HEALTHCARE IT
MANAGEMENT

THE OFFICIAL JOURNAL OF THE EUROPEAN ASSOCIATION OF HEALTHCARE IT MANAGERS

Enterprise Architecture: Accepting Chaos

Robotics and Healthcare

Midwifes
and e-Health

e-Health in
Africa: Hope
or Hype

Healthcare Data
Explosion

Country Focus:
Netherlands

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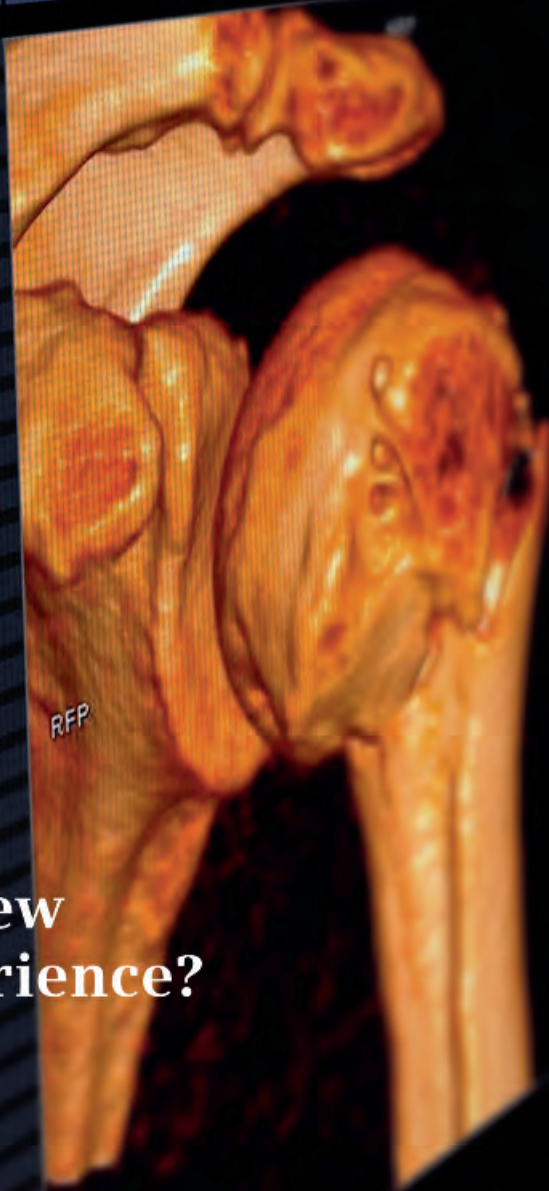
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HEALTHCARE IT
M A N A G E M E N T

Dear Reader,

Healthcare IT, like other realms of IT and 'technology' in general, is driven by a culture of non-stop innovation. This is undoubtedly good. However, we must also ask ourselves: is innovation the only solution? Such a question is urgent, given the long-running pressure on healthcare budgets, and the financial crisis, which has gripped the world for the past two years.

It is clear, healthcare IT offers tremendous opportunities to save money as long as it is deployed correctly. Unfortunately this has been neglected by policy makers, healthcare IT users and even its vendors and developers. In this issue of Healthcare IT Management, we come across a variety of examples.

Our Cover Story on Enterprise Architecture makes a case to strengthen the role of 'common sense' in the healthcare IT development environment. We must accept two factors: a) healthcare IT follows the same lifecycle as other IT areas (from invention and innovation to commodification)

b) choices are often made by IT enthusiasts and early adopters who are fated to overlook point a. The outcome is unfortunate. Tried-and-tested solutions like the telephone, which have successfully become commodities, are often ignored, although both their technology and business cases are strongly proven. Instead, attention is focused on new solutions whose position in the technology lifecycle is unclear, and out of synchronisationwith the rest of the IT environment. This, the author argues, results in a state of chaos.

Another example of a proven solution is the humble barcode. A feature article from the UK argues that barcodes offer a cost-effective solution to two everyday challenges faced by healthcare professionals: medication errors and quicker access to patient data. In addition, they also provide the means for higher efficiency in running a hospital, in terms of stock control and asset tracking.

Meaningful deployment of healthcare IT systems is not always an issue of the technological 'what' but also the 'where'. While complex IT applications in a hospital setting rightly demand – and get – our attention, it is also important to consider the relevance of smaller, simpler systems outside the hospital.

A feature article in Healthcare IT Management 2/2010 reviewed E-Health for nurses. They are the only healthcare professionals to interact with patients on a 24/7 basis, thus offering an opportunity for new healthcare technologies to quickly prove their relevance. In this issue, we take a look at a related domain, that of midwives, and the opportunities for E-Health in midwifery in New Zealand.

As far as the 'where' of healthcare IT deployment is concerned, some E-Health proponents believe it offers a great solution to the most pressing healthcare problems faced by the poorest of developing countries, not least in Africa. A South African Professor and authority on the subject disagrees.

Please let me invite you as well to our upcoming IT @ Networking Awards 2011 from 19 – 20 January (see pages 10 – 13). This unique competition promotes cross-departmental learning and will introduce healthcare IT solutions, which may not all be glitzy or glamorous, but do their job and do it well. May we count on your support to make this Event a success? Members of HITM are eligible to a very special rate.

Best regards,

Christian Marolt

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

HEALTHCARE IT MANAGEMENT

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ENTERPRISE ARCHITECTURE FOR HEALTHCARE

When we fail to understand the position of a technology within its lifecycle, the first casualty is commonsense. IT and healthcare IT, in particular, offer several examples of such a failure. Enterprise Architecture may provide a way forward since Enterprise Architects are, by definition and experience, the strongest advocates against hype. One of their strongest weapons is the acceptance of chaos – a state of permanently unfinished business – in the heart of all IT systems.

Page 40 – 47
COUNTRY FOCUS: NETHERLANDS

Four and a half years after implementing some of Europe's most ambitious healthcare reforms, how is the Netherlands faring? In spite of fears of a radical change in the character of the healthcare system, most Dutch are positive about reforms. And yet, some storm clouds do lie ahead – not least in terms of a looming shortage of staff.

READER'S COMMENTS

Health 2.0

Sir,

Congratulations to Benjamin Hughes for what is both an incisive and comprehensive analysis of Health 2.0 and Medicine 2.0 (Issue 2, 2010). I also think the article was balanced. Even though there are risks (e.g drug companies altering information on their products), the Internet is a foundation stone for the Open Society of the 21st century and open information can be misused, but its benefits outweigh the risks.

This is why it was bred in the United States, and why it faces the wrath of authoritarian governments from China to the Middle East.

So far, on its part, healthcare has been a closed club of cognoscenti. This is despite the fact that, for long, it has been apparent that not all doctors know about every medical matter much better than their own patients – and who many doctors have a hard time listening to. You must know what I mean. Indeed, counterbalancing the traditional Godlike authority of the doctor by patient groups sharing and learning from one another is giving them the strength to individually demand more personal medical care.

I also believe healthcare policy makers should build a structured system of feedback from Health/Medicine 2.0. Democracy in health may be one key pillar of the healthy democracy which the Internet seeks to make possible in the field of e-Government.

If I may, I would also like to propose converging Health 2.0 and Medicine 2.0 into one term: Health-e-cine 2.0.

Michael Kerry
Liverpool, UK

Of Hospitals and Wars

Sir,

In 'Capital In The City - Investing in the hospital of the future' (Issue 2, 2010), the authors miss some close similarities between the healthcare sector and the defence industry, in a variety of contexts which they covered - from spiralling costs to marketisation/privatisation and PPP models.

The hardest parallel would be the oxymoronic nature of a proven modern hospital – just like a 'proven' modern warplane, which is not just a machine – but a massive collection of systems and sub-systems working togeth-

er in life-threatening situations.

Indeed, military and healthcare technology face similar challenges – of trying to freeze-frame concepts and designs which by their very nature are prone to mission creep, to vested interests, often ill-informed or technically illiterate payers (governments) and extremely demanding consumers (pilots or patients) But, in the final count, both are must-haves.I find the best example of such observations in terms of the quote with which the article begins. Florence Nightingale did her work during one Crimean War.

Wolfgang Koch
Munich, Germany

Borders and Boundaries – Good or Bad

Sir,

I am unaware whether it was intentional on your part to include two rather oppositional articles in the same edition (Issue 2, 2010), at least from a political and philosophical viewpoint.

While Health 2.0 and Medicine 2.0 underscores the immense potential of technology in removing man-made boundaries (borders) and enhancing healthcare, the thought-provoking article by Canadian Professor Eike-Henner W. Kluge ('e-Health: The dangers of the technological imperative') dwells at the end on the need for borders – in terms of the implications of outsourcing private medical data to places like India.

On the other hand, the US for instance, has nearly one of five surgeons from India, so is it a question of geography alone ? I am speaking now of medical tourism.

Would an American patient be happier having surgery done in Chicago by an Indian surgeon, or by an American in Chennai ? I know top Indian hospitals are hiring Americans (Indian-Americans) and that some of them have better outcomes than the US.

Then there is the issue of costs, especially for the uninsured or not fully insured, and of waiting lists. There was a BBC story sometime ago of a 70-plus year old Briton who was told he would have to wait some 6 years for a knee or hip replacement and got it done in India in a month or so.

Such questions will become even more problematic when robots begin to do more surgery. Do I trust an Indian more than my American robot. And can I be sure that my robot is not manufactured in China - does it matter if it is ? And what if the software is designed in India.

This is not just imaginary. America (and probably the world's) top robotics school, Carnegie-Mellon University, has its healthcare robotics program designed in India. Its Website says so.

Jeremy Hale
New York, USA

*We invite comments from readers at **editor@hitm.eu**. Please keep your letters to below 150 words. Healthcare IT Management reserves the right to edit letters for space or editorial reasons.*

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
- To promote the efficient, cost effective use of IT

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

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Administração Central do Sistema de Saúd (ACSS)

EHTO-European Health Telematics Observatory (EHTO)

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Romanian Society of Medical Informatics (RSMI)

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JISA - Union of ICT Societies of Serbia (JISA)

SLOVENIA
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Slovenian MedicalInformatics Association (SIMIA)

TURKEY
Turkish Medical Informatics Association

UKRAINE
The Ukrainian Association for Computer Medicine

Association for Ukrainian Telemedicine and e-Health Development (AfUTeHD)

INDUSTRY NEWS

CARESTREAM

UNIVERSITY MEDICAL CENTRE GRONINGEN (UMCG) PURCHASES LATEST RIS FROM CARESTREAM HEALTH

Following a recent European tender process, Carestream Health has been awarded the contract to supply a new Radiology Information System (RIS) for eight departments at the University Medical Centre, Groningen (UMCG), the Netherlands. Installation is scheduled for December 2010 and the CARESTREAM RIS will interface with an existing Rogan PACS.

UMCG is one of the largest hospitals in the world, offering regional tertiary care to the northern part of The Netherlands. The Radiology Department undertakes approximately 180,000 exams annually, equating to around 500 patients per working day.

This latest installation will mean that Carestream Health is present in all the hospitals within the Provence of Groningen. Stichting Samenwerkende Ziekenhuizen (SSZOG) signed a seven-year RIS/PACS eHealth Managed Services (eMS) with Carestream Health in March 2010 and Martini Hospital currently has a four-year RIS/PACS agreement with the Company.

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

CSC

ZEALAND REGION IN DENMARK FIRST TO ADOPT CSC SPEECH RECOGNITION SOLUTION

CSC (NYSE: CSC) announced that the Zealand Region in Denmark has become the first health authority in the country to implement CSC's OPUS Speech Recognition solution. This solution will enable healthcare professionals working within the region's ten hospitals to transition from dictating notes on tape for transcription, to a system that automatically transcribes the notes directly into a patient's electronic medical record (EMR).

This real-time method of updating patient EMR's improves treatment and care by ensuring clinical decisions are always based on electronic records that are as accurate and up-to-date as possible. It also relieves busy hospitals of the time-consuming alternative of manual transcription and the risk of inaccuracies.

The integration between OPUS and the speech recognition software is based on the component SpeechEditor from the Danish subcontractor, Max Manus - the Scandinavian partner of the American speech recognition specialists Nuance.

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

DYNAMIC CONTROL

WHEELCHAIR USERS CONTROL AN IPHONE OR IPOD TOUCH VIA THEIR WHEELCHAIR JOYSTICK

A pioneering solution that gives wheelchair users the ability to control an iPhone or iPod touch via their wheelchair joystick will be unveiled for the first time at this year's Rehacare exhibition.

The next generation of the iPortal is Dynamic Control's latest solution to help enhance the quality of life of people living with a disability; allowing people with limited hand access to surf the internet, make phone calls, have access to friends and also use the speech assistance functions.

To control an iPhone through the DX2 REM 550 remote represents a quantum leap in functionality for wheelchair users.

iPortal was launched in July this year and displays wheelchair information in real time, alerting the user to things such as the speed range indicator, compass heading, a seat adjustment indicator and the battery state. There's also a diagnostics feature that interprets any problems with the wheelchair and enables clear communication with support services.

For more information, please visit:
http://www.dynamiccontrols.com/iportal/

iSOFT

ISOFT DEVELOPMENTS TO HELP RE-SHAPE PRIMARY CARE IN WALES

iSOFT Group Limited (ASX: ISF) has been awarded a contract to work with NHS Wales to roll out the Individual Health Record (IHR) nation-wide. The IHR will make patient information held in iSOFT's GP systems available to local out-of-hours services and in other unscheduled care settings via the Welsh Clinical Portal. Initially, the company will interface its GP systems to the Adastra out-of-hours system, via an iSOFT health record solution specifically customised for Wales.

The solution combines extensions to iSOFT's primary care practice systems together with iSOFT's integration technology and electronic health record functionality, which provides the central IHR repository and viewing tool for patient records fed from the GP systems. iSOFT is implementing data streaming to transfer data from the practice systems to the repository. The streamed data conforms to the nationally agreed Welsh NHS content and data model standards, which support practice and patient opt in and out preferences, and the exclusion of sensitive patient information.

For more information, please visit:
www.isofthealth.com
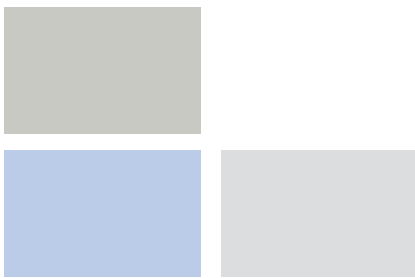
Patient Infotainment Terminals
Serving both the patient and the healthcare professional

The Patient Infotainment Terminal (PIT) by Advantech has improved the hospital experience, serving not only the patients through bedside entertainment and communication but also the medical staff through providing the tools to improve quality-of-care.

1 What does the PIT offer the patient?

The all-in-one technology enhances the hospital experience for patients. The interactive terminals include all the entertainment and communication tools right at the bedside. Patients can do anything from watching TV or playing a game to communicating with friends through a phone or instant messaging. Internet access supplies the patient with information on their condition or their caregivers and healthcare facility. With this added knowledge and amenities similar to the comforts and conveniences of home, Advantech PITs provide an overall better hospital stay for the patient.

2 How has the PIT benefitted hospital managers and staff?

Hospital managers and staff see more ease in workflow due to secure access to electronic patient records and databases at the bedside. Both patients and healthcare professionals benefit from the bedside images and information aiding diagnosis. Nurses save time as patients are able to more easily communicate their needs. With more options than just a call-button, improved communication allows nurses to more efficiently use their time, saving the hospital money. These improvements in operational efficiencies in turn

improve the overall quality-of-care in any healthcare facility.

3 Will the PITs advance with changing technology?

Today's PITs are enabled to adapt with the continually changing demands of healthcare. Clean and green: the PITs match the trend toward paperless hospitals while meeting the sanitation requirements through their easy-to-clean design, as well as other meeting other regulations.
The PITs fit within any healthcare facility as Advantech works with IT partners, to ensure compatibility often customising orders to meet the requests of hospitals. Advantech's partnership with Intel guarantees that the latest processing technology will be found in their PITs.

4 What is the added value with Advantech PITs?

The collaborations with IT companies add experience to R&D, ensuring the next generation of Advantech PITs meet the future demands of healthcare facilities. Advantech invest in their products from start to finish. They take part in each step of the product lifecycle: R&D, production, as well as providing continued service after product placement. This overall knowledge of the product and the needs of the healthcare industry allow for Advantech

to make continual improvement. As the technology changes, Advantech PITs adapt as well, with each generation being compatible enabling easy transition with further rollouts in facilities. This continual dedication ensures that the next generation will meet the demands of tomorrow while still being compatible with the technology of today.

The PIT-1702 terminal with the 17-inch Touchscreen and the 16:9 widescreen version, the PIT-1502W, will be both be on display at the Advantech Booth G12 in Hall 15 at Medica, taking place 17 – 20 November in Dusseldorf, Germany

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PORTUGAL

ACCESS TO HEALTH INFORMATION AND CARE EXPANDED BY PORTUGUESE HEALTH HELPLINE

Saúde 24 (S24), a telephone based service offering clinical assessment, health advice and health information in Portugal, has gained the trust of the Portuguese people by significantly improving direct access to heathcare advice, and is planning further expansion.

The national helpline directs callers to the most appropriate level of care and aims to ease pressure on more traditional branches of the healthcare service. It also enables the Portuguese Public Health System to allocate its resources more efficiently, ensuring the right level of care meets the right people, whilst the patients benefit from quick reassurance of their condition and advice on the best course of action to take. The top five most common ailments or symptoms registered by S24 are abdominal pain, nausea, coughing, a headache or a sore throat, with self care being the most frequent outcomes for a patient caller.

Launched in April 2007, the service has progressively gained widespread awareness and recognition (independent research reported 94 per cent of awareness in June 2010) and now handles an average of almost 1,800 calls per day, with a reported 100 per cent user satisfaction in August 2010.

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

THE NETHERLANDS / UK

A group of top Dutch health professionals came to look at a Merseyside hospital's innovative IT solutions this week as part of an annual initiative to visit areas of health care excellence in Europe.

The group of 23 experts, drawn from hospitals across the Netherlands, visited Aintree University Hospitals NHS Foundation Trust to look at its new electronic patient records system in action at the University Hospital site.

The visitors, all members of the Dutch Association for Medical Records Administration (NVMA), also found out about how the Trust is the using the latest technologies, including touch screens and whiteboards, patient kiosks, automated SMS texting, clinical dashboards and advanced clinical systems.

"This was an enjoyable visit to an impressive hospital", said Wybe Dekker, a leading health information manager from NVMA. "The IT systems are clearly welded into the delivery of patient care at every level".
Bob Smith, a medical manager from NVMA, added: "We were told about how staff were using technology to help patients; by reducing the amount of time patients had to

spend in hospital and helping to improve the quality of the service they received. Our visit today has definitely given us plenty of useful ideas to take back to Holland and use in our own medical practices".

Mr Priestman, Aintree's director of informatics, added: "We have always been proud of the innovative culture here at Aintree. We are now seeing levels of Information Technology excellence that is world class, and enabling us to treat our patients in a safer and more timely manner".

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

GERMANY

SCIENTISTS FIND BRAIN WAVES CAN PREDICT EPILEPTIC SEIZURES

Scientists from the Bernstein Center at the University in Freiburg in Germany have taken a step forward in the quest to predict epileptic seizures by monitoring the pre-seizure changes in sufferers' brains. The research study was funded in part by the EPILEPSIAE (Evolving platform for improving living expectation of patients suffering from Ictal events) project, which received nearly three million euro under the 'Information and communication technologies' (ICT) theme of the EU's Seventh Framework Programme (FP7). The research was recently published in the journal Epilepsia.

Epilepsy is one of the most common serious brain disorders that affects about one percent of the world population. In Europe, nearly six million people suffer from this disorder and 15 million are expected to be diagnosed with epilepsy at some point in their lives.

Professor Jens Timmer, a physicist at the Freiburg Institute for Advanced Studies (FRIAS), explained that "in recent years, several methods have been developed to calculate predictive features from the electroencephalogram, which measures brain waves". However, for individual prediction methods no satisfactory performances had been observed before this study.

The study was based on electroencephalogram (EEG) results measured directly at the cortex from eight patients. The scientists found that on average for all patients, a combination of methods yielded an increase in prediction performance by more than 50 percent.

"In our study, about every second seizure could be predicted correctly," Hinnerk Feldwisch-Drentrup from the Bernstein Center said, admitting however that the results from this study alone were not enough for the technique to be applied in real situations.

For further information, please visit:
www.epilepsiae.eu

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IT @ NETWORKING AWARDS 2011

25 projects from across Europe and beyond will compete in the IT @ Networking Awards 2011 on January 19 – 20 2011. This high-level competition will see candidates go through two rounds of presentations in an effort to persuade the expert audience and panel of judges why their solution deserves to win. If last year is anything to go by, attendees will not hold back in cross-examination of each presenter during the Q&A sessions before placing their vote for their favourite solutions.

Once again, the depth and breadth of candidate submissions for the awards convincingly demonstrate that European healthcare IT is second to none in its innovative capabilities. Nor do its researchers lack the zeal and drive to deliver solutions that address the ever-growing, real-world challenges of spiralling healthcare costs and an aging population in Europe. What is required is the will to get such a message known, in Europe's healthcare IT community – and beyond. This is indeed one of the over-arching goals of IT @ 2011. This article introduces you to each competitor in the running for the award.

EUROPEAN UNION

OLDES - An Affordable and Customisable Telecardiology System
Marco Carulli

An ageing population is considered to be one of the biggest challenges facing healthcare financing and delivery in Europe. E-Health has long been seen as offering at least some solutions. But not all old people are the same. Neither are the diseases. Nor are the clinical conditions of each specific disease. The challenge is to fine-tune e-Health offerings, and do this cost-effectively. The EU-funded "Older People's e-Services at Home" (OLDES) project has been deployed in the Czech Republic and Italy.

EUREQUO: Web based Disease Registry for Quality Outcomes in Ophthalmic Surgery in Europe
Rainer Waedlich

Cataracts and refractive surgery are not only the most frequent interventions in the world, but also have a perceptibly high impact on the patients' quality of life. EUREQUO seeks continuous improvement in treatment, via interconnection of 18 European registries reporting clinical outcomes in standardised templates. This, in turn, permits exchange of best practices between practitioners on the basis of local, regional or pan-European comparisons. The next step is the development of evidence-based European Quality Guidelines. The project also promises replicability for other practices.

AUSTRIA

HIS/CIS for process optimization
Franz-Georg Pichler

Process optimisation (and the accompanying cost-saving) is the Holy Grail of IT. Given the huge challenges accompanying legacy systems, new hospitals remain the ideal test bed for optimised applications in areas such as patient appointments, bed-planning, surgery-scheduling and documentation, automated ordering across the supply-chain, as well as outpatient follow-up. Klagenfurt, Carinthia's largest hospital, used a new (700-bed) facility to upfront design, adapt and interface its medical, nursing and supply processes in order to optimise patient treatment and costs. Its experience may hold lessons for the spate of other new hospitals being planned in Europe and beyond.

BELGIUM

Clinical Workstation (CWS), the GPS of every medical user
Prof. Rudi Van de Velde

Based on a component-based, multi tier J2EE architecture, UZ Brussels, a teaching hospital has developed a Clinical Workstation. The key innovation is an application server, which provides depth embedding of the complex business logic of a medical environment at the back-end. This provides smart/holistic insights to users of all patient and hospital-related information and processes. The architecture allows evolution and is thus future proofed. One major challenge was to also simplify the user experience, to minimize training and manage change more efficiently. In spite of a massive increase in data, as many as 95 percent of physicians are satisfied with the system.

BULGARIA

Integrated automated system for remote diagnosis of patients
Dr. Kiril Karamfiloff

This project, at the "St. Ekaterina" University Hospital of Sofia, aims at automated remote diagnostics of cardiovascular patients, with critical, decision-support information transferred in the shortest period after an event. As ambulance crews know, a response within the first so-called 'Golden' hour of a cardiac event usually makes all the difference. The GPRS-based system transfers key data (ECG, heart rate, Sp02 and blood pressure) in real-time from a patient's home or another non-medical facility during transport by ambulance, while storing the information at the hospital (as well as relayed data on any actions taken by the ambulance/emergency teams).

GERMANY

From 'Micro-' Towards 'Macro-' Mobility – building efficient clinical processes by using a hospital-wide, standardised and 'near-' patient communication platform
Dr. Carl Dujat

Current HIS systems face a lack of functionality in integrating patient and clinical data, documents and reports, which are stored in special, often-proprietary clinical applications. Such a problem, in fact, underlines the challenges of setting up an Electronic Patient Record, to give an 'over-all patient-centric view' of all relevant clinical data within the HIS. This project took a best-practices approach to several overlapping issues – namely migration and consolidation of proprietary clinical data collections, the design and implementation of a hospital-wide Master Patient Index (MPI), the development of a standardised/IHE-based patient and clinical data repository and the use of unified object identifications (OIDs) for all patient and clinical data objects. Its goal is to simplify systems complexity, enhance standardisation without compromising flexibility and reduce vendor lock.

Managed Care with Telehealth – the chance for new Service Offerings by the Hospital
Rainer Beckers

Europe has vast but populated rural tracts, with a shortage of physicians and healthcare facilities. This project, which combines two not-always associated topics (managed care and telehealth) uses an interactive Telemonitoring Platform for managing chronic patients. Key components include a Personal Health System, with sensors (weight, pulse, blood pressure, glucose levels) transmitting data to remote healthcare facilities in real-time over a secure video-conferencing link. Other than providing adequate ambulatory care in under-serviced regions and improving the quality of life of chronic patients, its benefits also include a reduction in physician/hospital visits – thus reducing transport costs and waiting times as well as re-admissions due to a lapse in the care delivery continuum.

IT Meets Medical Engineering – process optimization in medical documentation
Dr. Andreas Bess

This project aims to optimise both IT and medical engineering and achieve cost savings. It has selected two specialist hospital test sites. In the first, current treatment processes are first analysed - without medical devices. This is followed by integration of the latter and a re-evaluation of the treatment processes. A comparison is then made to evaluate their pluses and minuses, both with and without device connections. In the second test site, treatment processes are analysed without electronic requirements management. This is followed by a prescriptive establishment of the parameters of electronic requirements management – from both an organisational and technical perspective, as well as their implementation and comparative evaluation.

INDIA

Healthcare for the Rural Poor - WHP's Initiative
Prachi Shukla

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.

ITALY

Open Source Clinical Portal to Integrate Care Processes and Research
Nicola Restifo

This project draws on experience with an open-source/open architecture Clinical Portal for HIS access and seeks to become a reference case of software reuse inside the Italian healthcare environment. The Portal covers most features of an EHR. Alongside compliance with syntactic and semantic standards, parameterisation of new vocabularies and system modularisation, it allows networking of diagnostic subsystems and digitalizing of information streams between clinical processes. The unifying of clinical and administrative patient data, in turn, enables physician decision support.

Telecounselling Service for Ischemic Stroke Management
Claudio Saccavini

Ischemic stroke is a major cause of death and disability. Intervention via thrombolysis can only be done in a well-organised hospital, due to a high risk of haemorrhage. This teleconsultation project is based on a proven interoperability infrastructure and IHE Integration profiles, as well as consolidated clinical evaluation tools such as as the SITS-MOST protocol and NIH Stroke Scale. It enables sharing of documents and CT images and secure videoconferencing. It aims at a five-fold increase in the number of thrombolysis treatments, within three hours of the start of symptoms.

Controlling Memory Impairment in Elderly Adults Using Virtual Reality Memory Training
Dr. Gabriele Optale

Memory decline is considered to be a common age-related phenomenon but may also be the first sign of cognitive pathology. Virtual Reality (VR) finds ever-growing and more useful applications in the fields of therapy and rehabilitation. This project successfully exploited VR technology (using immersion and active interaction) in a cognitive rehabilitation memory training programme in elderly adults.

Ict System to Support Healthcare Logistics in Friuli Venezia Giulia Region
Paolo Forza

This project creates an end-to-end logistics platform for managing the pharmaceutical and medical devices supply chain in Friuli Venezia Giulia Region. The project has proceeded in two phases: firstly, to integrate warehouse and stock management, along with the procurement and delivery of the goods to local health authorities using a standardised format; secondly, to monitor and regulate all aspects after the arrival of a product (traceability from warehouse to the final patient, verification of patient-to-drug association, stock control in hospital wards etc).

NORWAY

Inventing Digital Hospital Infrastructure at St Olavs Hospital
Arve-Olav Solumsmo

The new 800-bed St Olavs Hospital has entailed a wholly new ICT infrastructure (5000 PCs, 5500 IP phones, 150 servers and 1100 wireless access points), utilizing a single converged IP network with over 100 completely separate VLANs, each with its own service level and rules for authorisation and access. The mantra of IP overall/all-over IP has involved integration of several disparate networks (data, paging, television, telephony, video, mobile, and clinical systems such as PACS and nurse calls) to one IP multiprotocol label switching (MPLS) medical-grade network with a reliability requirement of 99.999 percent. A digital EHR system is now in place, with speech recognition, alongside a hospital-wide drug dispensing system using automated pill pick machines.

Speech Recognition at St. Olavs Hospital
Arve-Olav Solumsmo

In the deployment of Speech Recognition at St. Olavs University Hospital in Trondheim Norway, 550 doctors went from training to full use in 15 weeks. 62 medical typists were made redundant and the typing pool was reorganised and moved. All doctors' notes are now expected to be made using speech recognition. The project reduced the typing pool by 70 percent, makes nearly 20000 notes per month available as text earlier than before (68percent of doctors have noticed this improvement), has stabilized the output of discharge notes around 65 percent within one week (stabilized but not increased), while the text of notes has become shorter and more factual (doctors are divided over whether this is positive or not).

POLAND

3-Dimensional Telediagnostic System for Postural Deformities Detection and Monitoring
Dr. Wojciech Michal Glinkowski

Detecting postural deformities usually requires on-site subjective examination. This project focuses on telediagnostic analysis of a patient's trunk surface for detecting and monitoring de-

formities, based on structured light which measures the body in 3D via projection of a set of raster images on its surface. One unique feature is the system's ability to operate remotely, carrying out interpretation by telemedicine, and utilizing a data warehouse. The system comprises independent modules which deal with measurement, data archiving and analysis, communicating over TCP/IP (with two channels, respectively for text and images). Telerehabilitation videoconferencing services are delivered for patients located in distant schools, outpatients clinics or homes where physiotherapy programs are unavailable.

RUSSIA

Modern Technology for Distance Interactive Tele-education: Our 12-Year Experience
Valery Stolyar

Real, cost effective technology for distance interactive tele-education. For the past 12-years, physicians in Russia, UK, USA, Germany and France have utilised this video-conferencing technology for lectures, training courses, tele-symposiums, as well as real-time transmissions of operations and investigations– in paediatric cardiology, endovascular and cardiac surgery (point-to-point and multipoint videoconference). Every week specialists of Bakoulev Centre of Cardiovascular Surgery conduct regular training for doctors from the Russian regions, including interactive real-time transmissions of cardiac and endovascular operations (>4200 hours per year).

SPAIN

Web 2.0 to Share Medical Knowledge and Improve Care: The Scientific Social Network of Madrid Health Region
Manuel Vallina

Madrid Health Region has launched a Social Network to allow physicians to share clinical and scientific knowledge, including medical images, videos and cases.The project aims to validate Web 2.0 tools for clinical collaboration and improve clinical outcomes via better communication among clinicians.

Medical Image Repository for physicians and citizens
Carles Rubies

The development of a Medical Image Central Repository (MICR) is one of the fundamental pillars of the ICT strategy of the Catalan Ministry of Health. The MICR already integrates radiological images and is being extended to imaging from other specialties. Its design and technical qualities are state-of-the-art, allowing healthcare professionals to access images through the Catalan Shared Medical Record (HC3), with a unique patient identification (as required by law). Furthermore, it offers similar access to all Catalonian citizens through their Personal Health Record.

Catalan Health Personal Folder
Submitted by Joan Guanyabens i Calvet, Catalan Agency for Health Technology Assessment, Spain

The Government of Catalonia has introduced the Personal Health Folder (PHF) in order to offer its' citizens access to personal health information, through a virtual secure portal on the Internet. The PHF is currently being used and provides citizens with access to information on active prescribed medication and vaccines, medical reports and results of tests and examinations, as well as various e-services, such as conducting online transactions through the Virtual Office, communicating with health professionals and participating in social networks.

SWEDEN

System Feedback: If You Do Not Learn from Your Mistakes, You Are Doomed to Repeat Them (Santa Yana, 1863-1952)
Dr. Nina Margareta Lundberg

Medicine lags behind safety cultures in other walks of life, e.g. aviation, in applying a systems approach to error. An ICT technology, System Feedback, has been developed and used since 2002 for automatic radiological discrepancy detection, independent of local RIS- and PACS vendors, and providing feedback within and between sites. In turn, the project has led to new ideas from clinicians about functionalities needed to support daily learning and teamwork. In spite of challenges (such as the subjective nature of feedback and the design of a diagnostic error scale), these have been implemented in an iterative process over time, resulting in both continuous learning and knowledge sharing, as well as greater patient safety.

Infobroker – an ICT Healthcare Solution: Reflections and lessons based on a four years experience, building an Enterprise Infrastructure for image and text information
Dr. Nina Margareta Lundberg

The Västra Götaland (VGR) region of Sweden has data shared by 29 X-ray departments, 170 dental clinics, two clinical physiology departments and four cardiology departments through the Infobroker solution – Sweden's (and possibly the world's) first enterprise data storage centralizing patient information regardless of different sites' local EPR, PACS and RIS systems. Text from EPR systems are stored as DICOM-Structured Reports objects, together with the images. Interoperability is based on IHE. Infobroker has improved treatment and diagnostic quality, clinical quality, provided better load balancing of clinical and diagnostic resources, and enabled team working across traditional departmental boundaries.

UKRAINE

Tele-ECG for the Newborns
Dr. Anton V. Vladzymyrskyy

Cardiac pathology of infants is a major challenge. A new mobile, wireless digital tele-ECG system has been developed and implemented in Ukraine. The system consists of an ECG device with embedded telemedicine module (block for ECG transmission, in-built SIM-card, block for audio contacts, headphones with microhone) and call-center (PC with GSM-modem and spe-

cial software which additionally allows to perform ECG analysis and automatic interpretation). In 2009, a wireless tele-ECG system was implemented in the neonatology unit of a Donetsk hospital. The project team assesses this as the world's first wireless tele-ECG for intensive care in neonatology, with significant benefits, including a high level of diagnostic accuracy and a positive influence on clinical strategy and outcomes.

UNITED KINGDOM

McKesson – Electronic Staff Record (ESR)
Clare Granville

In April 2008, McKesson successfully completed the implementation of the NHS Electronic Staff Record (ESR) – the world's largest single integrated HR and Payroll system. Based on Oracle HRMS, ESR replaced the NHS's 67 different systems with a single, national solution to modernise HR processes, improve administrative efficiency, provide accurate strategic information, and empower every member of staff. The challenges of rolling out ESR to 586 organisations and 1.4 million users made this one of the most ambitious and complex IT projects ever tackled.

Telehealth in Hull: Saving Lives, Improving Care
Paul Atkin

Telemonitoring equipment, installed in the homes of heart failure patients, allows patients to record pulse, blood pressure and weight – in addition to any symptoms – on a daily basis. Data are transmitted to a server, and viewed by a telehealth nurse. The system alerts the nurse to any substantial changes in the patient's condition, who then contacts the patient directly or arranges intervention by the community health team. Over 200 patients have benefited from this service since 2008, and evaluation of the service – one of the first of its kind – suggests that a large number of hospital admissions have been averted.

Increasing Clinician Productivity and Quality of Care with Mobile Clinical Computing
Maria Burpee

This Mobile Clinical Computing (MCC) Solution running in the University Hospitals Birmingham (UHB) NHS Foundation Trust is designed to increase clinician satisfaction and productivity and at the same time increases patient safety and quality of care. Through unique features like single-sign on and session transfer, clinicians have been able to save time. Doctors and nurses are now able to move around the hospital and log-in at any device with their applications following them. The MCC solution was integrated using a structured methodology, to plan, manage, monitor and analyze the results.

There is still time to participate. Register today to have your say on who will win the coveted IT @ Networking Awards 2011.

RESULTS OF THE MONITORING
NATIONAL eHEALTH STRATEGIES STUDY

"Europe is leading the rest of the world in advancing towards modern eHealth infrastructures and implementations" was the conclusion of Dr. Karl Stroetmann of empirica Consultants at an eHealth Strategies Symposium in Brussels.

This is a field where Europe has achieved and even overachieved its Lisbon Strategy goals. Results of the Monitoring National eHealth Strategies study (www.ehealth-strategies.eu) presented on Sept. 16, 2010 in Brussels, show that virtually all Member States of the European Union have either already begun or will begin shortly to undertake the implementation of national systems making basic patient data available to all healthcare professionals whenever and wherever needed.

While patient summary and Electronic Health Record (EHR)-like systems have already been high on the agenda for some time, most Member States (+16) now realise that there is an urgent need for (continuous) evaluation activities, both to better control policy progress and learn from challenges and experiences.

Ilias Iakovidis, Deputy Head of the ICT-for-Health Unit of the European Commission, which ordered this survey, noted "Services high on the agenda are the electronic transfer of prescriptions and the provision of telehealth services for doctors and patients in remote regions or for chronically ill patients at home. These are among the key activities identified in our 2004 eHealth Action Plan. We are happy to see that the development of this Lead Market Initiative, which we have supported for many years, is gaining such momentum."

Another indication of the strong political commitment at the national policy level is the growing establishment of permanent administrative support structures. National competence centres like Gematik, Germany's Society for Telematic Applications of the Health Card in Berlin; ASIP, France's Agence pour les Systèmes d' Information de santé Partagés in Paris; and THL, Finland's National Institute for Health and Welfare in Helsinki are increasingly used models of organisation.

More than 100 high level political representatives from European Ministries of Health, representatives of stakeholder associations and European policy institutions attended the workshop which showcased several good practice cases of Member States eHealth strategies and highlighted the overall trends across Europe with regards to eHealth initiatives and implementation. Compared to four years ago, when Member States had published only high level official policy documents or roadmaps, now almost all EU and EEA Member States have detailed documents outlining concrete eHealth goals, implementation measures and past achievements.

The results of the Monitoring National eHealth Strategies study reveal that reaching agreements with regards to eHealth strategies and, to a greater extent, implementation of these strategies across Europe have proven to be much more complex and time-consuming than initially anticipated. In addition, the complexity of eHealth as a management challenge has been vastly underestimated. It is evident that further exchanges of information on national and regional experiences are needed; both in relation to successes and failures, and that these lessons learned may prove particularly beneficial to eHealth in Europe as a whole.

Many challenges remain and there are many obstacles yet to be overcome: Issues of legality, semantic interoperability, standardisation and electronic identification domains must be resolved before these services can be regarded as truly Europe-wide and accessible to every citizen. Luc Nicolas from the Belgian Federal Public Health Services underlined that all Member States therefore "Strongly support the recently established eHealth Governance Initiative of European countries intended to tackle these and other issues at the highest political level."

For more information, please visit:
www.ehealth-strategies.eu,

EUROPEAN PHARMACISTS AND PATIENTS
CALL FOR BETTER COLLABORATION ON ADVERSE DRUG REACTIONS

Pharmacists and patients welcomed the new proposal for a directive on Pharmacovigilance at an event held on Wednesday 15 September 2010 at the European Parliament as an opportunity for pharmacists and patients to work more effectively together to improve medication safety.

The new directive was adopted by the European Parliament on 21 September and is expected to enter into force by the end of 2010 or in early 2011.

At the meeting, organised jointly by the Pharmaceutical Group of the EU (PGEU) and the European Patients' Forum (EPF) and sponsored by the Pharmacovigilance Rapporteur, Mrs Linda McAvan MEP, an audience of interested stakeholders heard the views of pharmacists' and patients' representatives, regulators (including the European Medicines Agency and the MHRA1), academics (the Netherlands Pharmacovigilance Centre Lareb), the European Commission and the pharmaceutical industry.

All speakers welcomed the new directive as a major step forward towards achieving a better balance between benefits and risks of medicines. In particular, speakers stressed the impor-

tance of effective reporting of adverse drug reactions. The new directive proposes a stronger reporting framework for pharmacists and health professionals, and introduces direct reporting by patients. The data gathered from such reports will be used to monitor risks posed by medicines once they have been approved and become available to patients.

PGEU President Mr Filip Babylon said "I believe the new Directive is a significant step in creating a basis for effective collaboration between pharmacists and patients in the area of medication safety." EPF President Mr Anders Olauson said "We welcome the proposals regarding direct patient reporting and giving patients wider access to safety data, as this contributes to patients' empowerment and greater patient safety. These efforts should be seen as integral to the wider EU debate on patient empowerment and health literacy, with the aim of enhancing the safety and quality of care for all patients across the European Union."

For more information, please visit:
www.eu-patient.eu

EUROPEAN COMMISSION'S HEIDI
STILL WORK IN PROGRESS

Heidi (Health in Europe: Information and Data Interface) is a new website and comprehensive search tool for European health information and data. Launched by the European Commission, DG Health and Consumers on October 6th 2010, it contains information about the public's state of health, determinants, diseases, health systems, trends, institutional and policy aspects.

The site is maintained by the European Commission but the information is up-dated by European health experts. The two-way tool allows approved experts, health authorities and various health institutions from within the EU to constantly update and adjust its content with relevant information. It will target policy makers, health professionals, academics and nongovernmental organisations, however anyone online will have access.

Heidi aims to provide comparable information at EU level. However, it is important to know that there are limitations for making such comparisons. Ideally, for health-related information to be useful at European level, it should be collected on a harmonised basis covering all Member States. But due to cultural, technical, political and social factors, definitions and measurement of key indicators and data coverage vary across countries. Although

cross-country comparisons should be interpreted with some caution, information which is more geographically limited or less harmonised can nevertheless still be useful.

The initial content in Heidi was based on the Eugloreh report – "The Report on the Status of Health in the European Union" - a project which was supported by the EU Public Health Programme. The Eugloreh benefited from the collaboration of health authorities or institutions from all EU Member States, Croatia, Turkey, Iceland and Norway, and of major intergovernmental, international and European organisations and agencies. Moreover, more than 170 European experts provided their knowledge and analysis for the report. The three year Eugloreh project was co-financed in 2005 by the Commission, DG Health and Consumers under the Public Health Programme 2003-2008.

Although the technical system is ready, Heidi is still being developed as the content still needs to be refined and made more user-friendly. The full version of the site is expected next year.

For more information, please visit:
 https://webgate.ec.europa.eu/sanco/heidi/index.php/Main_Page

cover story

'ENTERPRISE' ARCHITECTURE FOR HEALTHCARE

AUTHOR

Jim Quiggle
Chief Architect
and Founder, Altra
Concepts Corp.

The emergence of Enterprise Architecture may be a refreshing twist to the standard hype cycles because the Enterprise Architect will be the strongest advocate against hype, product or approach.

What is Enterprise Architecture?

Describing Enterprise Architecture (EA) is difficult outside the context of techno-architectural approaches and mindsets. A recent discussion thread in an Enterprise Architecture Group challenged members to describe EA in 160 words or less. The result, to date, is 1,275 responses ranging from "EA is about knowing where we are, what we have and where we want to be to ensure we build systems and processes which create value and do not paint us into a corner" to "EA is optimal enterprise business process, information and technology asset management tuned to meet customer and shareholder needs in relevant time frames".

Though information technology is following a similar lifecycle as other technologies – invention and then innovation until a consumer commodity is created – this reality is often overlooked, resulting in the seemingly chaotic application of IT within organisations.

Lifecycles and Commonsense

When we fail to understand the position of a technology within its lifecycle, the first victim is commonsense. One example of an IT invention/innovation being deployed as a consumer commodity is in Riverside California. Riverside Community Hospital's new 'ER Wait Time Text Messaging' program urges users to simply text 'ER' to 23000 on a cell phone to display average ER wait time.

Does this IT solution seem to be missing the critical design element, commonsense? If text messaging technology had run its course and become a consumer commodity, hospital decision makers would have interjected their own commonsense, resulting in a different solution, as opposed to being lead by IT enthusiasts and early adopters within the organisation.

At the other end of the scale are technical solutions that get missed because they are tried and true technology commodities. Eric Dishman points out this concept in his recent TED Talk: Take health care off the mainframe (www.ted.com-/talks/eric_dishman_take_health_care_off_the_mainframe.html). His example illustrates how a commodity technology – the telephone – is overlooked. He proposes that simple recording and analysis of the verbal response of a patient allows for passively benchmarking and gauging a patient's awareness over time.

Why has not this common sense technology solution been proposed as opposed to spending resources on a cutting edge technology, such as text messaging, in a questionable manner?

One possibility is that technology solutions, and in particular, healthcare IT solutions, are commonly presented by technologists: the very same people on the edge of invention and innovation, and thus disinterested in non-technical or commodity technology solutions.

Architectural Styles

An understanding of where an IT solution is in its lifecycle and the approach and mindsets of people advocating the technologies is critical in selecting and implementing 'right' or 'best fit' solutions in healthcare environments.

As illustrated in the diagram below, three types of architectural styles can be defined based on number of common criteria and resulting mindsets. Interestingly, they can also be aligned with the technology to commodity lifecycle. This is likely due to the 'what you know' syndrome or "when you know everything about a hammer, the world appears to be full of nails".

Technical Architects represent the cutting (and often bleeding) edge of information technology. They are commonly subject matter experts in a particular field such as application development or networking and as such, are strong advocates for the deployment of new vendor products within their fields of expertise. Historically, technical architects have been responsible for the selection and implementation of information technology solutions within healthcare organisations. When information technologies are at the invention or innovation stage, Technical Architects are well suited to bring them into production environments. However, the trade-off for their deep understanding often results in multiple technology silos within the organisation.

Solution Architects were the answer for silo'ed organisations. They brought a breath of knowledge related to multiple technical solutions and two primary constructs:

↘ Service Orientation provided a view into the technology silos by slicing out common components via delivered service paths. This allowed for reusable components that could be shared within the organisation. Because formerly silo'ed components were now shared, Solutions Architects had to perform cross-organisation requirement studies to successfully implement service-orientated solutions. Many saw this as the long sought after answer for 'business to IT alignment' solution. However, Solutions Architects soon discovered that it
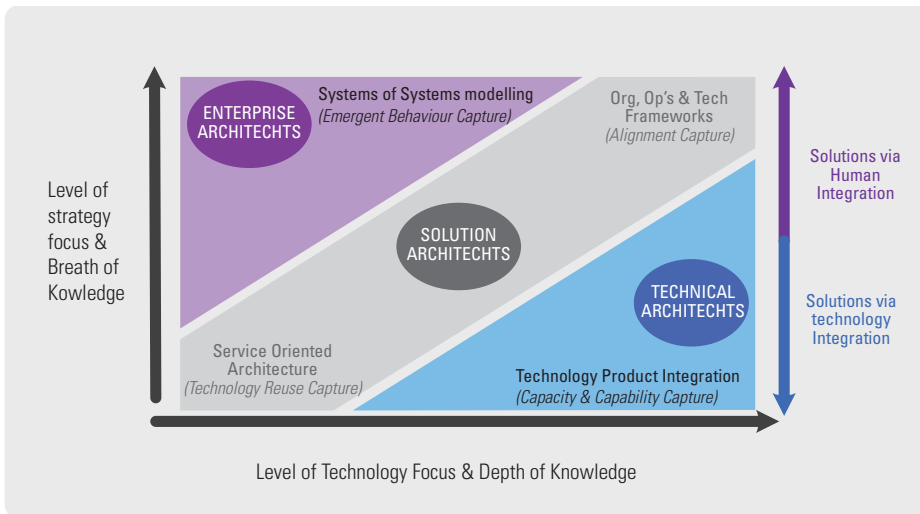
Figure 1. IT Architect Roles Design Approaches

When Frameworks Collide

Today, there seem to be frameworks to fix any kind of challenge: IT Solution Frameworks, Information and Data Management Frameworks, Business and Operational Process Frameworks. The established Frameworks are commonly related to the level of maturity and sponsorship within an organisation but have rarely, if ever, delivered.

Why did they not work? First, they were very hard to understand. A common misperception is that unless formally deployed, frameworks do not exist. However, you do not 'do ITIL' or 'install CobiT'.
Frameworks only provide a mechanism and common language for identifying existing components (Functions, Processes and Procedures). For example, every organisation does some kind of event management. It may be a highly complex monitoring system or someone yelling "it is getting hot in here". Both these examples can be left alone or optimised as needed. One might be over-engineered, another susceptible to human error. Frameworks do a great job of categorising both and presenting them back in a comprehensible manner, to wide audiences.

Where frameworks break down is in terms of what we do with the information. A common criticism regarding frameworks is, "thanks for telling me what I already knew, now what?" with the "now what" part being about the ability to apply logical selections within a complex system of systems. Using the event management example above, technically-focused decision makers would address the human error risk by selecting an automated system while business-focused decision makers may select hiring a second human monitor. While both are viable upgrades, the weighting of trade-offs between the options are nebulous, trapped within a higher level of interrelationships contained at the enterprise level.

Historically, the answer has not been to elevate the viewpoint to enterprise level but to develop specialised frameworks (such as CobiT and ITIL) to enable specific audiences to make IT technology selections.

The result has been yet another layer of silo'ing, this time via process frameworks, and with an unintended consequence: technical architects have never had it so good. Finding a technical requirement that justifies almost any new deployment can now be had from multiple locations. An ITIL Framework will support the development and implementation of complex monitoring and control systems but may not support a rapid development approach. "No problem, requirements for rapid development can be obtained from the CobiT steering committee."

was nearly impossible to collect organisational requirements without a common understanding of how the organisation operated, in other words, the Framework.

⤵ Frameworks such as ITIL and CobiT became a great complement to Service Orientation. ITIL allows for alignment from the viewpoint of the IT technologist and CobiT from the viewpoint of organisation management.

To date, few organisations have fully developed Service Oriented Architectures with viable Frameworks, largely due to a lack of acceptance. As illustrated in the diagram above, the reasons for organisational buy-in quickly become complex. Finding the sweet spot is not only tough, but even those who have found one have seen true alignment not occurring as expected.

Enterprise Architects may be the long sought after solution to alignment because they are inertly negative, having lived through just one too many hype cycles and the promises of aligned, right fit technologies and roadmaps that just did not come true. "Just implement ITIL and your Service levels will stabilise and costs will go down…" or "after we deploy an SOA, application development will be a snap…"

Enterprise Architecture views people, process and technologies as a 'systems of systems'. Technical expertise, innovation and interoperable solutions are all systems within incrementally larger and larger systems.

When viewed in such a manner, the application of technology results in some interesting observations. For example, unlike Solutions or Technical Architecture, Enterprise Architecture accepts and embraces chaos as the end-state. This is a bold departure from the mindset of a technical architect where order and predictability is the goal.

Chaos as the end state, from an IT standpoint, is akin to heresy. Interestingly enough, when this concept is presented to business managers the reply is often, 'you did not know that'. There truly is a chasm between the way technologists and the rest of the world think.

This is not to say that frameworks are not valuable. They are and like Service Orientation, have a place in every organisation. However, they cannot stand alone and do not hold the answer for alignment.

Models, Models, Models – Accepting Chaos

In times past, local television stations in the US often ran self-promotional campaigns proclaiming their on-staff meteorologist's forecasting accuracy. Over the course of the last decade this claim has faded away, along with apologies for missed forecasts. The shift has been from "sorry we missed that late afternoon rain in the forecast" to "the late afternoon rain yesterday was unexpected".

This shift has been primarily due to a much greater understanding of weather models and the acceptance of chaos. Similar to the Technical and Solution Architectural mindsets, there was a time when meteorologists thought they could figure it all out. However, the more the data they collected, the more did the sheer complexity of weather systems become evident, along with the realisation that the goal of accurate short-term weather forecasting could not be achieved. Attempting to predict afternoon rain, much like predicting the usage of wireless technology, is not achievable when all of the variables are understood.

The enterprise architectural mindset has followed the same course as the meteorologist. It has taken some time. Five years ago, we had no idea that service orientation was not the answer and two years ago we had no idea that frameworks were not going to fill the gaps.

It took failure to identify the true complexity of the enterprise. It also took some time to develop enterprise architects.

At the Enterprise Level, it becomes clear that a state of chaos exists in the form of complex interactions. Several models have been developed to aid in understanding the interactions such as The Open Groups Architectural Framework (TOGAFv9) and the Object Management Group's Business Motivation Model.

These models all address the relationships at the enterprise level and with an enterprise architect available to direct and populate the models, the first step was achieved. However, we were still one step away from understanding the true nature of the enterprise.

Current enterprise models include several foundational assumptions. Many are now beginning to be questioned.

↘ The first assumption is that the organisation as a whole has a common goal (e.g. a mission statement). This may have been true a number of years ago but it is certainly not how organisations are structured today. In a single healthcare organisation there are multiple influencers, all with their own directives and goals. Often, these are in alignment – more often, they are not. For example a radiology department may be on a rapid upgrade path, expecting IT to keep up in both on-premise storage and data management expertise while the oncology group as a whole may be considering the outsourcing of IT functions.

↘ The second assumption is that people are willing to change and 'want to do the right thing' or even understood what the right thing is. It took some time for technologists to understand this concept as they have surrounded themselves in change and thrive upon it. However, most people perform within a system of positive feedback loops. Whether these loops are positive or negative for an organisation is largely unknown. What is known is the loops are either positive or negative for the individuals. Changing what has worked for someone over a long course of time is almost impossible unless there is a perceivable upside for them.

Unfinished Business

Identifying and understanding these challenges has led us to the 'Acceptance of Chaos'. This concept has been (and continues to be) very difficult to accept on the part of technical architects, systems engineers and developers. In brief, the concept of leaving something unfinished or broken is a near-insurmountable roadblock for the technically focused mind.

However, the acceptance of chaos within the enterprise does not mean that the enterprise architects have given up. Conversely, they have identified that we must accept that chaos is not going away and that we must learn to design within a chaotic state by modelling and simulating the environment in order to understand possible outcomes.
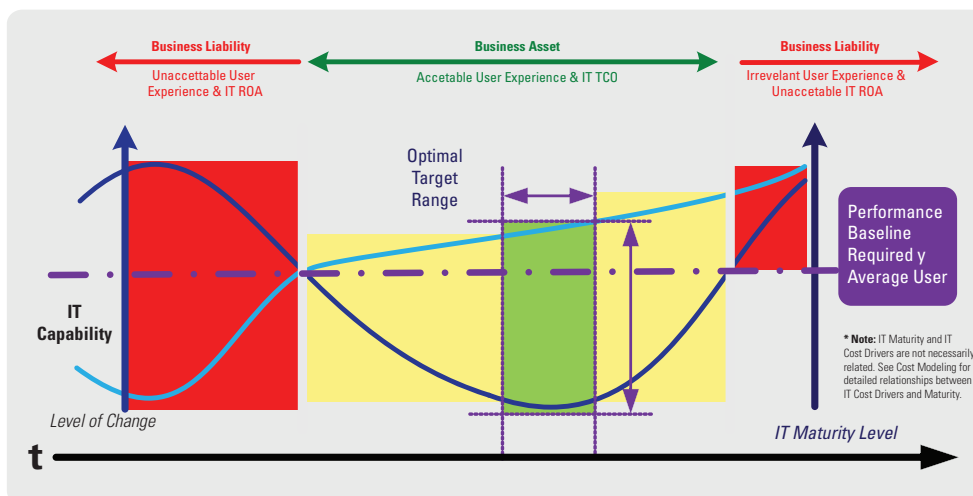

Figure 2. Why Change is so Hard

Swarm Models

It has not been hard to find a working model that addresses design within a chaotic environment, above all the swarm model. Swarm modelling addresses both challenges listed above in an elegant manner via the following rules. In a swarm there is (are):

- **Simple Rules:** *No Leaders, No Followers, No One Cares - alignment is achieved by design.*
  Several recent models have been proposed. One notable model is Nick Malik's Enterprise Business Motivation Model. http://motivationmodel.com
- **Positive Feedback Looping:** *Negative is ignored and dies while positive is reinforced and thrives.*
  The most technically elegant design on the planet is of no value if positive feedback loops align against it. Most people like their jobs and how they do them. To ask them to stop or to do them in a different way for the greater good of an organisation just does not happen. A core concept surrounding Centres of Excellence is based on positive feedback looping. However, COEs had a flaw; they were missing the concept of phased transitional emergence.
- **Phased Transitional Emergence:** *Changes just happen by simple 'gap' rules.*
  This is the" iPhone or Blackberry Effect". In short, give someone something they like and others will ask for it. Although this sounds simple, it is contrary to most IT design methodologies in use today. End-users are seldom given the right of selection outside of use cases. After the requirements study stage, technology-focused decision makers select the technology solutions that users must use.

Modelling an enterprise requires the insight of an Enterprise Architect. The role is hard to define and it is even harder to identify those capable of producing an enterprise architecture (no matter their title) because they do not fit into common role buckets. They are (and have been) technical and solutions architects, application developers and systems and process engineers or managers and directors. They may have started in desktop support but have also presented findings, designs and roadmaps to executives and boards. Their experiences have shaped their mindset allowing them to "see" the organisation from the enterprise level. This experience has also created a pragmatic, sometimes almost-fatalistic view due to the hype cycles and unfulfilled promises they have lived through. As such they are uniquely qualified to identify how and when technology is applied, the trade-offs of different approaches and the likelihood of success.

Process and Substance

An interesting characteristic of enterprise architecture and architects is that no one is happy with an enterprise architecture project or initiative until the results begin to emerge. The technical architects, application developers and systems engineers commonly feel that "we're not being asked the right questions" because the technical details relating to how things plug in are not being addressed. Likewise, the solution architects, business de-

cision makers and analysts feel that 'we're off track' because use case and organisational requirements are not being addressed.

Several years ago one of the best descriptions of an enterprise architecture project was "Wax-on, Wax-off". Those familiar with the movie Karate Kid may recall a karate master having a kid waxing his car all summer. The kid finally lost his tolerance for the work and insisted the master teach him karate. However, the master had been teaching him karate; the waxing techniques were training him in both technique and endurance. Similar to enterprise architecture, it is difficult to see the higher level until it is achieved.

Additional reasons for an initial push back to enterprise architecture are the enterprise architects, and much like the karate master, their approaches.

- Enterprise Architects are seasoned professionals. A recent survey in an enterprise architecture forum concluded that an enterprise architect under the age of thirty did not know the definition of enterprise architecture and therefore could not be an enterprise architect. It takes years of experience in multiple roles before the enterprise mindset begins to develop. As such, enterprise architects often know participants' jobs and roles, in addition to a greater understanding of the interrelationships within the enterprise. Their experience and understanding often intimidate individuals within the organisation. It takes a high level of professional maturity to accept the guidance that an enterprise architect can provide.
- Enterprise Architects do not give the answers expected and often ask questions that seem to make no sense.
- On the technical end of the scale, questions relating to software and hardware product selection, refresh or integration appear to be missing. However, from an enterprise viewpoint, these items are simply details that will be derived from higher level selections such as what components are outsourced or provided on premise and the organisation's guiding principles and design statements.
- On the business end of the scale, questions relating to operational process enablement and workflow optimisation appear to be missing. These items are commonly collected in the form of use cases and requirements studies. However, from an enterprise viewpoint, these items will be derived from the organisation technical capacity and capability roadmaps.

Looking back at the definition of Enterprise Architecture:

- EA is about knowing where we are, what we have and where we want to be to ensure we build systems and processes which create value and do not paint us into a corner.
- EA is optimal enterprise business process, information and technology asset management tuned to meet customer and shareholder needs in relevant time frames.

It is clear that both definitions above are correct. However, it can also be said that Enterprise Architecture is the pragmatic mindset of the Enterprise Architect.

ECRI-RECOMMENDED
SPECIFICATIONS *

MERGE Healthcare

Picture Archiving and Communication Systems (PACS)

ECRI Institute
The Discipline of Science. The Integrity of Independence.

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ECRI Institute, a non-profit organisation, dedicates itself to bringing the discipline of applied scientific research in healthcare to uncover the best approaches to improving patient care. As pioneers in this science for nearly 40 years, ECRI Institute marries experience and independence with the objectivity of evidence-based research.

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

More than 5,000 healthcare organisations worldwide rely on ECRI Institute's expertise in patient safety improvement, risk and quality management, healthcare processes, devices, procedures and drug technology. ECRI Institute is one of only a handful of organisations designated as both a Collaborating Centre of the World Health Organisation and an evidence-based practice centre by the US Agency for healthcare research and quality.

For more information, visit
www.ecri.org

* These recommendations are the opinions of ECRI Institute's technology experts. ECRI Institute assumes no liability for decisions made based on this data.

MODEL	PACS	Fusion PACS GL
WHERE MARKETED		Europe
CE MARK (MDD)		Yes
SYSTEM CONFIGURATION		
Architecture	Single server cluster	Single Server or Active Load Balanced
Hardware	Hardware-independent	Hardware -independent
Operating systems		
Image server	Windows or UNIX	WIndows
Web server	Windows or UNIX	Windows
Security	128-bit SSL	SSL
Database server	Windows or UNIX	Windows
Management	Experienced database company	MS SQL
Long-term storage		
Media	Hardware independent	NAS, SAN, DVD, tape
Hardware	RAID (SAN)	RAID (SAN/NAS)
SERVICE & SUPPORT		
Telephone	24 hr	24/7
On-site response time	24 hr	<24hr
Remote system monitoring/updates	Yes	Yes
DIAGNOSTIC WORKSTATION		
Independent login	Yes	Yes
Admin-contr. worklist/ad-hoc patient search/auto notification/ user definable hanging protcols	Yes	Yes
Prior reports (without images)	Yes	Yes
Session interruption function	Yes	No
3-D image processing	Yes	Yes
Integrated report dictation /Voice recognition	Yes	Yes, integrated with Dictaphone PowerScribe
WEB IMAGE ACCESS		
Max number monitors supported	2	2
Patient search	Name or MRN	Several Parameters
SYSTEM ADMIN		
DBase frequency	Every hour	Configurable
Auto duplication of long-term archive	Yes	Optional
Test server	Yes	Optional
INTERFACES		
IHE conformance	Year 5	all relevant profiles
RIS	Brokerless, bidirectional	HL7, ADT/ORM/ORU messaging
Electronic patient record	Yes	Yes, direct access via Web link
PLANNING & PURCHASE		
Price structure	Hardware and software separate, based on number of exams	SW only or with HW, based on # of exams
Training	1 week	On-site or remote
Delivery time, ARO	1 month	usually < 1month
Year first sold		2004
Number of full system installs		> 80 (Europe only)
LAST UPDATED		May 08

GE Healthcare | **FUJIFILM** | **SIEMENS** | **AGFA HealthCare** | **VISAGE IMAGING**

Centricity	Synapse	syngo Dynamics	IMPAX Enterprise Suite	Visage PACS
Worldwide	Worldwide	Worldwide	Worldwide	Worldwide
Yes	Yes	Yes	Yes	Yes
Central database with image cache options	Client/server distributed, Web-based	Client/server	Centralized server	Single server, single or multi-server clusters, Web-based, failover, NET
Sun, Wintel (Web)	Windows compatible	HP enterprise servers	Dell, IBM, HP, Sun (servers)	HP, Dell, Intel, IBM
Solaris, UNIX, Linux	Windows 2003	Windows 2003 server	Windows, UNIX	Windows 2003
Windows	Windows 2003, IIS	MS IIS (Win 2003)	Windows	Windows 2003
VPN or SSL	128-bit SSL	SSL	128-bit SSL	SSL
UNIX	Windows 2003	Windows 2003	Windows, UNIX	Windows 2003
Sybase	Oracle	Microsoft SQL	SQL or Oracle	Cache/SQL
Spinning disk, DVD, UDO, major HSM	Selectable to customer requirements	Dual-DVD(entry-level), HSM, PACS	Tape, DVD, spinning disk, MOD, UDO, others	RAID, backup (tape, disk, DVD)
Direct attached, area network storage	Any spinning disk technology	RAID	RAID (SAN/NAS)	Hard disk RAID (SAN/NAS)
24/7/365	24 hr	24 hr	24/7, 1 hr response	24/7/365
4 hr with agreement, 12 hr noncritical	Depends on contract	24 hr or based on contract	Depends on agreement	Same day, 1 day
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes and user	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Native thin-client MIP/MPR module available, or context integration to third-party 3-D applications	Yes , through additional software tools	Yes	Yes
Yes, third-party client	Third-party integrated	No	Yes	Yes
2	5	1	Up to 5	3+
Patient name, MRN, exam date, modality	Name, MRN, census	Name, MRN, user defined	Over 30 search criteria including Name, ID, GPI, location, accession number, doctor, modality, body part, study status, sex	Name, accession number, MRN, exam date, institution, DOB, others
Site configurable	Daily, configurable	Daily	Configurable	Optional
Yes	Optional	Yes	Yes	Optional
Optional	Yes	Optional	Yes	Optional
SWF, PIR, ARI	Selected profiles	Yes	All relevant radiology, cardiology, IT Infrastructure Integration profiles	Yes
Brokerless, bidirectional	Brokerless, bidirectional, HL7 Web interface	Bidirectional	Bidirectional using HL7, DICOM, IHE, Custom	Brokerless, bidirectional
Via URL	Yes	Broker or interface	Image enabler to EMR and EMR on radiology desktop	URL or direct
Concurrent-users license for procedure volume, workstations	Turnkey, software only, and per-usage options	Hardware and software separate	Turnkey or software-only solutions available	Hardware, software, licensing
HQ, on-site, remote	Varies	2-3 days	Variable	On-site, shared desktop, CD
90-120 days	90 days	90 days	Variable	3 weeks
1992	1998	1999	1990	2001
570	400+ (USA), 1,000+ (Worldwide)	>900	1,700 PACS systems and over 600 integrated RIS/PACS systems	>1,000
May 08	May 08	May 08	May 08	May 08

MODEL	CARESTREAM PACS	HORIZON MEDICAL IMAGING
WHERE MARKETED	Worldwide	North America, Europe
CE MARK (MDD)	Yes	Yes
SYSTEM CONFIGURATION		
Architecture	Servers: centralised, distributed; client: Web deployed	Multitiered, centralised, or distributed infrastructure serves dedicated, smart, or Web clients
Hardware	Sun, Wintel, Dell, IBM, EMC	HP, IBM, Dell
Operating systems		
Image server	Sun Solaris, Windows 2003	Windows 2003
Web server	Same server as PACS (Sun Solaris, Windows 2003)	Windows 2003
Security	128-bit SSL	128-bit SSL, VPN
Database server	Same server as PACS (Sun Solaris, Windows 2003)	Windows 2003
Management	Oracle	Oracle 9i
Long-term storage	Yes	
Media	Spinning disk (Multitiered), juke boxes, remote storage services; supports EMC and IBM Enterprise	AIT, DVD, MO, Enterprise integration
Hardware	RAID (SAN/NAS), EMC Centera	RAID (NAS/SAN), Enterprise integration
SERVICE & SUPPORT		
Telephone	Available 24/7/365	24 hr
On-site response time	Generally 4 hr for back-office	4 hr
Remote system monitoring/updates	Yes	Yes
DIAGNOSTIC WORKSTATION		
Independent login	Yes	Yes
Admin-contr. worklist/ad-hoc patient search/auto notification/ user definable hanging protcols	Yes	Yes
Prior reports (without images)	With/without images	Yes
Session interruption function	Yes	Yes
3-D image processing	Yes	Yes
Integrated report dictation /Voice recognition	Yes	Optional; PowerScribe, Lanier, Dictaphone, Fusion, WinScribe, SoftMed, eScription, Vianeta; Speech Q, Talk Technologies, DEWS, RadWhere, Fusion Expert
WEB IMAGE ACCESS		
Max number monitors supported	4	Any configuration supported by operating system and workstation chassis
Patient search	Yes	Name, MRN, accession number, date range
SYSTEM ADMIN		
DBase frequency	Yes, frequency configurable	Daily and hourly incremental
Auto duplication of long-term archive	Yes	Yes
Test server	Optional	Yes
INTERFACES		Yes
IHE conformance	Yes	Years 1-7
RIS	HL7 integration with third -party RIS, no broker required	Brokerless, bidirectional
Electronic patient record	URL activation, Enterprise storage integration, XDS repository, patient-centric clinical content viewing	Yes
PLANNING & PURCHASE		
Price structure	Software, hardware, professional services, service agreement	Hardware and software are quoted separately
Training	Yes, professional services	Yes
Delivery time, ARO	Flexible, depends on requirements	120 days
Year first sold	1994	1992
Number of full system installs	550+	1000+
LAST UPDATED	May 08	May 08

features

HEALTHCARE AND ROBOTICS
Miles to Go Before It Sleeps

AUTHOR

Tosh Sheshabalaya,
HIT

In spite of a variety of implementations since the 1980s, the field of healthcare robotics remains experimental and largely nascent. However, the long-term promise that it holds is acknowledged to be immense. This means that not only researchers and healthcare practitioners, but policy makers, too, are involved in bridging the gap between potential and reality.

Surgical Robots: The First Step

In the healthcare context, robots are now almost wholly used for surgical purposes. Various procedures from prosthetics (such as hip replacement) to a range of minimal invasive surgical interventions (especially prostatectomy, and other urological conditions such as bladder or kidney cancer) have been supported by robotics since the late 1990s.

The speed of acceptance seems impressive. According to Dr. Vipul Patel, Executive Director of the Orlando, Florida-based Society of Robotic Surgery: 85 percent of (prostatectomy) patients get their surgeries done robotically now. We would not have thought that possible a decade ago."

The bulk of robotic surgery is carried out in large university hospitals or specialised clinics. At one of the world's leading centres for robotic prostate cancer surgery, New York's Mount Sinai, a team led by the Head of its Minimally Invasive Surgery Department, Dr. David Samadi, has carried out over 3,000 interventions to date.

More recently, however, a growing number of smaller general hospitals are joining the robotic surgery roster, with a rapid growth in implementations. In the US, for example, Wheaton Franciscan Healthcare – Elmbrook Memorial, a Wisconsin-based healthcare facility, launched a robotic surgery offering in January 2010. By early July, it had already conducted 100 interventions.

Robots in Surgery: The Key Advantages

The key advantages of using robots for surgery are:

- Reliability: A lack of fatigue-induced errors, which are considered the bane of the surgical process. Minimally invasive surgeries are not called 'keyhole' for no reason. Some surgeons describe performing such procedures as driving a 40-tonne truck in reverse through a S-curve.
- Precision: The size of the human hand and fingers are an unavoidable physical limitation. Robots require smaller incisions and less room for manoeuvre.
- Effectiveness: Greater precision translates into smaller scars and quicker recovery, which in turn, means reduced hospital stay.

- Cost: Even in typical one-day, 'drive through' surgical procedures, the cost savings of a few hours (through the use of robots) can be impressive when aggregated across a large patient pool across a year. For Stanford University's Dr. Catherine Mohr: "Keeping a post-surgical patient who had an uncomplicated surgery in a bed in a hospital while they recover from that surgery costs that hospital 1,500 dollars per day on average; patients who have [minimally invasive] surgery go home two-and-a-half days earlier on average than patients having the same surgery through an open incision. The savings from being able to discharge patients earlier not only wipes out the premium cost for the robot instruments and maintenance, but actually brings the hospital out about 500 dollars per procedure ahead. The second big saving comes from a reduction in complications, which can cost a hospital up to three times what it will be reimbursed for a procedure, and associated blood transfusions, she adds.

> *"Robotic artificial intelligence (surgical) systems have shown the ability to locate the centre of a tumour and accurately insert a needle within a space of two millimetres."*

Synergising Other Technologies

In recent months, researchers have been augmenting the effectiveness of robotic surgery by adding in a series of other technology innovations. In August 2010, for example, New York-Presbyterian Hospital/Columbia University Medical Center surgeons announced that using CO_2 laser for robotic prostate cancer surgery showed
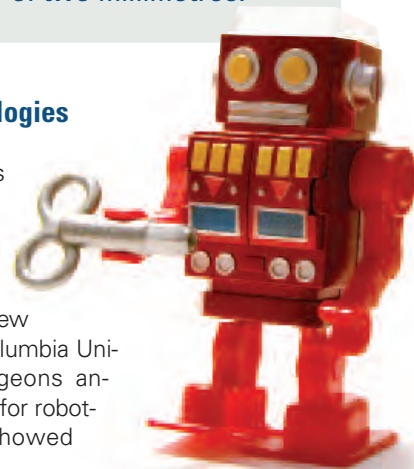
promise in reducing some of the major side effects of the latter (including long-term incontinence and sexual dysfunction in half of the patients).

Also, just a month previously, the Food and Drug Administration approved the use of robotics for treating obstructive sleep apnoea by the removal of lingual tonsils. Traditional (human) surgical excisions of the tonsils in adults to treat apnoea have been accompanied by a high degree of failure (re-growth), while systems such as continuous positive airway pressure (CPAP) machines remain associated with unacceptable impact on quality of life. One patient described it as 'trying to breathe like a dog with its head hanging out of an open car window on a motorway'.

Going Global

A large share of surgical robotic activity is accounted for by the US and Europe, but new applications are rapidly growing in other parts of the world, too.

In Australia, Flinders Hospitals recently announced that 16 patients with abnormal heart rhythm have been treated via remote control surgery. Another 80 are due to soon join the list. Israel's Mazor Surgical has made dramatic inroads in the US with a robotic system for spinal surgery, and plans to expand into Europe in the near future. It also seeks to get its system approved for brain surgery by the end of this year.

In August, the UAE and Qatar announced a list of their first surgeons authorised to conduct robotic surgery.

The Situation in Europe

Down the horizon is an inevitable increase in the spectrum of applications for healthcare robotics, galvanised by synergies and cross-fertilisation with other fast-emerging (and in some cases, related) disciplines, such as nano-technology and artificial intelligence.

Europe is clearly determined to be on the frontlines in this field. In 2007-2008, an EU Commission-sponsored expert group (led by TNO of the Netherlands) entered into consultations with experts and stakeholders. The group zeroed in on six representative areas as "ripe for further investigation and roadmapping" to stimulate market take-up.

Other than the core field of robotic surgery, dominated by American company Intuitive Surgical and its DaVinci robot, the other five go deeper into enabling technologies (robotised motor coordination analysis and therapy and intelligent prosthetics) and into a wider range of applications (smart medical capsules, robotised patient monitoring systems and robot-assisted cognitive and social therapy).

Best-of-class examples of each of the above five, which were highlighted by the EU initiative are as follows:

Robotised motor coordination analysis and therapy

This is designed to target patients with traumatised motor control (e.g. after a stroke, spinal cord injury, multiple sclerosis or Parkinson's disease). It provides robotised analysis of motion and supports physical therapists.

A leading company in this field is Switzerland's Hocoma, founded in 1996, and working closely with hospitals and clinics in Europe, the US and Singapore. Its core Lokomat System, launched in 2001, was the world's first driven gait orthosis, and has been used for robotic treadmill training of neurological patients. A paediatric derivative, targeted at children (e.g. with cerebral palsy), was launched in 2005.

Another Hocoma robotic product is the Erigo, a pioneering tilt table with an integrated robotic stepping system. In late 2006, Hocoma launched the Andago, a new user-friendly system for manually assisted treadmill training.

The research focus is personalised therapy through user recognition as well as virtual reality (VR) and haptic feedback.

Intelligent prosthetics

The EU study showcased a hand prosthesis from Germany's Otto Bock which permits individual movement of fingers controlled by nerve signals. Additional systems (will) facilitate natural movement and intuitive control of arm and leg prostheses, with the same sub-conscious control as for natural limbs. Future research aims at brain autonomy and control by a patient's peripheral nervous system.

More recently, however, an exciting new development from Britain shows the extent of latent potential in Europe in such fields. Shadow Robot is a small London start-up credited by two of the world's toughest customers, US space agency NASA and the British Ministry of Defence, for developing the world's most dexterous robotic hands. While the Americans do not say what they wish to use it for the British Defence Ministry is ostensibly using the robotic hand for defusing bombs. Shadow Robot's hand is unique in terms of its life-like nature. Its joints comprise 24 different angles of independent movement, and are powered by tiny tubular air pumped 'muscles'. Other than healthcare (and defence), the company's owner is also considering opportunities in the nuclear power industry.

Smart medical capsules

This NextGen system offers a way to 'journey' through the body of a patient with less discomfort than traditional (invasive) endoscopy. The smart endoscope is a 'pill' which is swallowed and then takes snapshots of internal systems such as the intestines. A robotising of capsules boosts their diagnostic effectiveness. In future, such capsules will also be introduced into the circulatory systems, thus boosting their relevance far beyond the digestive tract.

They could also be used to deliver medication (or radiation), directly where it is needed, and in patient-specific doses, thus signifying one of the most radical breakthroughs in medicine towards what has been billed as the era of i-Health.

Research in this area focuses on miniaturisation of robots (and convergence with nano-technology – in terms of the so-called 'nanobot') and some amount of artificial intelligence (AI) to take

decisions. The goal is to allow the robot to move from external steering to self-propulsion.

The EU study highlighted a Swiss IRIS (Institute of Robotics and Intelligent Systems) minirobot, which can be introduced into the eye to perform precision eye surgery under guidance of a surgeon.

Robotised patient monitoring systems

Europe's Welfare State healthcare model pays a great deal of attention to the specific needs of an ageing population, in order to enhance round-the-clock care-giving.

Current-generation remote patient monitoring devices (including several EU-financed e-Health research projects) assist physicians and nurses to look after patients staying at home. However, when unusual or emergency situations are detected, it is often a tough call to make a judgment call from a distance. Robotised systems, such as the Care-o-bot (from Germany's Fraunhofer Institute) aim to both enhance routine communications with an increased degree of efficiency as well as identify potential emergency situations.

However, the technical/legal challenges of such systems still remain huge. In the US, the FDA has cleared only one company to offer remote presence robot services to hospitals so far.

Robot-assisted cognitive and social therapy

The European Welfare State healthcare model goes at-home care-giving for the elderly (e.g. in terms of the robotised patient monitoring systems discussed above) to offer therapeutic functionality and develop or maintain social skills which are threatened by their relative isolation. An immediate associated benefit of such systems is their applicability to children – for developing basic social skills by play. Robotic systems can be programmed to generate a near-full range communicative sensory feedback (in terms of sound and colour as well as mimicking facial expression), provide incentives for movement (not least through the playing of games) and adapt to an individual person.

The EU study showcased CASPAR, a robotic system developed by the University of Hertfordshire in the United Kingdom, and designed to induce therapeutic play for children with autism.

The inherent entertainment/edutainment implications of such systems mean the presence of several competitors and contenders in this field – not least from the Far East (such as Fujitsu's 'enon' service robot and Mitsubishi's Wakamaru). In the US, GeckoSystems' CareBot is a mobile robot targeted at assistive home care for the elderly and their families.

The IT Challenge

Healthcare robots, like other medical machinery, are made of plastics and steel, aluminium and titanium, wires and flywheels, sensors and integrated circuits. The intensity of IT, however, is huge. Several healthcare robots have more software lines of code than an MRI.

Key systems in a healthcare robot include 2D and 3D medical image acquisition and analysis coupled to feature recognition algorithms (for example, to differentiate diseased from healthy tissue), micro-mobility and ultra-sensitive manoeuvring technologies, high-tech speech recognition, as well as continuous self-learning and artificial intelligence programs.

The American firm GeckoSystems has given a description of its CareBot, which it describes as "an internet appliance that is accessible for remote video/audio monitoring and telepresence."

The physical structure consists of "an aluminium frame, plastic shroud, two independently driven wheels, multiple sensor systems, microprocessors and several onboard computers connected in a local area network. The microprocessors directly interact with the sensor systems and transmit data to the onboard computers."

The onboard computers each run independent, highly specialised cooperative/subsumptive artificial intelligence (AI) software programmes (known as GeckoSavants™), which interact to complete tasks in a timely, intelligent and common sense manner.

Examples of GeckoSavants include GeckoNav™, GeckoChat and GeckoTrak™.

> *"Europe is clearly determined to be on the frontlines of robotics in healthcare."*

GeckoNav is responsible for manoeuvring, avoiding dynamic and/or static obstacles, seeking waypoints and patrolling.

GeckoChat is responsible for interaction with the care-receiver such as answering questions, assisting with daily routines and reminders, and responding to other verbal commands.

GeckoTrak enables the CareBot to maintain proximity to the care-receiver using sensor fusion.

Haptic Feedback

One major challenge for healthcare IT professionals involved with robotics is to develop more sophisticated haptic feedback (a perceptional sense of touch and grip control).

In spite of its acknowledged state-of-the-art technology, market leader Intuitive Surgical's da Vinci system lacks such feedback for a surgeon. This leads to maximal compressive force by the robotic needle driver, during every grasping manoeuvre. As a result, repetitive robotic needle manipulation risks damage to fine sutures used during delicate procedures.

At present, human trials are due to begin with force sensors coupled to grippers and retractors, which aim to avoid gripping blood vessels too tightly. Other laboratory-scale developments

✚ features

include robotic arms which can flex and glide down pathways inside the human body without causing discomfort or scarring.

Health Tech Giants, Others Target Robotics

Major healthcare technology firms have begun targeting the robotics opportunity. In April, Intel and GE announced a USD 250 million joint venture to develop home medical monitoring technologies. After extending its Telepresence videoconferencing platform to Healthpresence (to enable doctor-patient) interactions, Cisco is reported to be considering application of the technology to surgical robotics.

So too have military technology firms. The Shadow Robot referred to previously demonstrated the convergence between military and healthcare robotics applications. A similar synergy is shown in Dr. Catherine Moor of Stanford University (who is also Director of Medical Research at Intuitive Surgical –vendor of the DaVinci surgical robot): she began her career designing high-altitude aircrafts.

According to Healthcare Information Technology Management sources, a commercial spin-off from the military shortly due to hit the market is a head-up display (HUD) interface for a surgical robot to overlay CT scans upon the organ in question.

The Next Frontier: Artificial Intelligence

Researchers at Duke University in the US are studying equipping surgical robots with artificial intelligence to perform routine medical procedures.

One of the first human trials slated to commence within three – five years involves needle biopsies, a commonplace tool used to diagnose cancer. Researchers at the University, led by Prof. Stephen Smith, believe that existing computer 3D imaging technology combined with robotic artificial intelligence (AI) may soon free valuable time on the part of physicians performing this routine procedure. In simulations with animals, he states, the robotic AI system has shown the ability to locate the centre of a tumour and accurately insert the needle within a space of two millimetres. More recently, the Duke researchers have begun adapting the system to obtain evenly spaced samples across the entire tissue.

The entire procedure currently takes one minute to complete. However, with more sophisticated robots and faster computer programs, Prof. Smith says that the time required would be reduced to seconds.

Other applications of AI-assisted surgical robotics look set to also follow during the current decade.

LEGAL PITFALLS OF ROBOTIC SURGERY
HITM Analysis

In spite of the promise and excitement surrounding robotic surgery (as well as the wider use of robots as health caregivers), one of the most vexing issues is the legal framework within which hospitals begin to deploy robots.

Robotic surgery, in particular, will demand an exceptionally high level of training for overseeing physicians. The immediate challenge in this respect consists of the learning curve - the process of acquiring experience, and sufficient amounts of it, in order to impart the training. Alongside this would be the task of composing a credible certification body to give legal recognition to such experience, and assessing issues of professional liability. Who will such an organisation consist of – unless there are enough experts to staff it ? Future experts will, after all, be undergoing training, for a certain period of time, as demand is likely to comfortably outstrip supply.

It is also unlikely that a peer-group structure, composed of experts who sit on the certification body part of the time, and then perform robotic surgery afterwards, can withstand the pressure of conflicts of interest. As a former US presidential contender may have said: 'It is a surgical process, stupid, not a highbrow research paper'.

The issue of liability will inevitably pose its own set of trials and tribulations.

While the legal basis for physician liability is likely to remain similar to conventional surgery, a negative outcome in robotic surgery would open the floodgates to not only sue a physician and hospital, but also the vendor of the robotic system.

Litigation after remote robotic surgery would be additionally painful. Apart from physicians, hospitals and robotic system vendors, patients could also think about suing the telecommunications company.

The next question would be one most lawyers are familiar with – that of extraterritoriality. Whose laws would be used if the remote robotic cybersurgery is performed by a physician on a patient in another country, using undersea fibre optic cables owned by a company in a third?

Under such circumstances, the verdict is clear. Robotic surgery will take off slowly, very slowly, beginning with tightly-controlled pilots and trials in a few hospitals. Even as training programs mushroom for robotic surgeons, we can safely expect a flood of applicants for courses in robotic malpractice laws. Our litigation-happy American friends may indeed be already on the job.

MIDWIVES AND TECHNOLOGY IN NEW ZEALAND

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Information and communication technologies (ICT) present midwives with new opportunities. This article reviews how New Zealand midwives currently use technology in their practice, and its implications – both for midwives as well as health consumers and health organisations. It also discusses where midwives need to develop in their use of technology in order to meet the needs of the women and families they work with, and provide evidence-based midwifery care.

Midwives, on the one hand, see themselves as face-to-face, hands-on practitioners whose role it is to protect women from the interventions of clinical technology, which they see as increasing poor outcomes for mothers and babies. On the other hand, midwives recognise the potential for IT to make their working day easier and improve their practice management, information management, and communication. Midwives see the need to maintain 'hands-on' skills and protect normal, non-technical birth, yet leverage technology to provide a seamless service at an organisational and professional level.

In New Zealand, midwives use technology for six main purposes; clinical practice, practice management; access and disseminate evidence-based information; communicate with clients (mothers and their families); education, and ongoing professional development.

Midwifery in New Zealand

New Zealand is a small country with a population of just under 4.5 million. Official statistics report approximately 64,000 registered live births in 2009, with an infant mortality rate of 5.0 deaths per 1,000 live births.

According to the Ministry of Health's Draft Maternity Action Plan 2008-2012, most women (97.5 percent) give birth in a hospital or birthing centre with approximately two thirds having a normal birth, nearly 25 percent are caesarean section with the remainder having assisted vaginal delivery. Nearly all births have a midwife in attendance either as the lead maternity carer (independent midwife) or core (hospital) midwife.

The New Zealand maternity service is funded by central government and free to women. Every woman is entitled to a lead maternity carer (LMC) who is responsible for the woman's care from conception to six weeks following the birth of the baby. Over 80 percengt of women choose midwives as their LMC.

Midwife LMCs are responsible for planning and implementing women's care; providing information to women so they can make informed choices about their care; organising screening tests such as ultrasound scans; prescribing pregnancy-related medications and referring to other health professionals at appropriate times.

LMC midwives may be employed by organisations such as hospitals, or self-employed and paid directly by the government. The vast majority of midwives are direct-entry which means they complete a three-year undergraduate midwifery degree and are not required to be nurses.

In 2009, according to data from the Midwifery Council of New Zealand, 2,652 midwives renewed their annual practising certificates. Approximately half of practising midwives work as LMCs. Others work as core midwives.

Core midwives staff facility and hospital maternity units. They work shifts and provide support to LMCs; care for women once they have had their babies, and provide secondary and tertiary care to sick mothers and babies.

Clinical Practice

Telemedicine does not figure in the provision of maternity care in New Zealand. At most, midwives in rural and remote communities will consult with secondary or tertiary units by telephone or fax.

If more sophisticated monitoring is required of a woman or baby, the woman will be transferred from her home locale to a bigger medical centre.

Practice Management

LMC midwives provide woman/patient centred care in collaboration with other health services including laboratory, radiology, secondary care and other primary healthcare providers such as smoking cessation services. Referrals and information transfer between health professionals (especially between midwives) and institutions are often necessary.   At present this information is transferred in a variety of ways but mostly it is not within a standardised secure electronic environment. Paper and faxed information transfer is most often used.

Midwives in different parts of the country may manage their practices differently. It is less common for midwives to receive electronic laboratory results that can be associated with a

features

Picture 1. Second Life Virtual Birth Unit

woman's electronic record and it is not usual to have referral letters between management systems. While it is possible for midwives to use any of the three commonly used practice management systems to send letters and receive encrypted electronic information such as laboratory results and radiology reports, uptake depends on individual midwives buying into these services. Once the woman's clinical information is in the system, it is used primarily for statutory record keeping requirements, audit and claiming.

LMC midwives claim fees from a central government funding body in four segments: antenatal services are paid in two units; birth services fees are another fee unit; postnatal care is the fourth fee unit. If compulsory data fields are completed during the maternity pathway, electronic claiming is a straightforward process.

Data is commonly forwarded electronically to an intermediary body, and then fees are claimed on their behalf from the central government funding body. Individual midwives may make their own claim but this is by comparison a lengthy manual process.

At present, most of the electronic systems used by LMCs do not support fast, easy and useful clinical information sharing. However, the functions of claiming and easily printed information required for professional accreditation and audit are highly utilised and valued by midwives

Midwifery Information Systems

At a regional level, most secondary and tertiary hospitals now use one clinical maternity database which is capable of becoming a national database. This software provides a system to manage patient information through antenatal, perinatal and postnatal provision, with the ability to generate an extensive range of reports from clinical data. The majority of core (hospital-based) midwives enter booking data into this regional system.

There are also stand-alone maternity databases with neonatal and perinatal information. All pregnancies are recorded in the Maternity and Newborn Information System (MNIS) collection.

Extensive data collection and duplication of data entry is a time consuming and sometimes frustrating aspect of midwives' work. Frequently they do not have clerical staff to enter data, and they do not find the information systems they use to be intuitive.

Recent Health IT Initiatives

The New Zealand National Health IT Board has recently released a plan enabling an integrated healthcare model that will provide a core set of personal health information available electronically to the patient and healthcare providers, regardless of the setting.

The driving force is a vision of person-centred healthcare, which has not been possible because of the mostly disparate and fragmented information systems currently in place. Early adoption and successful use of isolated systems has slowed adoption of a nation-wide health information system that is aiming to be sector owned and community supported.

The New Zealand National Health IT architecture will make it possible for individual systems used by midwives, to access essential core patient information.

Access to Evidence-Based Information

It is vital that midwives have access to quality, evidence-based information for clinical practice in an era of increasing litigation and surveillance by media and other professions. It can be difficult for midwives in New Zealand to keep up top date with the latest evidence. Paper journals have expensive subscriptions, and many hospitals and maternity units are poorly resourced with appropriate journals and textbooks.

The Internet has become very important as a means to access evidence-information. Many hospitals provide access to relevant online databases such as CINALH and Pubmed but fire-walls prevent midwives accessing local hospital library electronic resources from outside the hospital.

The New Zealand Ministry of Health provides free access to the Cochrane Database for all citizens and midwives are able to use these systematic reviews. Nevertheless, midwives find it difficult to access other online journals, unless they are enrolled students at educational institutions, or are prepared to pay the fees that are charged for articles.

Communication with Clients

The Midwifery Council of New Zealand provides a web-based resource (www.midwiferycouncil.org.nz) for consumers to check the current registration details of midwives, and the New Zealand College of Midwives' website (www.midwife.org.nz) lists a set of consumer expectations it considers useful for a woman to consider. Some midwives have a personal or practice website outlining their location, style of practice and contact details but

this is not usual. Women frequently have to choose a midwife from a list of telephone numbers.

New Zealand midwives are increasingly using text messaging (SMS) with their patients, not only for appointment reminders but also for clinical questions, and sometimes for support and reassurance. Women offered text communication with their LMC appreciate easy access and support. Nevertheless, midwives have yet to fully implement the specialised software that can document text encounters and download them to a laptop/PC to attach to the woman's clinical record.

Education: The Virtual Birth Unit

Undergraduate and postgraduate midwifery education in New Zealand has moved to online and blended delivery as a means to addresses a national shortage of midwives. Historically, women have not been able to study to be midwives because they have been unable to uproot their families and move to campus for three years.

Blended and online delivery using a mix of face-to-face intensive workshops, and online delivery of theory allows women to stay in their communities as they study, and encourages them to stay once they are registered. This has become a very important recruitment and retention strategy for rural and remote areas that struggle to retain staff.

New innovations for education are being piloted, such as the Virtual Birth Unit in Second Life, which was developed by the Second Life Education New Zealand team in 2009 (slenz.files.wordpress.com/2010/03/slenz-final-report-_milestone-2_-080310cca.pdf).

This virtual simulation supports midwifery students to work through the scenario of caring for a woman in labour and birth. Unfortunately, there are a number of barriers that have prevented this technology to be taken up by educators in New Zealand, including time constraints for up-skilling staff and student as well as institutions' reluctance to make Second Life available on computers because of concerns about security. Nevertheless, there has been a lot of international interest, and American and British midwifery educators are taking up the project.

Professional Development:
E-Learning and Videoconferencing

All New Zealand midwives are required to undergo a rigorous accreditation process in order to practice midwifery. This includes acquiring professional development points relating to professional and education activities. Many midwives find it difficult to attend face-to-face conferences, seminars or workshops because of geographical distance and financial constraints, or they have difficulty in finding time to get away from their practice or employment. With this in mind, education providers are making opportunities for professional development available online.

One example is the "Immunisation eLearning Course" (www.learnonline.health.nz) funded by the Ministry of Health.

This provides professional development points once the midwife has completed and 'passed' the course. There have also been moves to provide professional development opportunities via video conferencing. 'The Telepaediatric Service' video conference network has provided several seminars for rural midwives but as yet these have not become a regular occurrence.

Online informal professional activities, discussions and communities of practice are increasing. Midwives' uptake of Facebook for social networking and sharing information is noticeable, and initiatives such as the free online conference "The Virtual International Day of the Midwife" (http://international-dayofthemidwife.wikispaces.com) are on the rise. However, the issue of lack of skills prevail as well as concerns about digital identity, and an attitude that learning and networking is best done in the face-to-face context.

Issues for the Future: Decision Support Systems

Midwives' style of practice involves working with consumers to ensure they make informed choices about their care. Besides having ready access to best evidence, clinicians and consumers in midwifery could be helped by decision support systems.
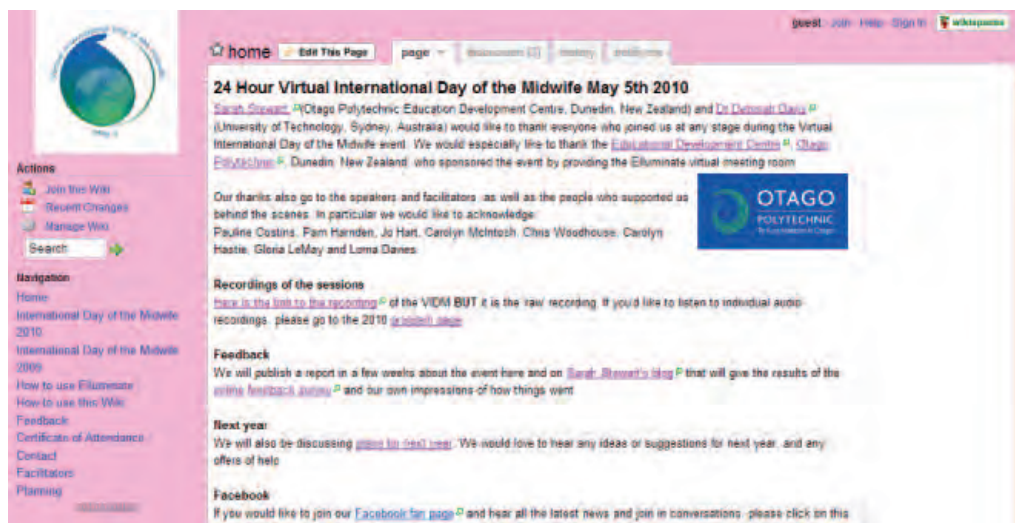
Most women proceed along a predictable temporal pathway towards the birth of their child, and for the weeks following the birth. Along the pathway there are standard points in time where the same decisions have to be made, requiring the same evidence. Therefore standardisation of care and opportunities for the exploitation of electronic mobile applications for commonly experienced situations arise.

Decision-making could be assisted with electronic Decision Support Systems (DSS) for both consumer and clinician. If the DSS were on the Internet, then access via a mobile device with a data services plan would be possible. Some midwives already have a data-services plan on their notebooks/laptops enabling them to remotely access the internet. There are already mobile applications applicable to midwives and women such as 'due date' applications, although these are only a guide, as are other computer tools and expert systems. Clinical judgement would always preside.

Will Mobile Technology Provide Solutions?

In New Zealand there are currently cost constraints for consumers using mobile data services, so mobile internet is out of the range of most consumers. Affordable devices and data services enabling the mobile internet will become available in the foreseeable future and be the drivers of change.

Exploitation of mobile solutions will see ubiquitous access to information and data input. Midwives provide care in their clinics, birthing centres, hospitals and homes so could be seen as mobile clinicians. Data input is required in each of these locations. Devices for mobile recording and transmitting information are becoming available and are currently being considered in New Zealand. Convergence of technologies has given rise to such devices as Net books, iPads and smart phones

Picture 2. Virtual International Day of the Midwife

terial given at first consultation and as needed, but further use could be made of trusted internet resources. Besides hardware and broadband services, access to web-based information requires a set of literacy skills. These include: traditional literacy and numeracy, health and information literacy, science literacy and computer literacy. Both women and midwives need these skills to take full advantage of web-based resources.

which are all Internet enabled mobile devices capable of capturing and transmitting information. Smart phones are both communication and computing devices and platforms for collaboration across time and distance. Some midwives already are finding 3G phones useful, and as costs lower, increased uptake could be expected.

Web-Accessible Information

Despite cost constraints, many consumers now have broadband and access to the Internet. However, this does not stop some women having difficulty with finding information about local LMCs.

Prior to first contact with a midwife, women need access to information regarding availability and style of practice of local LMCs. If women were directed to an easy to access site with contact and availability details for midwives, this section of the pregnancy and birth journey could be smoothed. Another section of the site could answer frequently asked questions (FAQ), with a growing database of previously asked questions with the answers and a forum with expert (midwifery) input.

At the moment there are commercial sites providing such services but most consumers and midwives are unaware of, or do not wish to access this service. Consumers who use the registered health professionals are also directed towards other services offered by the professional, which raises questions about the public-private mix and also the degree of sponsorship and advertising accompanying the information and expert help.

Information Needed by Women

Midwives see dissemination of quality evidence-based information as central to the process of informed choice, which is at the heart of the midwives' contract with women. Consumers need timely, accurate, authoritative information available to them. Currently this is often in the form of printed ma-

Women have always valued collaboration and place importance on 'what other people say'. Consequently there is an increasing trend for women to access social media to take part or follow discussion forums. Online social networking using social media is a comparatively new phenomenon but even so, health groups are already making inroads. Examples are: specialist groups in New Zealand using Facebook, Twitter, Bebo and YouTube to inform and educate mothers on breastfeeding issues (www.facebook.com/breastfeeding).

This central government backed breastfeeding initiative has a strong online presence. Participation has increased rapidly since the group was established less than a year ago. It is part of a carefully co-ordinated campaign to increase breast-feeding and is a centrally funded initiative.

Conclusion

Midwives need professional, clinical, professional development and administrative information. Services and devices for capturing, accessing, transmitting information have recently improved and availability is accelerating in New Zealand, although midwives are often frustrated by duplication or even triplication of data entry, both paper and electronic.

Midwives would welcome less duplication of data entry as the perceived value to the data collectors (midwives) is sometimes viewed as rather tenuous.

Midwives are also beginning to see the value of eLearning and social media for networking and online collaboration. Online solutions require a skill set, which New Zealand midwifery educators are addressing especially at undergraduate level. Time constraints to developing computer and digital illiteracies are cited but lack of time is due to prioritizing issues down the list, and ways must be found to help clinicians and consumers to use IT.

Collaborative efforts at a national planning level are moving towards more integrated solutions which must be seen as cohesive rather than small and isolated. Systems that are fast, easy and useful to midwives would be welcomed.

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CAN BAR CODES REVITALISE THE NHS?

Bar codes offer a way around two everyday challenges faced by healthcare professionals: medication errors and quicker access to patient data. In addition, they also provide a proven means for higher efficiency in running a hospital – in terms of stock control and asset tracking. Results from a survey conducted in the UK show that most physicians and nurses agree.

The Diagnosis

The NHS (National Health Service) is an integral part of British society. Many of us work in, or directly with it, pay taxes to fund it, and at some point everyone in the UK will have experienced its services first hand. Therefore it is a subject that many people feel passionately about, particularly as most agree that the system is struggling. Considering it deals with a staggering one million patients every 36 hours, this is not surprising. It is no secret that the NHS has had its fair share of challenges over the years; its resources are being significantly stretched, resulting in long waiting hours in A&E (Accident and Emergency) and records going missing.

Despite doing an impressive job with these limited resources, The National Patient Safety Agency in the UK reported that in 2007 alone there were over 80,000 NHS medication blunders. This is a lot of people, when there are simple and cost effective ways in which such errors can be avoided. For instance, the implementation of basic data standards and automated identification systems, such as bar coded patient wristbands and equipment, could have a great impact. This kind of basic technology can help trusts to improve efficiency and at the same time save costs, precious time, staffing resources and most importantly improve the quality of patient care. As the new government has pledged to ring fence resources to support the NHS, while all other public services are experiencing dramatic budget cuts, it is even more important for money to be spent wisely. But how should they do so and what do front line health staff think?

What are the Symptoms?

In light of this debate, GS1 UK conducted independent research with hospital doctors and nurses to gauge their opinion about improving ward services and quality of care, as well as the role of technology in enhancing patient safety and efficiency. In partnership with leading British medical publications, GS1 UK surveyed 861 hospital nurses and 409 hospital doctors across the UK. The results of which were rather serious.

The survey respondents were asked to assess how often they were unable to locate vital patient data. The findings of this research highlighted that a large number of doctors and nurses struggle to locate patient data on a daily basis with over 20,000 doctors spending over an hour a day waiting for vital patient data, while a quarter of nurses find that patient records and lab results go missing at least once a day. When asked about the time they have to check patient data, a large number of our doctor and nurse respondents felt that they had little time to check patient records thoroughly before treating them. To be precise:

- 12 percent of hospital doctors feel they rarely have enough time to check patient records before treating them
- 10 percent of nurses feel they have time to check patient records thoroughly all of the time

Another major issue highlighted by both doctors and nurses was miscommunication, whether it is through shift handovers or the misplacement of physical patient records:

- 78 percent of hospital doctors explained that miscommunication in multiple shift handovers is responsible for causing problems with patient care
- 38 percent of hospital nurses believe care is compromised because patient data is not shared between different doctors

These findings highlight key areas for improvement in the NHS, and the need for processes and technology to be put in place to enable key hospital staff to work as efficiently as possible, freeing up time to help them administer the best patient care possible.

Using Technology to Improve Patient Care

The doctors and nurses surveyed were also asked to highlight which processes could be put in place to improve these issues and standards, the result of which was an outcry for technology that makes information available electronically, to help front line staff work more efficiently. 48 percent of hospital doctors feel that the use of physical records instead of electronic systems is the cause of problems in patient care, and over three quarters of doctors specify they'd like to see real-time electronic records in place.

While 69 percent of doctors feel that better structured handovers would improve overall patient safety, highlighting that electronic systems and tracking need to be in place to abate

existing inefficiencies. 52 percent of doctors believe bar coded patient wristbands would help doctors and nurses perform their roles more effectively, with 44 percent of nurses feeling that bar coded wristbands could reduce patient safety incidents by 50 percent. Nearly two-thirds of nurses said they require a real-time view of vital stock levels, which is not currently available in many trusts. It is clear from these responses that front line health professionals have ideas about what needs to be done to improve the NHS, but can it be done successfully and within budget?

Successful, Cost-effective Treatment

Given the scale of the budget deficit, whilst everyone agrees that front line services should be protected and the government has pledged to ring fence the NHS budget, it is obvious that the service will be affected in some way. Therefore making the best use of doctors and nurses time on wards and enabling them to treat patients quickly and effectively is key. As the GS1 UK research suggests, simple changes to the way hospitals organise wards and promote staff communication can have a major impact on the quality of patient care given by doctors and nurses.

At the root of this communication is the demand from medical professionals for more real-time accurate, electronic data. The use of GS1 standardised bar codes and RFID technology has been shown to reduce errors, track medication, improve the quality of patient care and prevent counterfeit medication from entering the NHS supply chain. In turn, from an operational perspective, there are real efficiency gains including less paperwork, reduced manual processes, automatic stock replenishment, reduced time wasted by inaccurate data sharing, access to centralised, accurate and standardised data. This means that doctors and nurses can spend less time on administration, and more time with their patients.

Technology in Action

There are several examples of hospitals who have successfully implemented simple technologies and GS1 UK standards to save money and improve their processes.

Leeds Teaching Hospitals – Automated stock control
Leeds Teaching Hospitals implemented an automated stock control system which reduced stock levels by £570,000 while improving the service level to 98 percent over the last three years. This has released significant nursing time from routine stock matters to direct patient care and improved the hospital's efficiency. Leeds identifies 3,000 medical items including consumables and implanted products using GS1 bar codes which are scanned at its 270 stocking points throughout the hospital.

Wythenshawe Hospital – Electronic asset tracking
The use of GS1 bar codes to track and trace surgical instrument trays at the hospital has improved traceability of the decontamination process and enabled staff to store historical information on individual instruments electronically. This information can be accessed easily in the unlikely event of a recall proce-

dure. The tracking system also ensures that the right trays are returned to the right hospital or department from its outsourced decontamination facility.

Airedale NHS Trust – Bar coded patient wristbands
Following national guidelines for patient wristbands from the National Patient Safety Agency's Safer Practice Notice (SPN 24) and the NHS ISB Advanced Notice, Airedale has implemented a system that prints and positively identifies patients at their bedside using GS1 bar coded (Datamatrix) wristbands in 27 of its wards. The hospital is currently working on using the unique patient ID to ensure accurate labelling of blood samples and also for medication prescribing.

Mayday Healthcare NHS Trust
– Electronic blood tracking and patient wristbands
Mayday Healthcare NHS Trust have implemented bar coding and RFID technology for its electronic blood tracking pilot to track blood from ordering through to sampling and transfusion. This helps ensure the right blood is administered to the right patients. The trust has adopted GS1 standards for its passive RFID enabled patient wristbands using unique GS1 codes to help ensure positive patient identification.

Now is the Time to Revitalise

With a reassessment of public spending and a government focus on exploring new methods, now is the right time to think about how to revitalise the NHS. The results of the GS1 UK surveys show that doctors and nurses are clear about what the fundamental issues within the NHS are, and how they can be resolved. The simple solutions they suggest and the previous success stories of these technologies being implemented, show that other healthcare institutions should be following suit to increase efficiency, reduce costs and most importantly improve patient safety.

What's the First Step?

The first step is to become a GS1 UK member, which is free for all NHS Trusts in England. GS1 data standards underpin all of the technologies that front line health staff are asking for, enabling the systems to operate at their best. The Department of Health fully recommends the use of GS1 standards throughout the healthcare system in the UK. It is an important part of their 'Coding for Success' policy. Members of GS1 UK are inducted into the use of global and interoperable standards within their hospital, and gain free access to implementation guidelines, education modules and dedicated experts in their field.

They also have the chance to define GS1 UK healthcare standards through working groups. With all of these resources to hand, there is no reason why the NHS can't be cost effectively revitalised with improved patient care and greater efficiency.

To download the full GS1 UK survey report on hospital doctors and nurses please visit **www.gs1uk.org**

E-HEALTH IN SUB-SAHARAN AFRICA
Beyond the Hype

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"E-Health has the potential to be of great benefit to Africa if it can be planned and implemented in an appropriate and sustainable manner." Statements like this are heard at many conferences and meetings around the world, but what is the reality on the ground in sub-Saharan Africa?

One only has to look at the substantial amounts of money already spent on attempts to get electronic health systems going in the developed world and the low uptake of telemedicine internationally to ask why there is the expectation that things will be different in poverty stricken countries in Africa. Some tough questions need to be answered before embarking on e-Health in Africa. For example, is expenditure on IT for e-Health morally justifiable in the absence of hard economic data on the benefits of e-Health in the developing world?

The Dilemma of the African Politician – a Scenario

Put yourself in the position of a minister of health of a hypothetical sub-Saharan African country. Like most countries in Africa, your country is very poor. It is five years since the civil war that left much of the country's infrastructure damaged or destroyed. Many health professionals fled during the conflict and have not returned. The medical school lacks specialist staff and modern diagnostic equipment. Malaria, tuberculosis and HIV/AIDS are rife. Adding to the problem, refugees from one of your neighbours are fleeing the civil war in their country for the sanctuary of your now stable nation and adding to the burden of disease.

Donor agencies and international foundations are expressing confidence in the vision of the Government by supporting many projects in health, based on individual diseases. The international cell phone service providers see a new market opening up and are investing in infrastructure. You have a health policy that offers promise but which will be dependent on donor funding for some years to come. Your colleagues in Government have just finished the national ICT strategy and in general the country appears to be doing well. There is however the nagging issue of the health related Millennium Development Goals, reduction of maternal mortality, infant mortality and infectious diseases. Unfortunately even after 5 years of peace, you have not made any meaningful inroads on any of these. Indeed peace has lead to the reproductive rate increasing with associated increases in maternal and infant mortality.

At a recent regional meeting of Health Ministers, colleagues whose countries are members of the British Commonwealth, were talking about the Commonwealth Health Ministers' Meeting focussed on e-Health, subsequent regional meetings on e-Health and their plans to work on e-Health strategies, something which you do not have. You are surprised because e-Health is not part of the current African Union Health Ministers' Plan which you signed recently and you can't recall e-Health being part of the NEPAD Health Strategy. You are reminded that a few years ago, towards the end of the unrest, the World Health Organisation called on member nations to develop an e-Health strategy and to ensure that there was an adequate telecommunications infrastructure.

> *"Some tough questions need to be answered before embarking on e-Health in Africa. For example, is expenditure on IT for e-Health morally justifiable in the absence of hard economic data on the benefits of e-Health in the developing world?"*

But where do you get started? Several of the donors and NGO's have set up electronic systems to monitor their Aids and TB related projects and you had a deputation of District Health Managers in your office just the other day complaining that staff is unhappy about having to enter patients data and test results in four different electronic systems.

The time has come to look at e-Health and make informed decisions.

E-Health – the Promise?

Which aspect of e-health offers Africa the most promise? Is it a functional electronic district health system, an electronic pa-

tient card, a health portal, a health information system, an electronic patient record, an electronic medical record, store and forward telemedicine, synchronous telemedicine, robotic surgery, home monitoring, home care, tele-education or surveillance. All are e-Health needs that have been identified in the developed world.

The e-Health requirements and aspirations of countries vary, and this is exemplified in the e-Health road maps of the European Union member nations. Likewise, it is expected that there will be variations in the needs of African countries. These may differ markedly from those of developed nations because health issues in the developed world and the developing world are different. The developed world is grappling with the problem of increasing healthcare costs and keeping ageing populations out of hospitals. The developing world faces a disproportionately high burden of disease, growing populations, poverty, and shortages of healthcare workers.

The term 'developing world' is unfortunate as it includes both emerging giants like China, Brazil and India and also the poorest of the poor countries, home to the 'bottom billion' people. e-Health solutions for the emerging nations may well be different to those of the non-developing nations. It is the people of the bottom billion who are most in need of the potential benefits offered by e-Health and who are least likely to derive these benefits. All of sub-Saharan Africa's countries are categorised as developing and many countries are part of the unfortunate bottom billion family.

Africa's Health Problems

The World Health Report of 2006 succinctly stated the health problems facing Africa and sub-Saharan Africa in particular, "…Africa has 24 percent of the burden (of disease), but only 3 percent of the health workers commanding less than 1 percent of world health expenditure" and that the "exodus of skilled professionals in the midst of so much unmet health needs places Africa at the epicentre of the global health workforce crisis." In 2005, the World Health Assembly saw e-Health as a possible way of addressing some of these problems and resolution WHA58.28 called on member nations to develop long term e-Health strategic plans, provide necessary telecommunications infrastructure for e-Health and establish national centres of excellence. The WHO Global Observatory for e-Health report of 2006 suggested that, "It may be time to put forth the concept of 'e-Health for all by 2015' as an addendum to the Millennium Development Goals." It also noted the need for an international knowledge exchange network to share practical experiences on the application and impact of e-Health initiatives, the use of e-learning programmes and the inclusion of e-health courses within university curricula.

While the World Health Report identifies the problems of disease burden, the health workforce and budget in Africa, it does not mention technological and other obstacles to the implementation and uptake of e-Health solutions in Africa or the effect of population growth. These need to be examined in more

detail to better understand the potential use of e-Health and the obstacles to its sustainable use.

Poverty

All of sub-Saharan Africa's Countries are poor, the percentage that governments spend on health is relatively low and the resultant budgets are very small. The median government budget for health is US$ 14.00 per capita per annum which when corrected for purchasing power parity equates to US$ 32.00 per capita per annum. With budgets like these, salaries in Government hospitals and clinics are low, modern diagnostic equipment is scarce and drugs are in short supply.

> "The use of free and open source software is now seen as the logical approach to the development of health information systems in sub-Saharan Africa."

What then is available for e-Health? A working figure is that Governments spend about 2 – 2.5% of their health budgets on healthcare IT and communications technologies. Based on the median spend in sub-Saharan Africa this is US$ 0.28 – 0.35 per capita per annum which, after taking purchasing parity into account is US$ 0.64 – 0.80 per capita per annum.

What can be done with a budget at this level? Clearly expectations of what e-Health can offer have to be tempered by the reality of the available budget, careful reflection on the opportunity cost of using this money for e-Health and the recurring costs of ownership? What hard data are there to support the change to e-Health in the developing world: very little. What of the cost of change management which can be a 40 – 60 percent overhead on the infrastructure cost? The ultimate question becomes, what e-Health activity will benefit the most people?

Population Growth

While many developed countries face stagnant or negative population growth, Africa continues to grow rapidly. The United Nations Population Division forecasts the population of Africa to increase by over a billion people by 2050. Who is going to treat this growing and by inference, young population? Is there capacity to offer adequate care to the mothers and their children while at the same time addressing infectious diseases?

Human Resource Issues

The shortage of health professionals is already dire. Twenty-eight countries have ten or fewer doctors per 100,000 people and 35 countries have fewer than 20 doctors per 100,000 people. Germany, Italy Norway and the United Kingdom there are 340, 370, 380 and 230 doctors per 100,000 people respectively. While there are moves to increase the production of doc-

tors in Africa, it is often forgotten that when there is a short-age of doctors there is also a shortage of doctors to teach doc-tors. It is not uncommon for medical schools to have no spe-cialists in some disciplines and in some countries there are no specialists in certain fields. Who then teaches these special-ties at undergraduate and specialist trainee level? In South Africa with 80 doctors per 100, 000 people, approximately a third of all academic posts at medical schools are said to be vacant. It is also forgotten that in order to produce more doctors, the school system has to be able to produce enough people with sufficient basic education and of sufficient calibre to enter med-ical schools.

Some solution has to be found to build the capacity to devel-op capacity in sub-Saharan Africa.

Effects

In some countries maternal mortality and infant mortality rates have increased as already overstretched health services are unable to cope. Little progress has been made in reducing HIV and tuberculosis while inroads have been made in combating malaria through recent campaigns to provide chemically treat-ed mosquito nets. It is unlikely that any African country will achieve its health related Millennium Development Goals and for the foreseeable future there will be large numbers of chil-dren being born and mothers and children dying because of in-adequate human resources.

Telemedicine as a Solution?

Telemedicine offers an obvious solution to some of the clinical problems associated with a shortage of doctors. Information travelling through the Internet knows no borders. Rural patients can be treated at a distance in their own country and patients can receive specialist services from doctors in other countries. Why then is telemedicine, both store and forward and synchro-nous, not being widely used in sub-Saharan Africa and more particularly why are the free international humanitarian servic-es not used?

An example is the Swinfen Charitable Trust which offers free store and forward telemedicine services to 153 hospitals and clinics in 50 countries around the world. Hospitals and clinics in 13 African countries have used the service. Data from 2007 show that only 7 of 206 cases referred that year, were from 6 African countries and of the 6 doctors who referred cases, only one was a local national.

Why is use of a free service low? Possible reasons for this are: cost, lack of infrastructure or access to infrastructure, ig-norance, workload, lack of training, issues of remuneration and legislative and policy barriers.

Workload

Workload is seldom mentioned as a barrier to the implemen-tation of telemedicine but it is when there is shortage of doc-tors. Telemedicine adds steps to the normal workflow of both the doctors and nurses at the send and receive sites. It is not uncommon to be told by doctors that, "Telemedicine is a nice idea but I don't have time to do it. I'm too busy."

Connectivity

Connectivity is a pre-requisite for telemedicine. Africa missed the benefits of the dotcom boom when widespread deployment of cable occurred in the developed world. It not only missed the dotcom boom, it missed the plain old telephone generation. Fixed line telephone penetration in Africa is only 1.4 percent. Most Internet service providers use fixed phone lines for Inter-net delivery. It is not surprising therefore that internet penetra-tion in sub-Saharan Africa is low, in the region of 4.5 percent compared to Europe 52 percent and North America 74 percent.

In the developed world, fixed broadband is replacing dial-up ac-cess. Broadband connectivity is essential for synchronous telemedicine services. It has been identified as a prerequisite for e-Health services in Europe, and the United States is final-ising a national broadband policy.

The situation in Africa is somewhat different with fixed broad-band penetration at less than 0.1%. Mobile telephone broad-band access is in the region of 0.9% but its use is limited by the high cost of mobile phone access. Lack of broadband re-mains an obstacle to synchronous telemedicine in the Africa.

Country	Rank	Telephone	Mobile Cellular	Fixed Broadband
Niger	161	47.0%	55.7%	966.7%
Nigeria	141	5.9	10.7	108.6
Angola	120	5.8	3.8	54.7
Canada	11	0.5	0.5	0.7
Luxembourg	5	0.4	0.2	0.6
China	1	0.3	0.1	0.3

Table 1. The cost of a basket of telephone, mobile cellular and fixed broadband services expressed as a percentage of monthly GNI per capita. (Derived from ITU)

In part this is due to the low fixed telephone line penetration which limits the use of asymmetric digital subscriber lines (ADSL).

Per capita bandwidth is very low. In 2008, Africa had 12 Gbps of international bandwidth which is less than a third of that of India. New undersea fibre optic cables are coming online on the East coast of Africa and new cables are planned for the West coast. These will improve per capita bandwidth and are expected to reduce costs. Currently there is a large disparity in bandwidth per capita in sub-Saharan Africa with landlocked countries still dependent on expensive satellite access.

Communication Costs

The ITU has developed an ICT Price Basket and ranks 161 countries on the basis of a set of standardised fixed phone line telephony, mobile cellular, and broadband services and describes these in terms of relative cost, expressed as a percentage of the average monthly gross national income (GNI) per capita. Nineteen of the most expensive services are in countries in sub-Saharan Africa. Some examples of costs of sub-Saharan African and developed nations are shown in Table 1.

Broadband costs vary greatly. In the Central African Republic, Ethiopia and Malawi the monthly cost of the ITU bundle for fixed broadband services, is 39, 21 and 20 times the average per capita GNI per month. Broadband access exceeds the monthly GNI in 22 African countries. This is due in part to poor fixed phone line penetration and the resultant need to use fixed leased lines like WDSL and SDSL for broadband access rather than ADSL through a fixed phone line. Although costs continue to fall, they remain too high. This is a barrier to further uptake of healthcare IT in sub-Saharan Africa and may further increase the digital divide. Broadband connectivity costs are therefore a major obstacle to e-Health, especially synchronous telemedicine.

Mobile Telephony

It is frequently said that Africa has jumped the fixed phone line generation and has moved directly to mobile phones. Large annual growth in mobile phone penetration is reported annually. It must be remembered that this is off a low initial base.

Mobile phone penetration is now estimated to be in the region of 32 percent. Mobile phone penetration has increased access to rural communities with over 40 percent of the rural population covered by a cell phone signal in 2006. Of these areas only 3 percent have fixed telephone connections.

Health Informatics

Telemedicine is seen as a partial solution to the clinical needs of Africa, but what of district health information systems, hospital information systems, electronic medical records, electronic patient records and surveillance? Most sub-Saharan African countries are in the fortunate situation of having few if any electronic health information legacy systems.

They are, however, faced with another problem, that of vertical programmes and data duplication. Many international donors support disease specific programmes and require patient data capture and programme reporting in specific formats. It is not uncommon for the same patient's information to be entered several times in different systems in the same hospital or health system if for example they have had malaria, are HIV positive, on antiretroviral therapy and have tuberculosis. It is seldom that data can be moved freely from one system to another.

> *"The term 'developing world' is unfortunate as it includes both emerging giants like China, Brazil and India and also the poorest of the poor countries, home to the 'bottom billion' people."*

This vertical approach is a problem for Governments which, because of their dependence on donor funding to benefit their people, do not have enough power or influence to force donors to adopt a uniform system of data capture and reporting system in their country. This also leads to situations in which disease specific health information systems are written in proprietary software without any attempt to standardise data formats so that data can be shared between systems.

The use of free and open source software is now seen as the logical approach to the development of health information systems in sub-Saharan Africa. The Health Information System Programme (HISP) and the Open Medical Record System (Open MRS) are examples. Open source solutions are however a double edged sword; the end user is not committed to an initial purchase cost and subsequent upgrades but the open source developers are not beholden to an employer to provide support or software fixes.

There are other problems. Paper based district health information systems do not function well in sub-Saharan Africa. Data capture is erratic and often incomplete and time to analysis long. In most African countries there is not a culture of data acquisition, analysis and interpretation. The problem is exacerbated when data are captured electronically as people do not see the need to change the way they do things as in many instance they do not see the benefit of change. Internet penetration in Africa is low and computer literacy is also low. As a result, computer training is often required before electronic data capture can begin and training may have to be repeated as staff change.

> To be concluded in Issue 5.

FLUID DATA MANAGEMENT IS THE CURE FOR STORAGE HEADACHES AT GALWAY UNIVERSITY HOSPITALS

AUTHOR

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Within the Republic of Ireland's Health Service Executive (HSE), small teams of dedicated IT professionals face a constant challenge to maintain the systems that enable thousands of different health and social services to be delivered in hospitals and communities all over the country, 24 hours a day. In this environment, innovative technology solutions that help alleviate and automate the burden of data management make an enormous impact.

Coping With the Data Explosion

The last few years have witnessed nothing short of a data explosion in the health sector. The Galway University Hospitals are a prime example of the impact of such a surge.

Galway University Hospital is one of the major academic teaching hospitals in Ireland, made up of University Hospital Galway and Merlin Park University Hospital Galway.

Our two constituent hospital facilities provide secondary, regional and cross border services for the HSE. We have nearly 40 departments, ranging from haematology to hepatology, cardiology to geriatrics. Each of these departments demands multiple complex IT systems, and each of these systems has its own server and storage requirements, ranging from clinical databases, patient data, and file and print. I and my colleague Richard Malone, GUH's server and storage manager, look after all of these server and storage requirements.

When HSE began incorporating facilities in Galway into one overarching management unit, scalability, flexibility and ease of use were vital requirements in the technology evaluation process. Our own IT team is very small, employing no more than five technical operatives at any one time, so we have to cut our cloth to fit our resources. That's why when we look to deploy new technology; we have to select solutions that are intelligent and intuitive while also being manageable by any member of our team. We need something that will work straight out of the box without the need for hand-holding.

The move to a consolidated, virtualised server environment only accelerated the need for true storage virtualisation. Legacy storage systems couldn't cope with the allocation needs of the virtualised machines. The hospital departments were unable to accurately estimate their ongoing storage requirements – some of our bespoke clinical applications were only using a fraction of their estimated allocation while others were using more than expected and hitting their assigned limits.

As a result, the team and I spent the majority of our time administrating and fire-fighting issues arising from storage concerns. The wastage of disks and complex out of hours' storage were particular issues. By June 2008, our storage levels were at a critical level; not only were we on the verge of running out of storage, but we were close to capacity on the storage area network (SAN) we were currently using.

Our problems were compounded further by the fact that our existing SAN was also past its end of life and could not be upgraded. Our only option was to buy a new one. However our incumbent SAN vendor was unable to make the necessary reassurances that an expansion project wouldn't simply run into the same problems again after a few years. It was time to find a permanent solution that could help the GUH break free from the boundaries of its legacy storage environment.

Breathing New Life into the Storage Environment

The team and I searched for a solution to resolve five key storage issues. These were:
1. Easy administration that would relieve some of the burden from an overworked team.
2. Smarter storage allocation for a wide range of departmental needs.
3. Scalability for the foreseeable future without 'rip and replace' expansions.
4. No fear of an end-of-life full upgrade for at least the next five years.
5. A more efficient SAN that reduced day-to-day running costs.

After approaching and considering solutions from more than half a dozen leading SAN technology providers, HSE Galway University Hospitals chose to implement a virtualised storage solution from Compellent.

We made this decision after the fluid data technology capabilities of the SAN won the team over. This new storage framework could also be utilised through the entire organisation, and for me

features

in particular, the ease of management promised from such a flexible and powerful system was the key factor behind our switch.

Another compelling benefit was that we could get a huge array of advanced features and expansion possibilities with fewer overheads. With the new SAN we have been able to reduce the ever increasing costs associated with managing a storage infrastructure. These costs are usually made up of: data centre space, power and cooling, acquisition costs and the cost of storage administrators.

Immediate Efficiency Benefits

Having installed the solution, the team and I have found immediate efficiency benefits. Fluid data technology such as advanced thin provisioning automatically optimised capacity utilisation for the hospital. Today, Galway University Hospitals are able to expand their storage capacity on demand without over-purchasing upfront. In fact we have eliminated the need to pre-allocate storage and server space altogether.

As our data requirements grow, we can add more drives on the fly without any downtime. The system's thin provisioning technology has proven extremely effective in maximising capacity utilisation across such a diverse and departmentalised infrastructure. This feature of the new storage solution radically reduced the number of disks that the IT department needed to purchase. The new SAN only consumes disk space when data is actually written, which therefore results in less storage being taken up, but this does not sacrifice overall performance. Since implementation, the hospital's average disk utilisation has increased by 30 percent.

At the same time, the automated tiered storage functionality optimises data placement and increases performance. The solution's built-in intelligence classifies and dynamically migrates block-level data to the ideal tier based on usage patterns. As a result, we can now store infrequently accessed data on lower-cost SATA drives.

Today, 70 percent of all of our data has migrated to lower tiers that are SATA drives. The new system's fast track technology has also ensured that the most frequently accessed critical data is always located on the outermost, fastest tracks of our top-tier fibre channel drives. If our storage requirements continue to expand at the estimated 20 percent each year, the hospital will realise huge benefits by scaling with SATA drives rather than the more expensive fibre channel drives.

Achieving Peace of Mind With Fluid Data Management

To further increase operational efficiency within the IT system, the system's advanced storage virtualisation has proved to be the perfect complement to our VMware virtualisation environment. The new system creates a smart, shared pool of storage resources that streamline administration for the hospital's physical servers. This fluid data management allows the team and I to provision new virtual servers and dynamically allocate resources across that pool of virtual machines as demands dictate.

HITM ANALYSIS –
BULGING AT THE SEAMS: HEALTHCARE DATA

Hospital data centres are no longer tucked away in departmental basements – out of sight, out of mind. They have moved to the hub of hospital management concerns, driven by both techno-operational factors as well as the explosion in healthcare data. Much of this is required for clinical decision making, often in real-time.

Today's data centres are also increasingly centralised, and space is becoming a premium. So is power. Though newer technologies permit storage of far more bits and bytes per cubic metre, they also generate much more heat – and require dedicated cooling solutions—which use both extra power and space. As hospitals grow or rationalize, those who prepare pathways for their data centre requirements will be best positioned for the future – in both operational/financial as well as clinical terms.

The IT team at Galway University Hospitals now manages an environment consisting of 52 virtual servers and 20 physical servers. By deploying a virtual data centre, we were able to more effectively manage our data centre resources and shrink our data centre footprint through reduced expansion costs and facility limitations. Crucially for our bottom line, this means that we save significantly on disk costs.

From a human resource perspective, the new SAN solution is much easier to administer; which frees up administrators time and eliminates the need for extensive out of hours or weekend work. While the team used to spend four hours a week solving storage administration issues, we estimate that we now spend less than one hour a week managing the new SAN. With so much more time at our disposal, we can now return to our key focus: working to provide the most secure and efficient environment to enable our staff to carry out the best possible care for all of our patients.

As a final benefit, through using less physical servers we have significantly reduced our power and cooling costs, enhancing our green credentials in doing so. Using the SAN's enterprise manager resource management software, the IT department is able to view a 'Green Report' a powerful tool to assess energy and CO2 costs emissions. For all these reasons, we are now working towards 100 percent data centre virtualisation across all departments.

After installing the new system, it is clear that data management is, quite simply, a whole lot less stressful. There is more sanity and space in the data room and more services are coming onboard across the virtualised environment to support medial certification requirements.

The IT team and I can now rest easy knowing we have a simple yet advanced up to date solution, but also the flexibility and facilities for future growth. Overall, our experience with our new storage architecture has been ten out of ten.

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Overview

THE HEALTHCARE SYSTEM IN NETHERLANDS

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Radical healthcare reforms in the Netherlands in January 2006 saw the State replaced as the central player in day-to-day operation of the healthcare system by private health suppliers. Alongside, the difference between public and private health insurance was abolished, and all adult residents were obliged to purchase basic health insurance from a private firm.

The basic package – based on an officially set premium – covers medical and dental care, hospitalisation, and a variety of medical appliances, pharmaceuticals and paramedical care. Complementing insurance can be purchased by individuals to cover requirements beyond the basic package; insurance companies are, however, free to set prices, and, unlike the basic package, can reject applicants.

In spite of some early complaints that reforms would change the character of the healthcare system in the Netherlands beyond recognition, the Dutch are positive. The percentage of people who believe that the country's health care system functioned well has fallen only slightly – from 45 percent before reforms to 42 percent according to the government's latest survey.

Structure of the System: Changing Roles and Responsibilities

The sweeping reforms of 2006 engendered a fundamental shift in the structure of the Dutch healthcare system. Nevertheless, in spite of the new dominance of the private sector and the transfer of responsibility to private insurance firms, healthcare providers and patients, the government retains a strong residual role in ensuring universal accessibility and affordability as well as ensuring the quality of healthcare.

A variety of new statutory and semi-official watchdog agencies have since been set up or their powers strengthened. They aim at avoiding the undesirable effects of over-reliance on market forces. Backing this is a legacy of self-regulation which characterised the Dutch healthcare system since the Second World War. Professional associations are responsible for re-registration schemes and are involved in quality improvement, for instance by developing professional guidelines.

Furthermore, in long-term care as well, increased competition among providers of outpatient services is changing the system considerably. The delegation of responsibility for domestic home care services to the municipalities has resulted in more diverse care arrangements.

In the aftermath of reforms, the Dutch health insurance system consists of three distinct components.

1. A compulsory SHI (social health insurance) system, regulated by the Health Insurance Act (Zorgverzekeringswet) and covering the entire population for 'basic' healthcare. This is defined as essential curative care on the basis of demonstrable efficacy and cost-effectiveness, alongside an allowance to (partly) compensate lower incomes during their treatment. All Dutch residents contribute in two ways: a flat-rate nominal premium, paid directly to the health insurer of their choice; an income-dependent employer contribution deducted from their pay and transferred to the Health Insurance Fund which allocates resources among the insurers according to a risk-adjustment system.

2. A second compulsory social health insurance (SHI) scheme for long-term care, and covering those with chronic conditions. This is regulated by the Exceptional Medical Expenses Act (Algemene Wet Bijzondere Ziektekosten, AWBZ), and principally financed through income-dependent contributions. Payouts are regulated by (a rather complex) cost-sharing system and follows a formal medical assessment. Care is provided by dedicated care offices (Zorgkantoren), which are closely allied to health insurers.

3. Complementary voluntary health insurance (VHI), which covers services excluded under the two above components.

Preventive healthcare and social support are financed through general taxation. According to the WMO Social Support Act, certain forms of home care are the responsibility of municipalities. These directly purchase the home care services from providers.

Certain municipalities have, however, developed their own regulations on eligibility and needs assessment, in some cases by outsourcing the process to the Centre for Needs Assessment (CIZ).

Primary Healthcare

In the Netherlands, general practitioners (GPs) function as gatekeepers for patient referral to specialists. All patients are listed with a GP. GPs thus play the key role in primary care in the country, a relatively rare situation compared to other continental EU countries – but with parallels to the UK.

Patients are free to choose and register with a GP and can also switch to another freely. GPs, however, retain the right to refuse a patient, principally if their rosters are too full, or should a patient live too far from their practice. This is crucial since patients access care out-of-hours (at the night and weekends) through so-called GP Posts (cooperatives of practitioners). The latter, in turn, also have a gatekeeping function for emergency care. Indeed, in certain cases, emergency care can be provided by GPs without referral to a hospital.

Nevertheless, the GP gatekeeper system is unhampered by logistics – given the demographic density of the Netherlands. According to a 2009 study by the National Institute for Public Health and the Environment, nearly 100 percent of the Dutch population can reach a GP within 15 minutes from their home. The central role of GPs dates back to efforts by the Dutch government in the 1980s to reduce fragmentation in the delivery of primary healthcare, which traditionally involved not only GPs but also pharmacists, psychologists, physiotherapists, nurses and midwifes.

However, after the 2006 reforms, the government has sought to reverse course and dilute over-dependency on GPs. Although the GP remains the key figure in the fabric of primary care, several tasks have been shifted towards other providers, most crucially specialised nurs-

es. Since 2007, the latter have been allowed to prescribe medication – although diagnosis has to still be made by a physician. Overall, practice nurses have begun to play a major new role in general practice. Practice nurses take care of several categories of chronically ill, (chronic obstructive pulmonary disease, cardiovascular diseases, as well as diabetes.

Meanwhile, physiotherapists and other categories of remedial after-care providers have also became directly accessible to patients, while occupational doctors have acquired eligibility to refer patients to secondary care.

In the Netherlands, patients contact their GP five times per year on average – well below the World Health Organisation's Europe average of 7.9 and the EU-12 average of 7.7 in 2007. During the same year, 41 percent of the population had an average of 1.8 contacts with a medical specialist. Just over 10 percent were admitted to hospital.

Hospitals in the Netherlands

The Netherlands has 93 healthcare organisations, covering a total of 141 hospitals and 52 outpatient clinics.

Hospitals provide secondary care, almost always after referral from GPs – as well as 24-hour emergency wards, to which access is obtained by both referrals and via public services such as the police and ambulance services.

Care is provided at both in-patient and outpatient departments (which also provide pre-hospitalisation diagnosis as well as post-hospitalisation follow-up). Apart from general hospitals, these include the following:

⬎ 8 university hospitals
⬎ 98 so-called categorical hospitals (for treatment of conditions such as renal failure, asthma, epilepsy)

		Date
Population (million)	16.39	2008
Live births/1,000 pop.	10.7	2007
Deaths/1,000 pop.	8.7	2007
Life expectancy (years)	80.2	2007
GDP (billion Euros: 2006)		
Total healthcare expenditure (% GDP)	9.8	2007
Total healthcare expenditure per capita (PPP dollars)	3,837	2007
% of healthcare system financed by public funds	NA	
Number of hospitals (per 100,000 inhabitants)	0.86	2008
Number of CT scanners (per million inhabitants)	12.3	2007
Number of MRIs (per million inhabitants)	8.8	2007
Number of acute care beds (per 1,000 inhabitants)	3.0	2007
Length of stay (average in days)	6.3	2007
Number of physicians (per 1,000 inhabitants)	3.9	2007
Number of nurses (per 1,000 inhabitants)	8.7	2007
Percentage of households with Internet access	86	2007
Percentage of households with broadband Internet access	77	2007
Percentage of individuals using the Internet for interacting with public authorities	54	2008

Source: European Central Bank, OECD, WHO, EU Commission.tional Telecommunications Union (for Internet statistics).

country focus

HOSPITAL BEDS PER 1,000 INHABITANTS IN THE NETHERLANDS: **2000 – 2007**

	2000	2001	2002	2003	2004	2005	2006	2007
Acute care	3.5	3.3	3.2	3.1	3.1	3.1	3.0	3.0
Psychiatric care	-	-	1.3	1.3	1.3	1.3	1.3	1.3
Chronic care/other	-	-	0.1	0.1	0.1	0.1	0.2	0.2
TOTAL	5.2	5.0	4.6	4.5	4.5	4.5	4.5	4.5

Source: OECD, 2010, and data from Ministry of Health, Netherlands

⤵ 120 independent treatment centres or ZBCs (providing elective, non-acute surgery via one-day admissions for conditions such as varicose veins, cataracts etc.)

⤵ 50+ specialist referral centres (specialized in areas such as organ transplantation, IVF, cancer, and linked to university hospitals)

⤵ 10 trauma centres, most of which are again linked to a university hospital or a group of university hospitals.

Most Dutch hospitals are non-profit institutions. Since 2008, however, the Dutch government has authorised a certain number of pilot projects which pay part of profits to shareholders. The scheme, which remains a topic of contentious debate, is part of the follow-up to the 2006 reforms, and seen as a means to generate investment for quality improvement and innovation. Since 2006, the government has abolished central planning of healthcare facilities; each institution has been given the mandate to develop its own capacity planning strategy.

Meanwhile, legislation to counterbalance 'over-marketization' of the hospital – in terms of a new corporate structure called a 'social enterprise' – is under discussion. Under such a structure, strategic decisions on quality and continuity of care will contin-ue to be reserved for the hospital's professional management and supervisory board.

Such concerns may not be wholly out of place. The quasi-marketisation of the Dutch healthcare system has resulted in the beginning of some vertical integration between different players. Although the legality of such moves remains disputed and their scale small, some health insurers have begun to open pharmacies and healthcare centres (one has made a bid, in a consortium, for taking over a hospital).

Bed Numbers

In 2007, licensed hospital bed availability in the Netherlands was 4.5 per 1,000 inhabitants. Of this, 3 beds (67 percent) were in acute care – a ratio which has remained steady since the year 2000. Psychiatric care accounted for the bulk of the remainder, with 1.3 beds per 1,000 inhabitants (a share of 29 percent of total beds).

In terms of numbers, the average hospital in the Netherlands has about 560 beds. The total number of beds in general acute care hospitals amounted to just under 45,000 and in academic hospitals about 6,600.

The variation per hospital was significant, between 135 and 1,350, while the larger academic hospitals showed far higher consistency In the same year, the size of gen-eral acute care hospital organisations varied between 138 and 1368 beds per hospital. The variation in availability in academic hospitals was much smaller: between 713 and 1307 beds.

Compared to other European countries, the number of hospital beds in the Netherlands is below the EU average. The rate of 4.5 per 1,000 compares to seven to eight in neighbouring Belgium and the Netherlands or France, and is closer (but slightly ahead of the 3.5 in Denmark, Norway and the United Kingdom).

Nevertheless, as in most European Union countries, the number of hospital beds in the Netherlands has been steadily dropping, by over 15 percent since the year 2000 – from 5.2 per 1,000 to its present 4.5. In terms of acute care bed capacity, the number has also been steadily dropping – although, as noted above, their share in total hospital bed capacity has been roughly the same.

These trends are driven by a combination of similar factors as elsewhere in the European Union.

Firstly, spiralling healthcare costs have drawn attention to one of its largest components – length of stay, and there has been a rapid rise in the efficiency of use of bed capacity. Adding force to such a trend is the increase in availability of minimally

HEALTH SPENDING IN THE NETHERLANDS: **THE NUMBERS**

	2000	2001	2002	2003	2004	2005	2006	2007
Health spending as share of GDP in %	8.0	8.3	8.9	9.8	10.0	9.8	9.7	9.8
Health expenditures per inhabitant in USD (PPP)	2,337	2,555	2,833	3,099	3,310	3,450	3,611	3,837

Source: OECD, 2009

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invasive surgical techniques, which not only reduce length of stay in several interventions – but also permit one-day stays (a key factor underlining the presence of the 120 ZBC independent treatment centers). In 2009, Statistics Netherlands reported that approximately 46 percent of all hospital admissions were one-day admissions.

Secondly, treatment of chronically ill patients is increasingly being delivered in a patient's home – and this is helped by enhancing the responsibility and mandate of specialist nurses (as discussed previously). In 2003, the Ministry of Health, Welfare and Sport announced its goal of reducing the number of acute care beds per 1,000 inhabitants to approximately 2 in 2015. Nevertheless, after the 2006 reforms and the subsequent elimination two years later in central planning for hospitals, it is the latter themselves which are seeking such a goal.

Trends in Hospital Stay

The length of hospital stay in the Netherlands has traditionally been above the EU average (with the notable exception of Germany). In 2000, the average was nine days, as compared to five in Sweden, 5.6 in France, 7 in Italy, 7.7 in Belgium, 8.2 in the UK - and way above Denmark's record of 3.8 days.

Such a state of affairs was due to several reasons. A near-scandalous level of waiting lists meant that patients needing continued care in a long-term care institution were forced to stay longer in acute hospitals. In addition, the Netherlands was late in seizing the possibilities of transferring patients from hospital to a home care setting – the subject of an in-depth study by the Board for Health Care Institutions in 2003.

Currently, the average length of hospital stay has fallen – especially sharply over the past five years – to an estimated six days (from nine in 2000). This compares well with fellow-straggler Germany's performance (from 9.2 days in 2008 to 7.8 days in 2007).

As discussed, a key role in such a reversal has been played by the growth in one-day minimally invasive surgical interventions as well as home care.

Healthcare Financing

In spite of the ambitious reforms of 2006, overall health spending continues to rise

in the Netherlands, growing marginally in 2007 to 9.8% GDP from 9.7% the year below. Although this is below the 10% peak in 2004, the share of health spending in GDP – as compared to just 8% in 2000 – has shown no sign so far of a trend reversal. This is due to underlying structural factors, not least an ageing population.

In constant PPP dollar terms, too, the rise in health spending is inexorable. On a per capita basis, between 2000 and 2007, this increased by 65% from just 2,337 USD to 3,837 USD.

Hospital Financing

Since 2005, Dutch hospitals are remunerated through a DRG-modelled system known as Diagnosis Treatment Combinations (DBCs). This involves price and quality negotiations between hospitals and insurers during the contracting process. Free negotiations on price, however, re-

> "The abolition of State planning for healthcare facilities and pilot projects paying part profits to hospital shareholders are radical moves… However, strategic decisions on quality and continuity of care will continue to be reserved for the hospital's professional management and supervisory board"

main confined to just over one-third of contracts, although their share has risen sharply from 20 percent in 2008 and 10 percent in 2005. In addition, capital investments have not been freely negotiable within the DBCs. Instead, the Dutch Health Care Authority (NZa) established a normative compensation. From 2009, capital investments have become part of the negotiation process between hospitals and insurers, but given the impact of the 2006 reforms, the situation remains in a state of flux.

In general, there are no third-party payers for home care. However, some municipalities outsource the settlement of income-dependent cost-sharing requirements to the Central Administration Office (CAK).

Physician Payment

Since the introduction of the 2006 reforms, payment of GPs has undergone a corresponding shift. GPs are now paid in the Netherlands via a combination of capitation fees and fee-for-service.

Private Spending

Out-of-pocket payments have been declining steadily in the Netherlands – from a share of 9 percent of total healthcare spending to 7.1 percent in 2005 and then sharply to 5.5 percent in 2007.

In constant PPP dollar terms, the sum has been stable. It was 213 dollars in 2007, compared to 210 dollars in the year 2000, but down from a peak of 246 dollars in 2005.

Co-payments range from a fixed amount for certain NHS services to a fixed proportion of the cost of a medicine.

Healthcare Staffing

Physician density in the Netherlands has risen steadily in recent years, from 3.2 per 1,000 inhabitants in 2000 to 3.9 in 2007. This is more or less in line with the EU average.

In 2008, there were over 8,800 practising GPs in the country, with an average

2,300 patients each. Just over half of all GPs (51 percent) work in group practices (3-7 GPs), 29 percent work in two-person practices and 20 percent work as sole practitioners. Most GPs are independent entrepreneurs or work in a partnership; some are also employed by another GP.

Latest available data on registered medical specialists date back to 2005, when there were a total of 16,500. The largest categories were psychiatrists (2,500), followed by interns (1,800) and anaesthesiologists (1,250). Within hospitals, approximately 75 percent of medical specialists are organised in (mainly independent) partnerships. On the other hand, university hospitals in particular, have specialists directly employed, and on their payrolls.

In spite of efforts to emphasise the roles and responsibilities of nurses, their numbers have been declining – from over ten per 1,000 in 2000, to 8.7 in 2007. Although this reflects a reasonably satisfactory ratio of 2.2 per physician, nurse numbers will have to be boosted in the Netherlands, ac-

cording to healthcare experts – in order to reduce physician and hospital workloads further, and contain costs. By comparison, nurse density per 1,000 inhabitants in 2007 in Germany was 9.9, in the UK ten, in Sweden 10.8 and in Belgium above 14.

Outlook and Prognosis

The 2006 package of health insurance reforms are seen as the first (albeit giant) step in an ambitious policy agenda on overhauling the Dutch healthcare delivery system. This highlights quality of care as a steering instrument and the promotion of cohesion in the entire care delivery chain (primary care, hospital care, at-home care and ambulatory care).

Towards this, the government aims to continue introducing incremental follow-

on reforms to encourage a greater degree of managed competition. Some of the key steps expected to emerge in the near future include:

⮵ Functional payments across the entire episode of care (rather than on the basis of consultation/enounter) for specific conditions (mainly diabetes and cardio-vascular diseases).

⮵ The aim: to encourage GPs and specialists to work together on ensuring the highest and most cost-effective care, and provide health insurers a more active purchaser role in GP care. Improved DBC system for hospital care by virtue of which diagnoses and treatments will be translated into so-called 'care products'. These would be based on ICD-ten specialty-specific protocols, and result in just 3,000 care products rather than the

current 30,000 DBCs – with a multitude of specialty overlaps and gray zones. The new system would make it easier for providers and insurers to negotiate on the price of care products and the quality of delivered care.

Meanwhile, one of the loudest alarm bells seems to be a looming shortage of healthcare personnel, especially in certain categories. Although more recent figures are unavailable, in 2004-2006, announced vacancies in the healthcare sector increased by 42 percent. 25 percent of these were believed difficult to fill, up from 14 percent in 2004.

Endorsing such concerns is a survey in 2008, which found just 55 percent of nurses and caregivers believing there were enough personnel to guarantee safety. In 2004, the figure was 70 percent.

HEALTHCARE IT IN THE NETHERLANDS

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Healthcare IT in the Netherlands is driven by a combination of political and technological push-pull factors. The political facets in the process are underscored by an explicit commitment to clearing technology barriers astride the pathway to effective and meaningful e-government.

The government's landmark Policy Programme for 2007-2011 noted that: 'ICT applications, the Internet and digitisation are tools that can improve the service provided by the Government, making the Government more accessible. eGovernment also constitutes an important tool for reducing the administrative burden on the general public and professionals.'

e-Health is understood to be a core ICT application and a component within the broader framework of the 2007-2011 Programme.

In 2008, the Government's national ICT agenda identified interoperability and standards – a core challenge for e-Health – as one of five key priority areas to be addressed by administrative and regulatory measures. The year also saw the implementation of Citizen Service Numbers and a growth in the use of DigiD – both of which have relevance for e-Health. Service providers, on their part, also juxta-

posed their offerings on to the State infrastructure, with over two-thirds of government services available electronically by the start of the year.

Establishing and Funding the Foundations for e-Health

Lending more weight to establishing a solid technological foundation, the Government also published a new vision, known as the National Implementation Programme. This covers both the infrastructure required and the flagship projects that will use the latter. The end of 2008 saw a joint declaration signed by representatives of national, regional and local governments to adopt the National Implementation Programme as a joint strategy for the subsequent three years.

These foundations mean that issues of seamless connectivity, interoperability, se-

curity and privacy and above all, the upfront investment required to generate adequate scale will not hamper the takeoff of e-Health in the Netherlands.

EMRs: The Dutch are World Leaders

Such a lift-off seems, in fact, to be around the corner. At the bedrock level, no fewer than 98 percent of GPs in the Netherlands already used an electronic medical record (EMR) by 2008, giving the country a position of world leadership. By comparison, the figure in the US was just 28 percent and in Germany 42 percent. [In Europe, the closest to the Netherlands is the UK, where 89 percent of GPs use EMRs.

Meanwhile, a growing number of Dutch general practices and general practice co-operatives are also getting connected to the National Exchange Point for Electronic Health Records.

Impacting on Quality of Care

EMR data is, in turn, extracted and used to monitor GP care in the country. The LINH Netherlands Information Network of General Practice database holds longitudinal data on morbidity, prescriptions and referrals on about 500,000 individuals, collected from a representative network of about 250 GPs throughout the country. This enables quality-of-care research, whose results are being transferred to set benchmarks and guide health policy.

The maturity of the EMR system in the Netherlands also makes a difference to individual GPs, and their patients. The EMR systems are linked with professional guidelines (updated to reflect latest medical findings and best practices), which GPs can use during a patient consultation.

To optimise drug prescriptions, an Electronic Prescription System (Elektronisch Voorschrijf Systeem, EVS) is integrated into the GP EMR system. The EVS provides advice on pharmacotherapy and patient counselling tailored to individual patients, whose principal primary care provider is the particular GP; as mentioned in the previous section, patients in the Netherlands are tied to specific GPs.

The introduction of the EVS has impacted directly on the practice of GPs. It has improved the quality of prescriptions and resulted in a reduction of spending on medicines.

Hospitals, too, have begun playing a role in providing decision-support electronic data. The LMR National Medical Registry database collects aggregated data from hospitals on admissions, diagnosis, treatment and discharge, as well as any other relevant characteristics of the patient and the hospital. The LMR, in turn, provides data to Statistics Netherlands (CBS) and inputs for research.

Telemedicine: Early Starter

The Netherlands has been an early starter in the field of telemedicine too, with more than 200 telecare projects ongoing by 2009. These are principally in the areas of domotics and personal alarms, and cover an estimated 50,000 patients.

The benefit of telemedicine have been convincingly demonstrated in mental health. It has principally meant an end to the exacerbating clinical challenge of isolation in the mentally ill, both in terms of community – self-help groups, chat sessions etc., as well as intervention – screening to ambulatory assistance or transfer to hospitals before the onset of an acute-phase psychotic episode.

Basic Gaps Remain – The Grind of Scheduling Appointments

Nevertheless, there are numerous challenges ahead, and the Dutch are the first to admit this. Some of these are behavioural, while others involve funding and technology.

For example, although a majority of Dutch Internet users wish to contact their GP (or other healthcare provider) through the Internet, such an option is still rarely used. Making appointments or obtaining prescription refills from GPs via the Internet remains confined to only a handful of GP practices. A study in 2009, found that fewer than 25 e-mail consultations were billed for.

On the other hand, a growing number of hospitals offer patients the possibility to make outpatient appointments with specialists via the Internet. Hospitals are also increasingly becoming Internet-savvy, not least because of post-2006 reform pressures to enhance efficiency in the face of a rise in competition.

For example, the State-supported Website (www.kiesbeter.nl) offers comparative information about healthcare services and data about the record of different hospitals in the treatment of a variety of conditions . Such factors will make insurers more selective in awarding contracts – to the most competitive, and cost-effective hospitals.

Controversies Bedevil the EPD

Unlike the EMR, implementation of a national-level Electronic Patient Record (Elektronisch Patienten Dossier) remains hotly debated. By mid-2009, about 100 health care providers were connected, with some 350,000 individual EPDs available. The eventual catchment area of the EPD is a total of 6,500 interconnected healthcare providers. Its aim is to prevent medical errors resulting from lack of information about a particular patient's medical condition or medication, especially in after-hours or emergency care – which does not involve the usual provider.

EPD's proponents insist that what is at stake is not a central Big Brother database containing private medical data on everyone in the Netherlands, but rather an infrastructure which draws (in a secure/authorised fashion) from the local databases of individual healthcare providers who retain responsibility (as well as control and ownership) of their own database.

EPD access by healthcare providers would be regulated through an electronic

> "The National Implementation Programme seeks to ensure that issues of seamless connectivity, interoperability, security and privacy, and above all, the upfront investment required to generate adequate scale, will not hamper the takeoff of e-Health in the Netherlands."

authentication card, and only allowed if necessary for the treatment of the patient.

The Dutch have a tradition of enthusing and stoking consensus, and providing opt-outs from controversy. Prior to the launch of the EPD, Dutch citizens have been given the right to object to having their medical data (or parts of it) included in the EPD. Physicians too have provisos to exempt themselves from using the EPD.

By 2009, about three percent of the Dutch population had registered opposition to having their private medical data included in the EPD. Opposition from physicians, on the other hand, is far higher. About 35 percent of physicians are believed to have registered their refusal to use EPDs. Other than (long-running) concerns about privacy and safety, physicians also believe an EPD system would be superfluous since interconnected EPRs at the regional level already provide what an EPD would.

Healthcare IT Events

AGENDA **2010 – 2011**

November

RSNA 2010
28 November – 3 December
Chicago, USA
www.rsna.org

MEDICA
17 – 20 November 2010
Dusseldorf, Germany
www.medica-tradefair.com

December

HEALTHCARE IT EXCHANGE
5 – 7 December
Warwickshire, UK
www.healthcareitexchange.co.uk

January

IT @ NETWORKING AWARDS
19 – 20 January
Brussels, Belgium
www.itandnetworking.org

ARAB HEALTH
9 – 20 January
Dubai, UAE
www.arabhealthonline.com

February

HIMSS 11
20 – 24 January
Florida, US
www.himssconference.org

March

ECR
Vienna, Austria
3 – 7 March
www.myesr.org

April

MED-E-TEL
Luxembourg, Luxembourg
6 – 8 April
www.medetel.eu

IHE EUROPE CONNECTATHON
Pisa, Italy
11 – 15 April
www.ihe.net

THE 7TH ANNUAL WORLD HEALTH CARE CONGRESS EUROPE
13 – 14 April
Brussels, Belgium
www.worldcongress.com/europe

May

WORLD OF HEALTH IT 2011
10 – 13 April
Budapest, Hungary
www.worldofhealthit.org

HIT PARIS
17 – 19 April
Paris, France
www.health-it.fr

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Virtual Reality and Healthcare

↘ **FEATURES:**
▸ US healthcare IT – an update
▸ Security of Healthcare Data:
  The Challenge Endures
▸ e-Health and Latin America

↘ **FOCUS:**
IT&N 2010

↘ **MANAGEMENT:**
Hospital Procurement and Logistics: The Role of IT

↘ **COUNTRY FOCUS:**
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