues

One of the major problems facing the personnel of hospital informatics departments is the lack of definition and regulation of their duties and responsibilities. This is a management disadvantage since very often many responsibilities that are not related to the real duties are assigned to informatics staff. For example, other departments' data processing like invoices and disposals of drugs and supplies, secretarial support of directors, as well as the processing of medical equipment databases are often assigned to informaticians.

The outcome of these assignments is the total demerit of informaticians, since this treatment results in staff disappointment and demoralisation, as well as an information impact reflecting organisational deficiency.

Another important issue is the pointless assumption that hospital informatics departments work for the financial services, possibly due to the fact that the application of IT began roughly at the end of the decade 1980 by using personal computers in some economic departments, like the payroll department. This organisational structure results in the problematic cooperation of the DI with the staff of other departments and in the difficulty of decision-making as well as in the unsuccessful management of informatics projects.

In addition, the annual evaluation of informaticians by the economic administration and not by the hospital manager raises the question whether the evaluation system is beneficial enough to employees. We need to be sure that job descriptions are current and comprehensive enough to develop and improve the skills required by these responsibilities, as those evaluating are not familiar with informatics.

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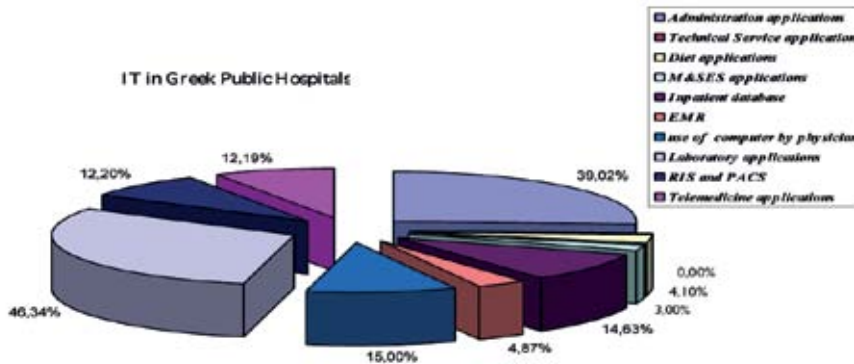


Fig. 1. Illustrates the above results.

Since 2006, according to Measure 2.6 of the ICT applications in health and welfare during the Information Society Operational Programme (OPIS), the completion of the introduction of information technologies (lab systems, patient records, etc) in the health sector is provided, so that the health and welfare services systems will be based on operational data. In addition, the development of information systems at health centres in order to implement an overall national health strategy, as well as the actions related to the preparation, selection, monitoring and assessment of actions and activities of the technical assistance and of the projects of the OPIS is provided. In addition, the service level agreement (SLA), in conjunction with the HL7 compliance denotation is setting the expectations between the consumer and provider concerning the guarantee for comprehensive support to hospitals through the realisation of patient management.

ICT in Private Sector Hospitals

In Greece, there are approximately 250 private hospitals and more than 350 medical centres as well as 20,000 private doctors and consultants. Contrary to the public sector, there is a great contribution of the private sector in

record (EMR) system that supports compliance with practice guidelines and facilitates workflow through computer-aided documentation, prescription writing and ordering tests. In addition, the Onassis Cardiac Surgery Centre (O.C.S.C.), a hospital specialising in cardiovascular surgery and in diagnostic and interventional cardiology, is using HL7 capabilities to allow automatic interactions with other complementary applications.

Likewise the Medical Athens Group, as a member of European programmes DocMem and Telecare, has implemented a computer-based system that includes hospital information formats like order forms, patient records, status reports, information screens and medical imaging results as well as lab results. Also, the Central Athens Clinic is using a health information system that includes LIS, ERP and MIS, which facilitate workflow management including displaying and printing various test requisitions received from wards (ICUs, OT, Emergency, etc.), and out patient departments.

In 95 percent of private hospitals the DI belongs to the administration service and it is responsible for the development and maintenance of the collection, storage, distribution and analysis

Another important issue is that public hospitals inevitably like most public services have their administration regulated by specific rules. Indeed bureaucracy is based on the principle of cold rules priority, while the role of these rules in aiding implementation of hospital DI can be considered in various subcategories:

Rules of Information:

Rules of information determine eligibility for knowledge – who and what. For electronic patient records, decisions must be made as to who can access patient information and make additions and changes to it. Since an extremely important issue in the healthcare environment is medical confidentiality and patient privacy, mechanisms must be implemented to track the actions of users and prevent unclear or ambiguous situations. Questions that need to be answered include: Could the hospital ID correct erroneous records and registrations of the hospital pharmacy or medical charge office by oral request or it would be accused of data elements alteration?

Rules of Jurisdiction and Process:

Rules of jurisdiction determine the conditions under which various administrative decisions are taken or cancelled. These are necessary to accommodate changes in legislation. For instance, what is the process for advertisement of IT tender competitions or the judgement to reject or accept any bid if the decision committee is usually composed of inappropriately qualified persons? Even if hospital managers decide to allocate IT staff members to these committees it is impossible to find a sufficient number of people, due to the inadequate staffing of DI. In addition, the high percentage of non-specialised staff of DI results in unfavourable qualitative and quantitative job performance, like the identification of terminology standards that support a concept terminology and the participation in the design, testing, implementation and evaluation of management tools designed to support maintenance of concepts and clinical decision support knowledge assets.

It is obvious that the above technical challenges will require not only persistence and innovation, but also technical skills that are ensured by Bachelors and Masters Degree in clinical informatics, as well as by good analytical skills, well-organised and systematic in work processes and collaborative work in inter-hospital teams. However, in the manifesto of the open competition for hospital integrated information system, which aims to be a network application integrating the total management framework and relating to all operational programmes of the 3rd CSF, only 0.37 percent of personnel are graduated in informatics, a 0.3 percent are collegian, and 0.74 percent are high school graduates.

A key problem for hospital informaticians is the fact that any application of new IT projects could be threatened by human psychology, since for example, the older staff are afraid that their lack of fluency in IT use could expose them to their younger colleagues, or to their supervisors, since their performance would be monitored more closely. Cultural matters, as well as the training of IT personnel, and the usage of closed software are also major factors that negatively affect the staff attitude.

Perhaps these issues are the key reasons why 25 percent of hospital informaticians are planning to change jobs within the next five years, while 15 percent of them are planning to teach in public schools. This movement is also incited due to the retrenchment of the informatics bonus for DI staff during any furlough, except the usual one, or in case that they work in other hospital departments.

Another important point is that people who have graduated from Greek Institutes of Validation Technology (IVT) do not have the opportunity to find the jobs they are seeking in the public sector and they are not considered legal professionals, although many IVT have collaborated with major companies like Oracle, Cisco Systems and Microsoft that provided certification of knowledge on database issues.

Conclusion

The contribution of informatics in the provision of both medical information for decision-making and support to the process of knowledge-creation inside an anthropocentric hospital is undoubtedly a key asset that leads to technology transfer and improvement of Greek National Health System.

Although hospital informatics has been upgraded due to the prospective integrated information systems and project «Syzefxis» that aims to develop and update the public sector's telecom infrastructure, a lot of things have yet to be actualised. With ever increasing amounts of hospital information available it is becoming more important to be able to manage this information. The key here is to develop and maintain the role of the department of informatics to handle and properly control the vast amount of data and information.

In particular, DI has to convert to a hospital informatics service, and a pure job description for hospital informaticians must be formally defined. In addition, hospital DI should be adequately qualitatively and quantitatively staffed, while the economic motives, like a raise in Phd or MSc bonus could minimise the outsourcing.

Although the establishment of a National Chamber of Informatics could consolidate the role of informaticians, inside the less structured hospital it is first necessary to change the personnel's attitude through the acceptance of informatics achievements. This would serve to empower hospital administrations to observe the added value of informatics. The technology era we live in mandates that we should extend the current technologies with emerging ICT in the health arena, like access to heterogeneous distributed medical databases, and recognition for those who serve this arena. The Department of Informatics can and must take centre stage as the mechanism for information provision in the hospital world, only if it is administered by good managers and only if it is staffed with well-educated personnel.

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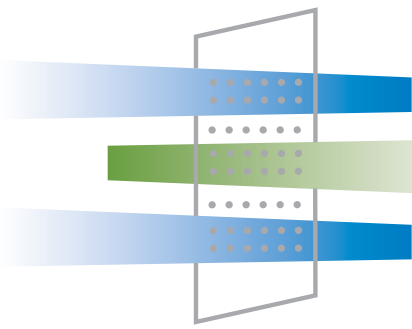


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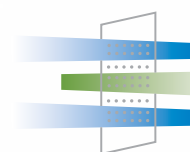
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