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AN UPDATE FROM EUROPE'S PACS PROGRAMMES: WHAT HAVE WE LEARNED?

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Financial Ratios: A Useful Planning & Investment Tool?

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An Update From Europe's PACS Programmes **What Have we Learned?**

Prof. Iain McCall

Editor-in-Chief
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Dear readers,

This edition's cover story examines both emerging and established PACS installations in Europe with the purpose of highlighting some valuable lessons about what elements are needed for a successful project rollout. Two of the articles in particular give a comparative analysis of their nationally led solutions, one which failed to meet any of its desired requirements despite an enviable level of funding and one that has provided a successful nationally-integrated system to the benefit of all and particularly in a country with a relatively low population density and widely dispersed clinical facilities.

The planning and purchasing processes in each involved European country have had similar variations ranging from government sponsored and controlled procurement to local lease or purchase arrangements. As a result, the evidence of the risks and benefits of the different models is now more clearly understood and some key principles are now evident.

However, even the smartest of PACS is only efficient unless it is directly linked into the radiology and hospital information systems. Furthermore, what we have learned is that a unifying patient number should be a key goal. It is also important that the need to transfer reports and, if appropriate, images to primary care physicians who have referred the patients is taken into account when considering these linkages.

Patients often do not stick with a single healthcare establishment for their entire gamut of healthcare needs, and in areas where a number of hospitals are available to patients, either through patient choice or specialty and subspecialty care, it is essential that patient images and data are easily transferable and available for consultation between clinicians and radiologists at all relevant sites. It is therefore vital that compatibility is established at the procurement stage between different manufacturers bidding for a contract. This can be more easily established in a regional development providing the variety of users' requirements are considered and met. This leads to a further requirement that the users of the service, including radiologists, radiographers, clinicians and patients are all included in the process of developing the specifications and that standards are established prior to any implementation.

These are important lessons for all of us, as e-health remains the European Commission's highest priority, both for commerce and delivering healthcare to a burgeoning and aging population in the 'containment' mentality that exists presently regarding the exploding cost of healthcare and the reduced availability of trained personnel. It is vitally important that the legal framework of any of these developments is established, particularly where they involve cross-border healthcare and the transmission and reporting of examinations and data. Patient confidentiality, the standards of medical care and the qualifications of those involved must be legally protected and monitored to ensure compliance. It is also incumbent on all manufacturers to fully embrace the Integrated Healthcare Enterprise (IHE) initiative, to enable the provision of a high quality and efficient service to our patients.

To share your thoughts and feedback concerning any of the articles in this edition, please contact editorial@imagingmanagement.org.

Prof. Iain McCall

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Our cover story deals with the disparity in progress being made with national PACS programmes in the wider context of e-health, taking a look at a selection of different European examples. The lead article for this story is an exclusive look at the newly inked deal for a nationwide PACS programme in Ireland. Known as the NIMIS project, and signed only February past, this deal highlights how creation of a countrywide health information system demands consideration of different issues in organisational, legal, ethical, technological and related areas. As you will read, the Estonian model is another example, in its seamlessly integrated efficiency, of how a national PACS programme should operate.

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IMAGING Management speaks to David Fisher, Executive Director of the Medical Imaging & Technology Alliance (MITA) and Vice-President of the National Electrical Manufacturers' Association (NEMA) about recent momentum in the drive to address potential health hazards caused by radiation exposure through medical imaging and related procedures. Also concerned about health impacts of radiation exposure, the Federal Drug Agency (FDA) has turned their attention to three types of medical imaging procedures: computed tomography (CT), nuclear medicine studies and fluoroscopy, said to be "the greatest contributors to total radiation exposure within the U.S. population." This interview explores appropriate justification of radiation procedures and optimisation of the radiation dose used during each procedure.

Cover Story

Update From Europe's PACS Programmes: What Have we Learned?

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Imaging Leaders

Country Focus

Greece

In Every Issue

In this edition of IMAGING Leaders, Prof. Francesco Sardanelli is interviewed about his professional career as associate professor of radiology at the University of Milan, Italy, and director of the radiology unit at the Scientific Institute Policlinico San Donato. A well-respected expert in research methodology and statistics applied to medical imaging and in multimodality breast investigation, in contrast agents for MR imaging, and MR technology, he is also known as a voice for the implementation of evidence-based radiology. In this light, since 2009, he is director of EuroAIM (European Network for the Assessment of Imaging in Medicine), a division of the European Institute for Biomedical Imaging Research (EIBIR), which is supported by the European Society of Radiology (ESR). Here, he explains why medical imaging needs to pay closer attention to the efforts being made in the community to apply an evidence base to its science, to make imaging safer, more efficient and to provide a foundation to solidify the role of radiologists.

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EU NEWS

News From the EU Presidency

Ministers Provide Direction for E-health

EU Ministers and the Spanish Presidency have drafted a Ministerial Declaration of European Cooperation on E-health, a plan for the future that recognises the efforts that brought EU policy on e-health to the fore. In the Declaration, a detailed framework was set forth in order to achieve the overall objective of enhancing the quality and sustainability of healthcare professionals and society. The main points addressed in the declaration include:

- Political and strategic commitment, both at the regional and national level, encouraging collaboration with states outside the EU;
- Building confidence and acceptance, focusing on all stakeholders (patients, health providers, authorities and government);
- Bringing legal and ethical clarity and ensuring protection of personal health data;
- Solving interoperability issues, specifically legal, regulatory and organisational barriers to e-health and,
- Linking E-health policy to competitiveness, innovation and research as well as to cohesion and inclusion policies.

Spanish Presidency Proposes Four Goals

In a recent communication, the Spanish Presidency proposed four goals for e-health as part of a wide strategic framework and corresponding action plan:

- Introduce a global vision for an e-health policy totally integrated in the post 2010 European Agenda;
- Drive a new E-health Action Plan, facing the new European challenges;
- Develop and promote ministerial agreements, in particular regarding integration of e-health in community policy, and
- Implement reinforced government.

The Action Plan will be directed at the current challenges in European healthcare: crises, ageing populations, sustainability and efficiency in the public sector, and economic and social inclusion. The Spanish Presidency hopes to integrate e-health policy in the post 2010 European Agenda, contributing to its main goals of economic recovery, growth and employment and economic, social and territorial cohesion.

In conclusion, the ministers and representatives responsible for e-health encouraged policy coordination among the various areas of e-health as well as stronger synergies within policy areas like competition, research and regional development. They stressed involving all stakeholders in strategic planning, validation and implementation of e-health solutions and specifically, including e-health within the framework of the European Digital Agenda. Most importantly, they encourage using e-health solutions to improve patient benefits, welcoming more research, innovation and deployment.

For further information, please visit: **http://ehealthspain.eu**

Commissioner for Development Addresses Global Health MDGs

At the Cross Europe Conference, EU Commissioner for Development, Andris Piebalgs, addressed the progress made toward the Millennium Development Goals (MDGs) and the work that still needs to be done.

In his keynote address at the conference, titled "Delivering the Right to Health with the Health Millennium Development Goals," Piebalgs offered an overall perspective of past, present and future actions toward the MDGs. The MDG framework focuses on three main priorities: mortality of children under five years old; maternal mortality; and the impact of major pandemics, such as HIV/AIDS and malaria.

Piebalgs reported that progress towards health-related MDGs remains totally insufficient, giving examples of the little and seemingly no changes in child and maternal mortality, respectively, in sub-Saharan Africa. Piebalgs did recognise the positive changes, citing the increase in direct aid to health since 2000 by a factor of four, now amounting to 16 billion euros a year. This increase has enabled access to HIV/AIDS treatment to three million people in developing countries.

Four Major Health Challenges

Piebalgs then outlined four priority areas in the EU's future commitment to global health challenges: the challenge of governance, the challenge of coherence of policies; the challenge of knowledge; and the challenge of health coverage. Specifically on health coverage, Piebalg addressed the prioritisation of aid commitments, the fragmentation of the health sector, and the division of labour. These priorities will be addressed in a future Commission Communication on the EU's role in global health, in agreement with the Spanish Presidency.

The Cross-Europe Conference for Global Health took place March 2 in Brussels. The day included panel discussions including the EU Presidencies' Panel which consists of the EU Presidency of Spain and the upcoming EU Presidencies, Belgium and Hungary,

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New Legislation to Reduce Injuries for Health Workers

The European Commission has adopted a Directive to prevent injuries and infections to healthcare workers from sharp objects such as needle sticks.

The Directive implements in law a framework agreement on prevention from sharp injuries in the hospital and healthcare sectors signed in July 2009 by the European Public Services Union (EPSU) and the European Hospital and Healthcare Employers' Association (HOSPEEM) – European Social partner organisations that together employ more than 3.5 million healthcare workers.

Needle Injuries a Serious Threat

Injuries and infections from needle sticks amount to one of the most serious health and safety threats in European workplaces and estimated to cause one million injuries each year. The agreement addresses one of the priority objectives of the EU's current strategy for health and safety at work, which aims to cut workplace injuries by 25 percent by 2012.

Furthermore, the Directive specifically aims to:

- Achieve the safest possible working environment for employees in the sector an protect workers at risk, as well as patients;
- Prevent injuries to workers caused by all types of sharp medical objects including needle sticks, and
- Set-up an integrated approach to assessing and preventing risks as well as to training and informing.

Speaking at the Council of Ministers meeting, László Andor, EU Commissioner for Employment, Social Affairs and Inclusion said, "The healthcare sector is one of the biggest employers in Europe and needles represent a real risk to workers, both in terms of injuries and increased rates of life-threatening infections like HIV or hepatitis". He added, "This new Directive will better protect workers and their families while reducing the burden of injuries on European health services".

The European Parliament first proposed a resolution for the Commission in 2006, specifically addressing blood-borne infections due to needle stick injuries. Meetings with stakeholders, nurses, doctors, surgeons, etc., and further negotiations took place to arrive at the current legislation.

For more information, visit: **www.europa.eu, Reference IP/10/243**

European Industry Responds to Action on Telehealth

On release of a European Commission Communication on telemedicine, the medical technology industry has voiced their opinion on the future of telehealth. Led by COCIR, an industry group representing the healthcare IT sector, the industry has made recommendations to the European Commission and member states for better deployment of telehealth solutions in aid of the current challenges facing the EU. The five recommendations for deployment are:

- European Commission and Member States to establish an appropriate legal framework with effective transposition at country level;
- Strengthen cooperation between healthcare stakeholders to "best practice health strategies" supporting telehealth adoption in routine clinical practice;
- Finance more and sustainable large-scale projects with health economic evaluation to assess the impact of telehealth solutions;
- Integrate telehealth into existing care delivery structures and ensure interoperability of telehealth solutions, and
- Establish sustainable economic model for telehealth by starting dialogue between healthcare stakeholders.

Fragmentation Must be Tackled

Highlighting that the current fragmented legal systems limit evolution of IT solutions across the EU, COCIR says that a new legal framework could eliminate current problems in licensing, liability and cross-border jurisdiction. While COCIR has welcomed the recent Commission Communication on the benefits to patients, healthcare and society, COCIR urges telehealth solutions to be developed at EU and national level. They say these solutions are needed to combat growing financial and staff shortages in the European health sector.

The position paper from COCIR warns that Europe's current financial model for healthcare is unsustainable, making telehealth a key area for the future. The group recommends more cooperation between stakeholders to accelerate the adoption of telehealth in practice, as well as more dialogue in order to establish a sustainable economic model for telehealth.

COCIR answers the fear of an increase in telehealth use having a disruptive impact on clinical practice and downgrading the doc-

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tor's role, saying telehealth methods will improve detection of diseases, reduce mortality and hospitalisation rates and empower patients to deal with their condition.

For more information, please visit: **www.cocir.org**

Committee of the Regions' "Healthy Workforce, Healthy Economy"

The European Committee of the Regions (CoR) has recently addressed the economic importance of reducing health inequalities.

Commenting after his draft opinion, Dave Wilcox (UK/PES), the CoR's rapporteur on health inequalities, stressed that health issues have to be a part of EU policies, specifically broadening the EU2020 Plan to include them. Investing more in quality health services would support general measures, stimulating economic growth and increasing job creation.

"Among all the proposals to lift our economies out of the doldrums, there is little or no mention of health issues", said Wilcox. "A healthy workforce is an obvious advantage when it comes to boosting productivity and improving competitiveness."

Commenting on his draft opinion, titled "Solidarity in Health: Reducing Inequalities in the EU", he expanded on this topic by saying there is a need for a more comprehensive measure of the inequalities along with the efforts made in reducing them. Appealing to the CoR, Wilcox emphasised the importance of obtaining regional input in order to have a more complete view of the inequalities, not just across national borders, but also regions.

Common Measures Address Inequalities

He suggested common measures such as infant mortality and anticipated life expectancy to judge inequalities, but said there is need for even more measures when looking at the regional inequalities against national averages.

"We need to be able to know how we want to measure the changes that we are looking for in terms of reducing inequalities", said Wilcox. "This is not just a question of looking at how long people live, but at how long the wider population lives too, so that we then start to focus on the inequalities as well as the improvements."

Wilcox and fellow CoR member Karsten Uno Petersen (DK/PES) had presented a proposal to create an inter-regional group that would attempt to define a new set of criteria for assessing health inequalities. He said they had received positive feedback from the European Commission, and he hopes opinion can become action.

For more information, please visit: **www.cor.europa.eu**

News from World Health Organisation

Key representatives of the world's leading medical imaging societies have recommended that a common set of global referral guidelines for appropriate use of medical imaging be produced, in the first such global meeting of experts convened under WHO auspices in nearly two decades.

Experts from international, regional and national professional societies as well as the International Atomic Energy Agency and the European Commission, met in the WHO- hosted consultation in Geneva, 1 - 3 March, 2010. The consultation, "Referral Guidelines for Appropriate Use of Radiation Imaging", was held in the context of the WHO Global Initiative on Radiation Safety in Health Care Settings (Global Initiative), launched in December 2008.

Trends Point to Unnecessary Referral

Their call comes in the wake of trends that have seen diagnostic imaging and interventional radiology procedures being used more and more to accurately diagnose a wide range of illnesses and injuries and provide life-saving treatment. At the same time, however, appropriate use of such technologies is becoming an important health policy concern, particularly since medical radiation exposure constitutes the main source of radiation exposure in many countries and inappropriate use can lead to unnecessary exposure.

The 36 experts, representing 23 agencies and professional societies from across WHO's six regions, agreed upon a roadmap to develop an international set of evidence-based referral guidelines and facilitate their implementation. Plans also call for monitoring the use and evaluation of the impact of the use of such guidance in different clinical settings.

The consultation recommended development of a global set of referral guidelines under the umbrella of WHO, and in collaboration with other relevant international bodies. This would include review, adaptation and expansion, as necessary, of evidence-based guidelines that exist nationally and regionally.

"Reduction of unnecessary radiation exposure by justification of radiological medical procedures is a major goal for the global initiative. Such a referral tool developed in collaboration with major expert agencies and institutions will contribute to that goal", says Dr. Maria Neira, Director of WHO's Department of Public Health and Environment (PHE).

" This is a major collaboration towards a more coherent, global approach to promote an appropriate use of medical imaging and interventional radiology procedures. The guidance we envision will provide direction to practices in both developed and developing countries that may or may not have the most up-to-date tech-

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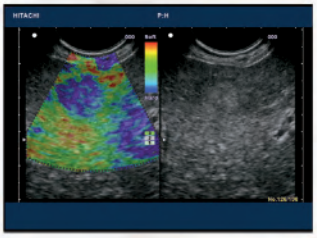

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nologies," says Dr Lawrence Lau, Chairman of the International Radiology Quality Network (IRQN), the leading international organisation representing imaging specialists, imaging technologists and radiographers.

Background on Referral Guidelines for Medical Imaging

Cancer is the biggest long-term risk of significant and repeated exposures to ionising radiation, especially in children and young adults. National guidelines exist in many different parts of the world to promote good medical practice and protect patients from unnecessary exposures. Typically, these guidelines are the product of extensive and systematic literature review, in line with internationally-accepted practices.

Such guidelines generally provide recommendations for particular medical imaging procedures that should be used in diagnosis of different illnesses and injuries, along with:

1) The level of radiation dose for each type of procedure;
2) Rating of efficacy of the procedure, and
3) Grading of the strength of the evidence about efficacy of the diagnostic procedure.

Such guidelines provide critical reference points for doctor's referring or conducting medical imaging procedures. The guidelines also inform patients about the potential risks of ionising radiation, so that they can make informed decisions about diagnostic procedures.

While most of the guidelines are available in developed countries, many fast emerging economies and developing regions are seeing a boom in demand for medical imaging procedures. These countries often lack a common set of national or regional guidelines for referral. And at the same time, developed country guidelines may not adequately refer to certain older technologies used in more poorly resourced settings.

The panel of specialists agreed on their proposed future collaboration under the umbrella of WHO and other international organisations for the development of common guidelines that would support countries not having such referral tools yet.

"This common set of guidelines to be produced over the coming two years would be unique in that they would take account of differences in available technologies and disease profile between and within countries," said Dr. Emilie van Deventer, Team Leader of the Radiation programme at WHO.

For more information contact: **ionizingradiation@who.int**
Source: **www.who.int**

ASSOCIATION NEWS

MIR – Congress Confirmed for October

The Management in Radiology (MIR) Annual Scientific Meeting 2010 takes place this year in Mallorca, Spain, from October 14 - 15, 2010, chaired by Dr. Nicola Strickland. The congress, which covers topics relevant to those leading departments interested in management, healthcare economics and administrative issues, is accredited by the European Council for Continuing Medical Education (EACCME). EACCME is an institution of medical specialists (UEMS).

MIR Junior Management Workshop a Success

In a further update from MIR, the association held its second management-themed workshop for junior and up-and-coming radiologists, from 14 – 15 April this year. The advice given was applicable to all medical or surgical disciplines, not just radiology, and was equally relevant to all European doctors without British bias. Programme topics included the following:

- Value Added Imaging: "Radiology" A Dying Discipline?
- Medical Politics: Why Bother?
- How to Appoint a New Colleague
- Why Do Research?
- How to Write a Business Case
- Dealing With On-Call
- How to Negotiate Your Job Plan

Further information is available at: **www.mir-online.org**

CARS Congress: Register Now for Geneva, 23 – 26 June

The CARS Congress Organising Committee invites you to be part of their congress which will be held in Geneva, Switzerland from 23 – 26 June, 2010. The congress is aimed at those who work in the fields of radiology, surgery, engineering, informatics and/or healthcare management and have an interest in topics, such as

- Image guided interventions;
- Medical imaging;
- Image processing and visualisation;
- Computer aided diagnosis;
- Surgical simulation;

- Surgical navigation and robotics;
- Model-guided therapy, and
- Personalised medicine.

New PACS applications, including IT infrastructures adapted for surgery as well as related results from the DICOM and IHE working groups are also within the scope of CARS. Recent successful CARS congresses have taken place in Berlin, Paris, Tokyo, San Francisco, London, Chicago, Osaka and Barcelona. The congress will be held in conjunction with the annual meetings of ISCAS, EuroPACS, CAR, CAD and CMI societies.

Further information is available at: **www.cars-int.org**

CIRSE 2010 Announced for 2 – 6 October, Valencia, Spain

In this year's annual CIRSE meeting and postgraduate course, billed as the "world's top platform for specialists in all minimally invasive image-guided procedures", the programme has been designed around seven main themes, facilitating itinerary planning and allowing delegates to follow one of these themes with little or no overlap. This years main topics are:

- Vascular Interventions;
- Transcatheter Embolisation;
- Non-Vascular Interventions;
- Interventional Oncology;
- Neuro Interventions;
- Clinical Practice Development, and
- Imaging.

The concept of main topics running parallel to avoid overlap has been further expanded, adding neuro-interventions as the seventh topic in addition to transcatheter embolisation, non-vascular interventions, interventional oncology, vascular interventions, clinical practice and imaging.

The introduction of an extended neuro-interventional section was conceived to address the expanding role of the interventional radiologist in the management of stroke in hospitals the world over. Stroke prevention, imaging and treatment will be discussed in three special sessions. In addition, delegates will have the chance to have a closer look via two dedicated workshops and one hands-on workshop.

Further information is available at: **www.cirse.org**

ECRI Institute Purchases Biomedtalk Listserv

ECRI Institute has announced its recent purchase of the Biomedtalk Listserv, a popular email subscription service for biomedical and clinical engineering professionals where they can connect to share information and advice. Founded in 1997 by Mike Kauffman, assistant director of facilities for the Reading Hospital and Medical Centre in Reading, Pennsylvania, Biomedtalk became an active forum for discussion across all members of the biomedical and clinical engineering profession. The listserv now has over 1,700 members, having attracted over 100 new members since March 1, 2010, when ECRI Institute took the reins and discontinued the membership fee.

The Biomedtalk membership is worldwide, including more than 13 countries. Averaging about 50 posts a day, Biomedtalk discussions cover common topics such as alternatives for the Steris System 1 processor and information about the new 1E model; talk about CT scanners, flat panel detectors, and infusion pump battery life.

Further information is available at: **www.ecri.org**

IHE-Europe Expands its Membership - Welcomes Four New Members

IHE-Europe has announced that it is pleased to welcome IHE Suisse, IHE Turkey, Forcare and VISUS as four new recent members to their organisation. Both IHE Suisse, which was created in March and IHE Turkey, set up in November last year, are national IHE initiatives, thus bringing the number of national IHE initiatives from seven to nine. Forcare and VISUS are both software small and medium enterprises (SMEs).

These companies are the first two SMEs to join IHE-Europe, a consequence of the newly-revised membership model for vendors, which now favours SMEs and especially those who take part in the European Connectathon event, which focuses on interoperability and standards between healthcare IT systems. Forcare is a Dutch-based SME employing about 10 people that develops profiles and establishes projects in the Netherlands and Belgium. Forcare has been coordinating the industry team for the European project epSOS on behalf of IHE-Europe. VISUS is a company with 70 employees based in Germany that develops healthcare software.

Further information is available at: **www.ihe-europe.net**

IRELAND'S NATIONAL PACS PROJECT

Unified Procurement Takes Steps Towards National E-health System

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Ireland's National Integrated Medical Imaging System (NIMIS) project will make radiology in the nation's public hospitals filmless and paperless by introducing PACS/RIS with Voice Recognition (VR) and electronic Order Communications (OCM) to all public hospitals, and enable electronic image sharing between them. Some Irish public hospitals have already implemented PACS/RIS. Those with end-of-life PACS/RIS will have their systems replaced; otherwise, legacy systems will be left in place and integrated with NIMIS. This is the first large central procurement of a clinical system in Ireland and we hope this will provide a basis for future public procurements in Irish healthcare IT.

Healthcare in Ireland

The Health Service Executive (HSE) came into operation in 2005 and replaced 11 regional health boards, which left a legacy of a large number of relatively small hospitals with poor integration of information management structures. Fifty public hospitals of Ireland perform radiologic imaging ranging from large academic hospitals to small district hospitals.

The HSE is driving a radical transformation of medical care. This includes rationalising the delivery of hospital care. Radiology departments, which had previously been working in isolation, are being amalgamated into regional teams, involving radical changes in work process. There are private hospitals in Ireland that operate outside of the HSE. Patients frequently access both public and private services. Irish patients may also access health services from Northern Ireland. NIMIS will require the ability to integrate with private hospitals.

Current Status: PACS/RIS & Healthcare IT

The first PACS installation in Ireland was in 1998. Since then, a further 15 hospitals have introduced PACS. About 3.5 million radiology exams are performed in Ireland per annum and 1.4 million of these are currently performed in hospitals with PACS. There is a wide variety of RIS from multiple vendors. A few hospitals have OCM but most, including many of the hospitals with PACS installations use paper ordering. All hospitals have their own Patient Administration Systems (PAS) from a wide variety of vendors.

Family doctors or general practitioners (GPs) use a messaging system known as Healthlink to receive reports. Healthlink will be used by NIMIS to send reports from hospitals to GPs and will eventually allow GPs to order radiology investigations from hospitals.

Electronic transfer of image data occurs in a limited form via stand-alone teleradiology systems, mainly facilitating review of neurosurgical cases. The majority of image transfer is done manually with transport of films or CDs. Radiology reports are, with few exceptions, provided by the site that produced the images and there is currently no significant off-site reporting. There is an increasing demand for subspecialty off-site reporting from the clinical and radiological community and for off-site cover on-call.

There is no unique health identifier in Ireland. NIMIS will need a central 'Source-of-Truth' for patient identification across multiple sites. This would permit Patient Identity Crossmatch (PIX) and Patient Demographic Query (PDQ). A system with this functionality is currently being used to reconcile outpatient pharmacy and medical card payments but is not integrated with hospital PACS. The NIMIS tender suggested the use of this system as the central PIX/PDQ server, although vendors were allowed to submit alternative proposals.

Procurement Process

Based on analysis of other national and regional models, it was decided to do the procurement as a single entity, rather than have several small 'best-of-breed' procurements for subsets of the system. After approval of the initial business case, a central project team was established within the HSE to perform the procurement and act as the nucleus of the rollout team after the procurement had finished. The team consisted of representatives of all relevant stakeholders and had input from the Irish government's department of finance.

There is a local project team in each hospital that carries out accurate surveys assessing the current status of local workflow, and relevant infrastructure. This team also initiated a process of consultation with future users of the system, which was fed back into the tender specification. This form of central procurement for a clinical system had never been performed before. Integration of the local and cen-

tral team is of crucial importance in gaining the trust of the ultimate end-users. The project will be funded centrally from the capital budget of the HSE. The budget will include not only funding for the vendor but also funding to augment HSE infrastructure where needed, to facilitate the project. There was a two-step procurement process.

Step One: A Pre-Qualification Questionnaire (PQQ) set minimum selection criteria for inclusion in the next phase, including financial capacity and standing, sufficient support teams to facilitate installation of the system in the timeframes set, and evidence of previous experience at multiple large-scale PACS/RIS installations.

Step Two: Full detailed technical and functional system specification was distributed to successful vendors from phase one, along with a draft contract and other required details. No specific design was mandated. The project team envisioned a number of scenarios where image sharing would be used and these were included in the tender documentation along with various timing goals. Vendors were to design a system to account for each scenario within the specified timeframes, based on the current status of the HSE networks.

There was review and initial scoring of technical and functional specification responses. Then, detailed system demonstrations and tender clarification meetings took place. These involved the project team and a wide variety of clinical users and IT personnel. The decision was based on scoring the initial tender documentation and verified by the system demonstrations and site visits. McKesson Imaging Group was identified as the preferred vendor and the contract was signed on 23 February 2010.

Proposed Design of NIMIS

The overall design of NIMIS is quite simple. There will be one PACS/RIS shared by all hospitals. It will be based in a central data centre with full disaster recovery where all images will be archived and stored. Individual hospitals will have a local store of two years of images and a backup system that can provide PACS/RIS and VR in the event of network failure. Hospitals with existing PACS/RIS will send copies of images and RIS messages to the national PACS/RIS. The archive will have an XDS archive and registry to allow for future integration of a full electronic heath record and to allow for potential sharing of information with healthcare IT systems in Ireland and potentially in other jurisdictions such as in Northern Ireland.

McKesson are the prime contractors, and will provide their own Horizon PACS/RIS solution. Hospitals with pre-existing OCM will have that interfaced with NIMIS. A number of hospitals are implementing OCM projects concurrently with NIMIS and these will also be integrated. McKesson, as prime contractor, will integrate a number of third party solutions, which will be available to all users of the system. These will include Nuance RadWhere for voice dictation, TeraRecon for advanced 3D image manipulation, Segami Oasis for molecular imaging, and Magview for mammography reporting.

The national image archive will create opportunities for medical research and education. NIMIS will include McKesson's Horizon Study Share, which counts amongst other features, the ability to enable the creation of a national teaching archive. There will also be integration with McKesson Research Share to provide a central server for research projects and facilitate multi-site projects.

NIMIS Rollout and Challenges

The rollout schedule is 30 months. It is aimed to have the first hospitals going live by Q4 2010/Q1 2011. The process will clearly involve having multiple hospitals interacting with the vendor and the HSE central design team at one time with hospitals at different stages of the process at any given time. Delivery within this timeframe faces several key challenges including:

- Integration with multiple existing hospital IT systems;
- Developing a system of clear communication between McKesson, the HSE central project team and the project teams in the individual hospitals;
- Mapping existing workflow across multiple hospitals and integrating and adapting this with NIMIS;
- Integration with the central PIX/PDQ process will involve considerable effort for local hospitals in changing their workflow for more accurate patient registration, and
- Maintenance of data security and patient confidentiality. This will be a key element in both system design and in working through the new workflows for the system.

Conclusions

Thus far, NIMIS is regarded as a success within Irish medicine. The central procurement process has clearly delivered a high-specification system. It is acknowledged that this would not have been possible based on the previous models of individual hospital procurement. However, the final success or failure of the system will now hinge on both the HSE's and the vendors' ability to roll out the system within the specified timeframe. ■

E-HEALTH IN THE NORDIC REGION

PACS in Finland and Norway Enters Replacement Phase

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In Europe, medicine is moving from a provider-centric to a patient-centric environment and, in order to do that, infrastructure must aggregate large volumes of data across time and space. A health service that puts the patient at the centre of a network of providers increases the sector's dependence on information. Such a model presumes access to and availability of a patient's medical information independent of time and place. The creation of multispecialty, multisite archives for medical images will further drive a multidisciplinary approach that will promote enhanced patient-centric healthcare. This patient-centric view is also being driven by the availability of information throughout the hospital, enterprise and beyond; as regional health information systems become commonplace, radiologists will search for prior studies throughout the region, maybe even the country.

Regional PACS in Europe

The current European scenario is a bit different from the other (mainly North American) global markets and there are a number of issues to be addressed when it comes to PACS installations. The major factor affecting the market is the unaffordable price of the PACS systems and the fact that, being a substantially public healthcare system, governments do not encourage new technology with ease. Different geographies face different kinds of challenges. On one hand, countries such as the United Kingdom, have run national programmes for PACS installations, and on the other hand the northern European regions are fully saturated and entering the replacement market. There is a lack of understanding of the importance of efficient imaging systems and the storage of their outputs, but standardisation of these systems across the world in terms of usage, applications and quality is expected to play a major role in the development of the field.

PACS at Saturation Point?

A few peculiarities of the Nordic region allow us to understand the development of PACS technology within Scandinavia: a low population density, large geographical areas and non-ideal environmental conditions. Taken as a whole, they represent a bigger issue for healthcare delivery. In these countries, healthcare authorities have always looked at digital technologies as a solution to overcome the above problems. As a consequence, Scandinavian countries have been early adopters of PACS and as a result, the PACS market is completely saturated. Scandinavia, which is advanced in its PACS saturation in both software and services, is now entering the replacement market and looking for investments in post-processing modules, which would add functionalities within the widespread and existing radiology PACS infrastructure. Scandinavia represents Sweden, Norway, Finland and Denmark, and has the highest average PACS penetration rates in Europe. Almost 95 percent of hospitals, notably in Sweden and Norway, use PACS applications. Denmark is 90 percent saturated currently. During the next five years, the total non-radiology PACS market inclusive of ortho-, mammo, surgical and others in Scandinavia is estimated to grow at a compounded annual growth rate (CAGR) of 4.6 percent.

Healthcare in Finland

The Finnish public healthcare system is largely the responsibility of its 452 municipalities. In Finland there are five university hospitals financed in a similar way to ordinary hospitals, but that receive extra state subsidies, based on the number of specialists employed and the level of research undertaken. The role of the state government is largely supervisory and regulatory. Finland has one of the highest beds-to-population rates in western Europe at 8.3 per 1,000 as a result of the geographic remoteness of some of its regions. For the sake of comparison, the beds-to-population rate in France is around seven, in Italy is around four, in Germany is around eight and in the UK is around four.

The E-health Network in Finland

The large distances between population centres makes Finland ideally suited to the introduction of telemedicine. The country has embarked on an ambitious project to make the entire healthcare system digital and has pioneered one of

the largest PACS installations in the world, initially with a network of 17 hospitals. An efficient network for transferring images provided the infrastructure for integration of different distributed imaging systems and enabled efficient handling of all patient-related information on one display station. Because of the need for high-speed communications and the massive amount of image data transferred in radiology, ATM (155 Mbit/s) was chosen to be the main technology used. Both hardware and software redundancy of the system have been carefully planned. The size of the DICOM image library in 2000 was 1.2 TB with 300 GB RAID capacity. For the increasing amount of teleradiologic consultations, a special DICOM gateway has been planned. It allows a centralised and resilient handling and routing of received images around the hospital.

The Finnish PACS initiatives continued in the following 2000 - 2004 period with HUSpacs (Hospital district of Helsinki and Uusimaa), one of the largest PACS projects in the world, producing 20 terabytes of image information and close to one million examinations per year. HUSpacs has a common database for 21 hospitals in the hospital district of Helsinki and Uusimaa. The goal of the regional HUSpacs has been to ensure seamless radiological service in specialty and primary healthcare in the HUS area. Exams are archived electronically to a regional image archive and are viewable, with the patient's permission, securely via the network in any hospital or healthcare centre.

Availability a Key Priority

HUSpacs ensures the availability and low cost of imaging services offered to 32 communities in the hospital district. In the HUS area an architecture that combines centralised and decentralised features is applied. The region has one network archive, which covers long-term storing and backup copying of images. Each hospital group has its own local RAIDs as a short-term online archive. The capacity of the Fault-Tolerant RAIDs is sized to store one to two years of image material. RIS/PACS integration has been accomplished using HL7-standards.

There is one common image database in the HUS area, divided for images of different organisations. It can be used to view images from the whole service chain. HUSpacs also contains exams ordered from HUS by primary healthcare. Among the main advantages this project brought to the various stakeholders, are less moving and transferring of patients, fluency of care chains and better quality of care, simultaneous processing possibilities of images that enabled interactive consultations, lower cost of x-ray examinations and lower loaning fees.

Norway's E-health Network

Norway has extensive health services and a well-developed social security net. Each year Norway spends NOK 50 billion (around six billion euros) on hospitals, making it one of the European countries with the highest level of public spending on health per capita. About 35 percent of the state's yearly budget, or seven percent of the GDP, is spent on the Norwegian health and social welfare system. Norwegian health policy is centred on a publicly run health service available to the population, and the private sector, therefore, remains relatively small. The healthcare network is divided into three levels: national, county and municipal. The role of the state is primarily to devise national health policy, to prepare and oversee legislation and to allocate funding, while the counties and municipalities provide services. The country's five health regions have a regional hospital, each of which is a university-level teaching hospital. All the 19 counties have one county hospital and several district hospitals. In addition, there are a few state hospitals for nationwide service.

Health IT in Norway

Information technology has been integrated into the Norwegian health system to a considerable extent. Networked PACS solutions have emerged as a trend in the country. Investment in IT and making broadband available throughout the country is part of the government's E-Norway plan, which has established ambitious goals for IT development within both the private and public sector.

Electronic interaction is an important part of the health reform. The national health network has provided a good foundation for electronic interaction and information exchange in the health sector. National funding has been provided for the development of different services, standards and security guidelines as well as investment in broadband. Most hospitals in the country have already digitalised x-ray divisions, procuring equipment and systems for digital storing and communication of x-ray images.

Integration is a key requirement for all PACS in Norway. PACS has to be integrated with the RIS and the RIS has to be integrated with the HIS. Initially PACS was a departmental unit but nowadays it is a part of an enterprise system. The role of RIS and PACS within the hospital has evolved, and during the last few years has moved towards full integration with PACS: medical images have to be on-line 24 hours a day, discussions about archiving strategy and performance - with details about image retrieval times, disaster recovery, integration of images and text and selection of stor-

age media - are going on.

Offsite archiving has been introduced and ASP models have been used by some hospitals and private imaging centres. Some regions in Norway have implemented PACS as a regional solution for all health enterprises within the region. In such a regional system one solution is that the health enterprises share a physical storage unit for the PACS (and RIS) information. The hospitals in Norway have chosen different solutions for RIS and PACS. Although all image communication uses the DICOM standard, information exchange does not seem to work seamlessly between hospitals.

In Conclusion

In Europe, the main challenge with full e-health implementation has been standardisation, harmonisation and integration. Some countries have succeeded in implementing seamless nationwide PACS systems, a key component of a national and fully electronic system, while some have not succeeded in avoiding having isolated 'islands' of unconnected PACS systems, thereby leaving the dream of a nationwide, interoperable Electronic Health Record (EHR) for each patient unfulfilled.

For the Nordic regions, who are advanced in their PACS implementations, and where the market is almost fully saturated, all regional health enterprises are obliged to exchange RIS/PACS information and the entire hospital must communicate both on a PACS to PACS and a RIS to RIS level. This high standard can be a model for countries still in the implementation stage, such as Italy. The challenge for the near future will be on the work on IHE and the use of the national health network to get the best RIS/PACS solutions for all hospitals. ■

The European Commission & E-health

The European Commission is proposing the creation of European reference networks for e-health, not to regulate the individual efforts of its Member States, but to ensure that their individual efforts are coordinated. Androulla Vassiliou, the EU Commissioner for Health has this to say about the unfolding implementation of e-Health in Europe: "In the framework of both the Lisbon Strategy and the i2010 initiative, Information and Communication Technologies guarantee quality standards in healthcare for all. Furthermore, the financial crisis accentuates the need to rationalise the health sector and to search for scale economies.

E-health is European because it is naturally suited for co-operation and networking. The purpose is not to question the Member States' competence in determining how e-health should be applied at their level. However, their efforts should be coordinated. For example, the proposal for a Directive on patients' rights in cross-border healthcare creates a health technology assessment network. The proposal does not force Member States to introduce online health system or services. Nonetheless, when these applications do exist at national level, the Commission could work on measures to ensure their inter-operability. Finally, the text proposes the creation of European reference networks, designed more particularly for patients suffering from rare diseases, which will maximise the health technologies' speed and scale of diffusion.

E-health clearly has a European dimension. However, its benefits on patients and health professionals are more evident at the level of the Member States. This is the reason why, with its recommendations and Communications, the EU complements the initiatives adopted at national level."

Also, the Commission is working on defining and regulating the implications of this new mode of servicing the healthcare needs of its population, and how "Telemonitoring and teleradiology extend the notion of "workplace" for health professionals". It adds, however, that: "It should be noted that it is only by adequate training can we ensure that health professionals benefit from these different applications."

E-HEALTH IN THE UNITED KINGDOM

Programme Faces Lack of Interoperability & Single Supplier Monopoly

The National Programme for IT (NPFIT) was set up in England in 2002. Millions of pounds of ring-fenced money were promised for the delivery of an integrated health record for the NHS (National Health Service). An organisation called "Connecting for Health" (CFH) was created to deliver this promise. The country was divided into five clusters and companies (called Local Service Providers or LSPs) bid for multi-million pound central contracts. There was slow progress on the development of a nationwide Electronic Health Record (EHR). The emphasis shifted to PACS in 2003/4, as PACS was already a tried and tested global technology.

Initial Implementation Stages

NPFIT promised a totally seamless patient-centric image sharing system between NHS organisations. CFH put their faith into the ability of the involved companies (LSPs) to deliver this, without a clear understanding of the underlying technology involved. There was no emphasis put on standards. The programme did succeed in producing a wave of rapid PACS implementations throughout England. By the end of 2007, England was largely covered with local PACS implementations. The PACS was deployed at a higher cost due to LSPs acting as intermediaries rather than sourcing them directly from dedicated PACS suppliers.

The architectural design for PACS was for a short-term local archive with a large central archive, called Central Data Store or CDS. It was thought by the user community that with a central data store, all the exams relevant to a patient would be visible to a doctor sat in any hospital.

However, what was delivered, were local PACS solutions with little connectivity between different hospital Trusts for image sharing. In the eyes of many, the NPFIT and CFH failed in its main manifesto, which was to provide a patient-centric integrated health record that was not bound by NHS organisational boundaries.

Interoperability Proves a Stumbling Block

The two main causative factors for this failure to deliver were:

1. The failure of the programme to deliver a robust English unique identifier known as the "NHS number". Other local unique identifiers continued to exist in secondary care NHS Trusts and GP surgeries. Even today, we do not have a real-time, 100 percent NHS number for everyone.
2. Strategic failure to insist on global interoperability standards within contracts with LSPS.

> "Even today a doctor in Hospital A is unaware of all the radiology investigations that a patient may have had in Hospital B or C. Hence, we are nowhere near the integrated health record that was promised by NPFIT."

The contract with LSPS resulted in single-supplier monopolies for PACS, and every element of Electronic Patient Record. Lack of standards for interoperability was a very lucrative business for LSPs as they had monopoly for every clinical system without interoperability. This type of top-down approach from CFH and LSPs created a lot of resentment within the user community and towards the LSPs and CFH.

The situation today is that although digital images and PACS have replaced hard copy film in England, manual processes like CD transfer and DICOM push are required for images to follow patient care between NHS organisations. Furthermore, even today a doctor in Hospital A is unaware of all the radiology investigations that a patient may have had in Hospital B or C. Hence, we are nowhere near the integrated health record that was promised by NPFIT.

Will IHE Solve Interoperability Challenge?

The PACS user community in the UK (The UK PACS and Teleradiology Group, a special interest group of the Royal College of Radiologists) has been lobbying for a change in strategic direction for PACS and clinical IT. They have been suggesting the use of XDS (Cross Enterprise Document

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Sharing) and XDS-I (Cross Enterprise Document Sharing for Imaging) as the emerging global interoperability standard, which will allow for a patient-centric health record based on a multi-vendor environment.

XDS is a standard defined by IHE (Integrating the Healthcare Enterprise), a global enterprise that sets interoperability standards. XDS adopts an indexing model. All clinical IT systems will index clinical documents and images to a registry. The UK PACS and Teleradiology Group believe that having a multi-vendor market based on interoperability standards will increase competition, increase innovation and reduce prices for PACS and other IT solutions for NHS.

Update From Wales

The approach to PACS in Wales was very different to that implemented in England. In Wales, Trusts have been able to choose their PACS systems. They have local PACS systems that are bought in open competition. Hence, there is a multi-vendor environment for PACS in Wales. Their focus too has moved to an integrated health record. They too rely on manual processes like CDs and DICOM push to transport images from one NHS Trust to another.

However, they are looking at a more automated strategic solution to support seamless image sharing. Currently they are piloting the XDS-I project (using an indexing model rather than pushing data around) in order to provide a proof of concept for an integrated patient-centric imaging record in a multi-vendor environment.

Update From Scotland

Scotland decided to go for a single PACS solution. Scotland has had some success with image sharing. However, this is not a seamless process, despite having a single PACS vendor and a single central PACS archive. Some of the success of image sharing between NHS organisations in Scotland is due to their Community Health Index (CHI) number functionality and usage being superior to the NHS number used in England and Wales. There is 100 percent CHI number availability within Scotland.

Update From Northern Ireland

Northern Ireland too went for a single supplier PACS, bought directly from the supplier. However, in order to implement Image and Report Sharing with Trusts with an existing PACS solution they are looking at XDS methodology of indexing data with their main supplier. The success of the initiatives in vendor neutral image and report sharing started in Wales and Northern Ireland will influence the strategic direction for the whole of UK. ■

E-HEALTH **IN ITALY**

Moving From Regional PACS Towards EHR Integration

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In the past few years, PACS in Italy has increased significantly and, at the same time, has moved towards a larger regional dimension. Italy's 20 administrative regions are in charge of managing their own healthcare budget and have differentiated themselves by adopting different approaches in defining rules and policies to minimise costs and maximise quality. Their aim is, of course, to increase the level of health for citizens, thus managing the costs of healthcare delivery. Here, we present an overview of some of Italy's succesful regional programmes.

Regional PACS in Tuscany

In this context, in 2004, the government of Tuscany opted for a major shift by launching a regional PACS tender with a funding of 44 million euros. In September 2009, after five years, and after several months of testing and training, the regional PACS project finally became part of routine implementation. Tuscany, with a population of 3.5 million and requiring 4 million radiological examinations each year, has implemented a regional PACS project that is considered to be a milestone because of its size, scope and also its architectural choices. The figures for this project are huge: several petabytes of storage for image and data repositories with over 500 PACS workstations and over 700 RIS seats.

In order to minimise the risk of delivery, start-up and training, and to control the impact of such a great change, the project was divided into three different sub-regions (or 'Area Vasta') within Tuscany: North, Centre and South. Each

area was awarded to a different multi-vendor's consortium led by Siemens-Agfa (Centre), Fujifilm-Esaote (North) and Carestream-GE (South). Each consortium was asked to provide a complete 'turn-key' solution for five years (with option to extend the duration to eight years) based on an all-comprehensive lease, including materials, spare-parts, consumables, maintenance, personnel etc.

The project was based on framework provided by Integrating the Healthcare Enterprise (IHE) , where interoperability between the RIS/PACS and other actors involved in radiological workflow, such as Order Placers and Admission-Discharge-Transfers (ADTs), are clearly identified and defined. To minimise the cost, the results, such as reports and images, are digital and thus easily delivered to the patient via optical media, following the specifications of IHE Portable Data for Imaging (PDI) profile. To achieve the all-digital goal, the project also has included the substitution of all non-digital diagnostic modalities and the revamping of all networking both on a local and wide-area basis. Inter-hospital communication was another tender requirement: the clinical history of the patient, that usually migrates among the several hospitals located in the region, must be available at any point of care at any time.

Benefits for Hospitals & Patients Alike

The projected final cost for each examination, based on an eight-year projection, is expected to confirm a sensible gain versus the film-based cost. Moreover, due to new, fully digital diagnostic modalities, the time spent for each procedure will decrease significantly, allowing better usage of radiologists' time and of other valuable human resources, increasing the quality of the entire diagnostic process. Many benefits are also expected for care-receivers, such as a decrease in waiting times, both for the examination and the results; a decrease in ionising radiation, which must be monitored and audited; and an increase of direct accessibility for the GP to the results of such examinations.

Regional E-health in Italy

Launched in 2004, Tuscany's electronic health programme is designed to modernise the healthcare system and make processes more cost-efficient. A range of other different regional health IT programmes and initiatives, and EU e-health projects got off the ground. The regional approach to PACS implementation and related sub-systems is a key ethos behind a multi-region e-health drive. These regional electronic health records (EHR) are also the bricks for a future nationwide EHR.

This project, however, is only a step towards a regional EHR system. As opposed to the past, this regional structure for PACS, which is no longer directed to sustain a teleradiology goal, establishes a common infrastructure to assist the production and retrieval of information to and from a regional EHR repository. The structure of such repositories and their associated workflow, is regulated by a collection of documents published by NSIS (New Healthcare Informative System) specialists panel, under the authority of the Italian Ministry of Health.

The NSIS documents, that depict a nationwide EHR, are very close to the IHE framework for the integration profiles of Cross-Enterprise Document Sharing (XDS). However the differences are minimal and related only to the structure of the national registries, which are based on a hierarchical structure instead of the cooperative and federative of IHE XDS.

Besides being the first, the Tuscany project is not the only project with a regional dimension and with a noteworthy eye towards EHR integration.

PACS in the Friuli-Venezia Giulia Region

In 2009, another region, Friuli-Venezia Giulia, located in the northeast of Italy bordering with Austria and Slovenia, issued a large tender for a regional PACS/RIS system. With a population of 1.2 million and slightly more than one million radiological procedures required each year, the tender requested a complete lease for five years with the option to extend it further at a later point.

The services involved are all related to imaging producers: radiology, nuclear medicine, cardiology, mammography, etc. Integration with existing and future information systems is based on IHE Integration Profiles, with a special attention to XDS to supply IT services for retrieving imaging and report information at a regional level: another important step towards EHR integration, aiming for a real and practical daily usage.

PACS in the Veneto & Liguria Regions

Another of the most prominent regional projects is Health Optimum, a telemedicine project co-financed by the European Union and led by the Veneto Region (Consorzio Arsenàl) with the participation of Spain, Denmark, Sweden and Romania. The goal of the project was to improve the supply and performance of quality telemedicine services, allowing them to serve a greater number of users regardless of their area of residence, through the use of the IHE profiles for imaging, specifically XDS and XDS-I. Also the Liguria region is moving towards the same goal by fos-

tering the integration of new PACS/RIS installations with their XDS-based EHR project, formerly known as 'Conto Corrente Salute' (Personal Health Record).

PACS Moving to a Regional Level

The trend in Italian healthcare IT is therefore to move PACS from an institutional level to a large regional dimension. This is supported by different, and tangible, pragmatic needs, chiefly to constantly ameliorate cost-effectiveness performance of healthcare delivery. To this end, the IHE XDS approach is future proofed and provides a sound basis for a safer use of public money for these kind of investments. These PACS projects act also as technology-movers, pushing the old centralised HIS and dispersed GPs' interfaces in new directions and moreover towards tighter integration. All these regional EHRs are also the bricks for a future nationwide EHR. ■

THE NATIONAL E-HEALTH **PROGRAMME IN ESTONIA**

Moving From Regional PACS Towards EHR Integration

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As of September 2008, a nationwide health information system has been available for citizens and healthcare professionals in Estonia. The information system includes certain data that is supposed to reflect the population's health status, entered into the database either by the healthcare professional or by the patient himself. The content of the centrally stored information is indicated by national legislation. This database is a part of the state information system. There are four e-health projects that make up the Estonian Health Information System (EHIS), led by the Estonian E-Health Foundation and Estonian Health Insurance Fund: Electronic Health Record, Digital Registration, Digital Image, and Digital Prescription.

The creation of a countrywide health information system demands consideration of different significant issues in organisational, legal, ethical, technological and healthcare related areas. These issues were intensively discussed and planned since 2002, when preparation for implementation of the system began. Because of the complexity of a nationwide project, the various components of the EHIS were launched in several timed stages.

To guarantee wide user acceptance of a central medical database, a foundation involving all main stakeholders in healthcare was created. The Estonian E-Health Foundation was established in October 2005 by the Ministry of Social Affairs, three main hospitals (Tartu University Hospital Foundation, North Estonia Medical Centre, and East Tallinn Central Hospital), the Estonian Hospital Association, the Estonian Family Doctors' Association, and the Union of Estonian Emergency Medical Services. To value this decision retrospectively, the involvement of the main players in the field was one of the key aspects in the development and launch of the EHIS.

Parameters for Legal Issues

A lot of effort was put in to the discussions about the compulsory content of the centrally-stored medical data. Another important topic concerning legal issues was the definition of user rights. To find an acceptable solution, a working group for ethics was established. After discussions and debates with medical professionals regarding content, they decided the central database of citizens health information would include:

- Time critical data of chronic diseases, allergies, etc;
- Information about the patients' general practitioner or hospital visits;
- A summary of ambulatory or stationary cases and,
- A link to the Picture Archiving and Communication System (PACS) where medical images are stored.

Every healthcare institution is obliged to send the abovementioned data to the central repository. The patient has the right to block these data from any other user (opt-out). However, our one-year experience shows that, to a remarkable extent, this has not happened. In addition to the

information listed above, there is an electronic referral letter and electronic prescription available for the health professionals' and patients' use. Physicians have the right to make queries from the central repository.

Stage One: Nationwide PACS

The first fully implemented solution was a nationwide Estonian PACS launched in June 2006. It is technically based on the PACS of two major hospitals in Estonia, Tartu University Hospital and the North Estonia Medical Centre, acting as one central PACS for all other radiology departments in Estonia. Until today, all radiology facilities in the country have the possibility to send and archive radiology images in the central PACS. Radiologists and all referring physicians have web-based access to the PACS if they have signed the necessary contract with the responsible authority (the Estonian Health Image Archive Foundation).

The importance of the implementation of a nationwide PACS was proving the concept and viability of a cross-institutional healthcare information system. It also showed that during the establishment process, one should favourably combine external and infrastructural presumptions, technological prerequisites and the interests of different stakeholders.

The next steps in the development of nationwide PACS was archiving of non-radiology, as well as non-DICOM images. This work is in progress as some institutions already archive endoscopy images and ECGs centrally. However, the development of PACS should follow the general rules of development of EHIS. In regards to patient safety and clinical quality, it is of the utmost importance to integrate images with referral letters, relevant clinical information and prior reports. For this purpose the integration of EHIS and Estonian PACS should be done at a deeper level. Currently there is a link in the EHIS that does not open the image but shows the location of the image to the physician or patient. To see the radiology image, one must open the PACS in a different window and log in to the system. Radiology reports are available in the EHIS.

Stage Two: Nationwide EHR

The second widely implemented project in Estonia was the Electronic Health Record. By the beginning of 2010, there were 268 healthcare institutions sending medical data to the EHIS. Among them there were 17 hospitals. The average number of queries done by physicians from the EHIS is 150 - 200 per day. Medical data are entered into the database and signed electronically by the physician or healthcare institution. It must be underlined that GPs and hospitals in Estonia have been using their own information systems for years. The penetration of information systems is high.

This made implementation of a central database relatively acceptable from the healthcare providers' point of view. The main concept has been that institutions are continuing to use their own databases, their internal processes have remained unchanged as much as possible and the main task has been to integrate local systems and central databases. Still, a lot of effort has been invested to train medical personnel. This included training in computer skills, teaching security regulations and the introduction of central system usage.

The most complex project appeared to be digital registration. Currently, there is a fully integrated solution for electronic referral letters but the booking system works by delivering links to the electronic booking systems of the dif-

E-health in France

The French approach to implementing e-health on a national scale emphasises several key points – according to Roselyne Bachelot-Narquin, French Minister of Healthcare and Sports, "Human interaction is, and will remain, at the heart of our healthcare system. The goal of information and communication technology is primarily to serve medical practice in reinforcing our capacity to prevent and treat. E-health must deliver the same confidence in the reliability and security of the system as patients have in health professionals."

The strategy being proposed for e-health in France relies on four approaches:

- The first relies on modernising hospital IT systems via the Hospital 2012 plan, with 1.5 billion euros earmarked for healthcare information technology. This is intended to support systems that optimise hospitalisation processes.
- The second focuses on the personal healthcare record. The patient will be able to control the data while allowing information sharing and facilitating coordination among healthcare professionals. A basic EPR will progressively be made available across the country.
- The third development is in regards to technologies that facilitate surveillance, diagnosis, expertise and long-distance healthcare. An ambitious plan aims to implement wide-scale operation of these new services.
- Two governing bodies will be created dedicated to these technologies, plus reinforced strategic management of national healthcare information systems.

ferent hospitals on one website. It is still under discussion whether there is sufficient need for a common countrywide electronic booking system or if it is enough to use the available electronic booking systems of healthcare providers.

Stage Three: Nationwide Digital E-prescription

A nationwide digital prescription project was launched in January 2010. The use of digital prescription has been surprisingly high. During the first two months there were almost 700,000 digital prescriptions issued by around 2,800 physicians. There are 440 pharmacies that have sold medicines based on digital documents. The number of digital prescriptions represents about half of all prescriptions issued in Estonia. To secure access to the national EHR, we have used a countrywide data exchange platform called X-Road. This is based on the concept of using one integral set of user interfaces for organising communication with databases. The system ensures sufficient security for the treatment of inquiries made to databases and responses received. It is suitable for managing a dialogue between the consumer (citizen, civil servant and entrepreneur) and numerous databases as well as for realising cooperation between application programmes and databases.

The technical solutions of this project lie not in the transition of all databases to a larger data management system but in the creation of unified user interfaces for different databases. Citizens and institutions can join and use X-Road free of charge. Identification of the person is based on compulsory ID cards issued by the state. This ID card is used both for identification of the user and for digital signing of documents, e.g. discharge letters, radiology reports, etc.

Citizen Access to Personal Data

There is a portal in EHIS for citizens to access their own medical data. Here, they can give their own informed consent about who is allowed to see their medical data and about the donation of organs or acceptance of blood transfusion. Patients can see reports of their images but have no access to the images through the EHIS. However, this option is available in some hospital applications and implementation of the same feature through the EHIS is under development.

For integration purposes, standards have been agreed, which should be used by all healthcare providers. These standards are widely known internationally – XML, HL-7, DICOM, etc. The publishing centre, managed by the Estonian e-health foundation, provides a central environment for publishing medical classifiers and standards. The centre publishes all standards, classifiers and nomenclatures that are used in the health information system. Additionally, the central system user and interface manuals are available through the centre.

Conclusions

The Estonian model for implementation of nationwide EHR and PACS shows that technically and organisationally, the task is achievable in a relatively short time. However, realising concrete benefits for patients and hospital personnel, depend on the completeness and quality of the data in the central system. This is achievable only where common standards are used and the majority of healthcare institutions connect to the system in a relatively short period. It seems that the real benefits of nationwide health information systems will be achieved when there are sufficient data about citizens' health and new services based on a central database can spring from there. These kinds of services include monitoring of health trends, diagnosis and treatment decision support, epidemiological research and personalised medication. In Estonia, the successful implementation of nationwide EHR and PACS does not mark the end of innovation but the beginning of a number of new projects preparing to be implemented, including e-ambulance, e-laboratory, data-mining and decision support systems. ■

Learning Points

Even though Estonia is a small country, the implementation of a national health information system includes the same organisational and governmental components that are required by any other country. The main challenges of these kinds of complex projects are not technical but require effective organisational and management solutions. The learning points from the Estonian health information system implementation include:

- Agreement of standards before starting implementation;
- Agreement about procedures for changing standards;
- Preparation of a proper legal environment, and
- Involvement of the main stakeholders.

Regarding technical solutions, there is a lot of flexibility because of rapid development in the field. One also has to keep in mind that there is never enough IT training for medical personnel.

Hitachi's Real-Time Elastography in Practice

With Elastography, You Can…

The department of radiology at Aarhus University Hospital, Denmark, has such a high demand for ultrasound exams, that it runs a dedicated ultrasound division headed by section chief, Dr. Lars Bolvig. "We perform more than 220,000 medical imaging exams per year, of which more than 33,000 alone are ultrasound". Due to this high demand, five of the department's 50 full-time radiologists perform only ultrasound exams. Dr. Bolvig, a specialist in ultrasound since 1979, section chief at Aarhus since 1992, and President of the Danish Society of Diagnostic Ultrasound, says that "Ultrasound is the most commonly used imaging modality in the world - not just by radiologists but other specialists who increasingly rely on it to provide quick, accurate and non-invasive diagnoses." Growth in the applications of ultrasound mean that the Danish society are experiencing greater demand for educational courses not just on ultrasound in general, but now in an exciting and innovative new technology called "Real-Time Elastography" (RTE).

Why Hitachi?

The reason Aarhus University Hospital chose Hitachi as their RTE provider is simple: Says Bolvig, "They are the first to develop this technology: therefore they have the widest experience in the area." Plus his department has long-term experience using Hitachi equipment and were excited about the new development, seeing the clear benefits to patients and the department in general. Also, it takes minimal training to bring sonographers up to speed, and Dr. Bolvig confirms, "It is extremely easy to install. There are minimal interruptions to ongoing workflow in the department."

Not only is Dr. Bolvig an early adopter of this proven technology, he is co-operating in an international multi-centre scientific study with the University Hospital of Innsbruck, Austria, to study the use of RTE in Achilles tendons. The marked advantages of using RTE for musculoskeletal imaging make it standout in comparison to traditional ultrasound: it makes complex areas easy to visualise. **"Some changes in tissue are not possible to visualise with traditional ultrasound,"** states Dr. Bolvig, **"With elastography, you can."**

What is HI-RTE?

HI-RTE is an exciting innovation in ultrasound imaging which allows assessment and real-time colour display of tissue elasticity. Hitachi's pioneering technology has revolutionised the detection and visualisation of malignant disease in clinical areas such as the breast, prostate, thyroid and pancreas, and many more. It has the potential to reduce the number of diagnostic biopsies thereby saving time, cost, and not least, the emotional burden on the patient. Where diagnostic intervention is indicated, HI-RTE improves the accuracy of lesion localization and precision of targeting.

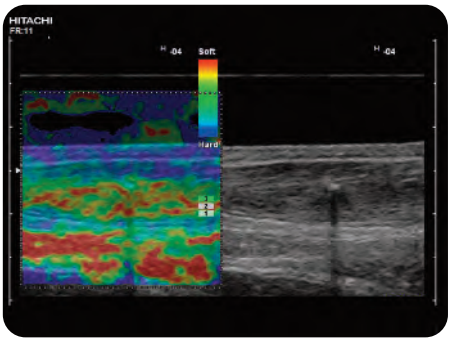
Core Advantages Over Traditional Methods

Dr. Bolvig states that he is most impressed by the cost- and time-savings of implementing HI-RTE, as well as by the benefits to patients. Says Bolvig, "When we realised the possibilities of RTE to relieve patients of the pain and high risk associated with core needle biopsies in examining cases of liver fibrosis, we were very excited". Liver fibrosis in notoriously difficult to detect with traditional imaging methods, hence the need for core needle biopsies to make a diagnosis. However, RTE makes imaging these patients easier. Not only this, but prostate imaging can also be streamlined. Dr. Bolvig states: "We can use RTE to guide biopsies straight to the affected area when examining the prostate." Such innovations make the lives of doctors and patients effortless, saving doctors time by reducing unnecessary invasive procedures, as well as minimising risk to the patients of pain or haemorrhage following biopsies.

Technology Behind HI-RTE

The assessment and visualisation of tissue elasticity can provide potentially vital information in disease diagnosis. Hitachi's Real-time Tissue Elastography module uses an Extended Combined Autocorrelation Method (ECAM) to produce an elasticity image in real time. It uses a freehand approach to compress the tissues with the ultrasound transducer – a technique that is easily integrated into the routine ultrasound examination.

Relative tissue elasticity is calculated and displayed as a colour overlay of the conventional B-mode image. Stiffer tissue structures are displayed in blue, while the more easily deformed tissues are in red. The ECAM elastography algorithm performs a 2D correlation in both axial and lateral directions, overcoming the problem of sideslip and improving the accuracy of the strain image. Clinical evaluation of the modality has shown that lesions can be characterised more rapidly and with a higher degree of accuracy, when elastography is incorporated into the conventional exam.



Elastography *is sensitive for detection of alterations in symptomatic Achilles tendons and has excellent correlation with MRI and conventional ultrasound techniques.*

Real-Time Elastography is the Future

Dr. Bolvig is certain that "RTE is the future of ultrasound. Not only is the industry moving more and more in the direction of adding RTE to their product offering, but at the national and international congresses, elastography is a major topic of discussion during scientific sessions and between specialists who wish to discover more".

Case Study:

Siemens Virtual Touch Tissue Imaging and Quantification

A New Dimension in Ultrasound Imaging

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USA, Inc.

Virtual Touch Provides Advanced Scanning Capabilities

Unlike conventional B-mode sonography, which provides anatomical detail based on differences in acoustic impedance, Virtual Touch imaging describes relative physical tissue stiffness properties making it more similar to a physical palpation exam of tissue than conventional sonographic evaluation. Virtual Touch tissue quantification provides accurate numerical measurements related to tissue stiffness at user-defined anatomical locations. Subsequently, numerical measurements of the lesion can be made. Overall, Virtual Touch software is an advanced form of sonographic imaging and provides complementary information to a conventional ultrasound scan while benefiting from anatomical localisation.

Benefits of Virtual Touch Software

There are several advantages of Virtual Touch software compared with other methods of tissue strain imaging. Overall, compared with several other methods, there is increased contrast transfer efficiency resulting in superior image quality, and increased reproducibility with decreased inter-operator variability. Previously available methods require manual compression of tissue with the transducer or rely on physiologic motion within the body that may limit the depth and location of imaging and result in artifacts. In contrast, using Virtual Touch software applications, only the target tissue is "pushed," and displacements within deep tissue are feasible and the local displacement force better penetrates tissues located deep to a stiff surface. Tissue surrounded by a low friction environment, or physically separate from its background, may also be imaged.

> **"This new dimension of diagnostic information represents the most important development in ultrasound technology since the advent of Doppler imaging."**

What is Virtual Touch Tissue Imaging?

A Virtual Touch software image is a qualitative grayscale map of relative tissue stiffness (elastogram) for a user-defined ROI. This information is computed by examining the relative displacements of tissue elements due to an acoustic push pulse. For a given elastogram image, bright regions depict tissue that is more elastic (less stiff) than dark regions. While a Virtual Touch software image may be displayed side-by-side with a corresponding conventional ultrasound B-mode image, apparent tissue boundaries may differ between the images as they rely on different tissue contrast mechanisms.

Virtual Touch Tissue Quantification

ARFI technology may be used to measure a numerical value of shear wave speed as implemented by Virtual Touch tissue quantification. In general, the more stiff a region of

What's unique to Siemens ACUSON Ultrasound Systems?

Siemens ACUSON™ ultrasound systems feature a comprehensive range of tissue strain analytic applications that enable qualitative visual or quantitative value measurements of the mechanical stiffness (elasticity) properties of tissue. This new dimension of diagnostic information is not available using conventional sonographic imaging, and represents the most important development in ultrasound technology since the advent of Doppler imaging. Tissue stiffness information is complementary and independent from the acoustic impedance information provided by B-mode (grayscale) imaging as well as vascular flow information provided by Doppler imaging.

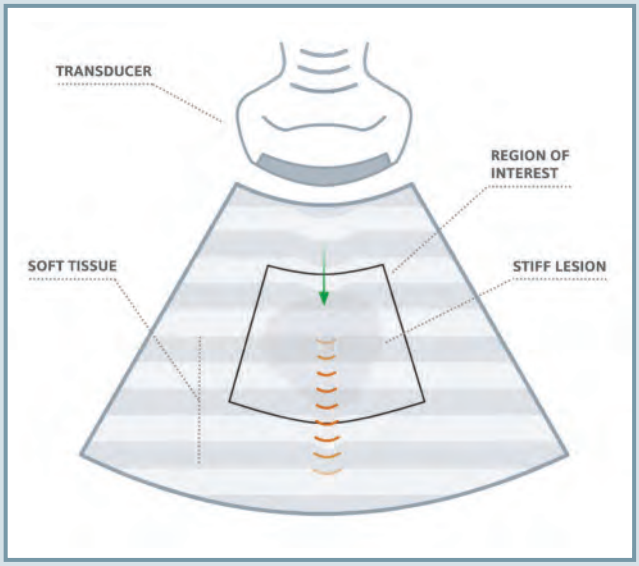

Figure 1. Virtual Touch tissue imaging utilizes acoustic push pulses (orange) and tracking beams (green arrow), sequenced across a user-defined region of interest, to generate an elastogram depicting the relative stiffness of tissue.

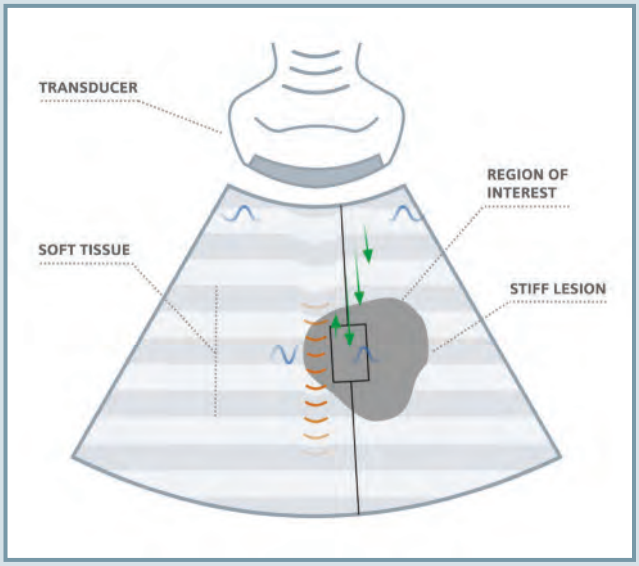

Figure 2. Virtual Touch tissue quantification utilizes an acoustic push pulse (orange) to generate shear waves (blue) through a user-placed region of interest. When detection pulses (green arrow) interact with a passing shear wave, they reveal the wave's location at a specific time, allowing calculation of the shear wave speed. This numerical value is related to the stiffness of the tissue within the region of interest.

tissue, the greater a shear wave's speed as it travels through this region. Thus, the measured shear wave speed is an intrinsic and reproducible property of tissue. In contrast to conventional axially oriented ultrasound waves, shear waves do not directly interact with the transducer and are attenuated approximately 10,000 times more rapidly, and thus require greater sensitivity to measure. However, as the shear wavefront travels through tissue, the generated displacements are detectable using ultrasound tracking beams. By observing the shear wavefront at several locations, and correlating these measurements with the elapsed time, the shear wave speed is quantified.

For Virtual Touch tissue quantification, an anatomical location for measurement is first identified using a ROI placed on a conventional ultrasound image. An acoustic push pulse is applied just lateral to this location, inducing a shear wave that travels through the ROI. Tracking beams, sensitive to greater than 1/100 the wavelength of sound, are applied adjacent to the push pulse path. These beams are continuously transmitted until the passing shear wavefront is detected. The time between generation of the shear wave and detection of the peak is utilised to compute the shear wave velocity. Multiple measurements are made for a given spatial location before a value is reported in order to ensure measurement quality.

What is Acoustic Radiation Force Impulse Imaging (ARFI)?

Acoustic radiation force impulse imaging (ARFI) is a new tissue strain imaging technology that utilises sound waves to interrogate the mechanical stiffness properties of tissue. Virtual Touch™ tissue imaging and Virtual Touch™ tissue quantification are the first and only commercially available applications implementing this technology. These applications are available exclusively on the ACUSON S2000™ ultrasound system.

Conclusions

Virtual Touch tissue imaging and quantification are the first and only commercially available implementations of acoustic radiation force impulse imaging. Through this modality, previously difficult or impossible elastographic examinations are made accurate and practical. Most importantly, Virtual Touch software technology enables a new dimension of tissue information to be applied for screening, diagnostic and therapeutic clinical applications.

For more information on tissue strain analytics, please visit ***www.siemens.com/strain***.

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FINANCIAL RATIOS IN RADIOLOGY

A Useful Tool for Planning, Monitoring & Investment

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This article investigates how financial ratios can serve as performance indicators or guide investment decisions. Performance indicators are used to guide short to midterm controlling and monitoring. In contrast, investment decisions have a longer time horizon, and involve financial planning over a couple of years. In the first case, financial ratios help budget monitoring by actively looking at deviations from ideal or forecast figures, while financial ratios can inform investment decisions by simplifying assumptions and thus take advantage of, for example, averaging.

Different Costing Methods

There are different types of costing methods. The most complete method is called the "full cost approach", and this accounts for both fixed and variable costs. For example, maintaining an imaging scanner on a daily basis is classed as a fixed cost, while printing images after an exam can be regarded as variable costs. Step-fixed costs are halfway between variable and fixed costs and occur stepwise with increasing scale, e.g. switching on a second scanner during peak time.

Marginal Costing

Another costing method is marginal costing. This accounts for the perfectly variable costs incurred by the next unit. While the full cost approach is likely to be used for planning reasons and determining transfer prices ex ante, marginal costing can be used to determine the contribution margin of further activity. A radiological entity cannot determine the actual price of exams by only accounting for variable costs. However, once fixed costs are incurred, an additional exam contributes to the margin as soon as the price is above the marginal cost.

Lifecycle Costing

By increasing the time horizon, one arrives at "lifecycle costing". This accounts for costs incurred during the time of active usage, procurement cost and upfront payments of instalments, for all maintenance activities to the extent they are not regarded as fixed costs and also cost of disposal, etc. In radiology this is especially important when determining the cost associated with scanners, but it also applies to personnel costs and overheads.

Differences in a projected versus an actual cost are driven by the distinction between calculated versus actual cost. While actual costs refer to the cash flow incurred, calculative costs are an estimation to mirror the economic cost per unit. Thus, calculative cost may also include opportunity cost and utilise allocation mechanisms for different cost objects; thus when a radiological department orders butterflies for the coming months, the actual cost is the amount payable per shipment. However, the calculative costs are zero at this time and are incurred proportionally over the time of use.

> "Financial ratios can tell you whether the instalment of new equipment or an increase in service is profitable"

The problem of redistributing fixed and step-fixed costs is that this is only an attempt to make them variable. The result, crucially, depends on the choice of cost objects. It might seem reasonable to redistribute the power bill to the examined patients, but this implies that for fewer exams the cost per exam rises - yet patients cannot affect the power bill. Obviously, the differentiation between fixed vs. variable cost alters among cost objects. For example, while payroll costs are fixed per patient, they are perfectly variable per employee.

From Target Costing to Financial Ratios

Radiological entities deal with a large amount of fixed or step-fixed costs, especially regarding personnel and machines. Scanners can be regarded as fixed costs since the main cost drivers are depreciation and maintaining a ready-to-use state. The actual examination hardly bears additional costs, once the scanner is switched on anyway. Further, a large fraction of the costs per exam is borne prior to the actual scan such as time used to schedule the appointment, the examiners effort to familiarise themselves with the case, and upfront expenses for e.g. tracers. These costs are not recoverable if the actual exam is not conducted (patient not showing up, medical conditions not fulfilled, etc.).

What are Financial Ratios?

The term "financial ratios" refers to a variety of ratios that are used to help analyse financial statements and assess the financial health of an institution. These ratios can easily be constructed by matching any data available. The two most commonest uses of financial rations are controlling certain financial indicators and informing investment decisions but there are many standard ratios used to evaluate the overall financial condition of a corporation or other organisation. Financial ratios may be used by managers within a firm, by current and potential shareholders (owners) of a firm, and by a firm's creditors.

Given these two issues of fixed cost and upfront expenses, neither the full cost approach (distorted by workload) nor the marginal cost approach (neglecting significant cost) seem appropriate. Rather, target costing can be used. This method calculates the economic cost per cost object ex ante based on a forecast utilisation and determines a price per unit on these plan figures. Any deviations such as peak loads or underutilisation then unravel gaps in different cost categories. This allows the controller to identify the cause for the deviation and use counter measures. A cancelled exam for example should not increase the price of future exams to cover fixed costs, but also unravels upfront expenses. Based on such experience the radiological entity can either claim these expenses against the referring entity or adjust target costs for future periods by an expected failure rate.

Financial Ratios as Performance Indicators

The financial ratios we have explained can be used as performance indictors. First, lets identify an appropriate cost object. Since the exam process comprises different steps, one can break down the process cost to sub-parts such as the physician's salary or the use of the scanner. Furthermore, it is necessary to define an objective before monitoring the figures. In general, one distinguishes between profit centres, service centres and performance centres. Profit centres obviously maximise surplus over cost and thus generate profit. This is only applicable to private radiological entities as public entities are non-profit. Performance centres only regard the utilised input as the output is constant. This cannot be applied to radiological entities, as the quality of the deliverable highly varies independently of cost. Thus, radiological entities are treated as service centres. Thereby for financial planning, the goal should be to optimise output given a certain input. Regardless of the costing method, volatility in workload is another issue. Obviously, only the reimbursement for each exam can cover expenses, which are mainly of a fixed nature. Thus, careful planning and reasonable buffering methods are necessary to estimate the costs per exam best. One issue here is to identify cycles of workload and adjust the controlling period to even out the volatility. When it comes to using financial ratios for investment decisions, the relevant time horizon can take into account planning for up to several years. The upside is that any volatility in utilisation levels resolves and the quasi-variable redistribution of fixed cost now is more applicable.

To make the right investment decision, one needs to account for the whole lifecycle cost, including instalment of infrastructure, maintenance and disposal. Especially issues like training or idle time are highly likely to be underestimated. With regard to scanners, there are alternatives to purchasing, such as leasing contracts. To compare alternatives one needs to figure out the correct economic depreciation of a machine and include the same items in all calculations. Because small distortions will occur, this might only be suitable for favourability analysis (planning the pros of investing in something, for example), while profitability analysis will need to account for all costs borne over the whole lifecycle. Hence, financial ratios can be used to answer both questions: whether the instalment of a new piece of equipment or increase in service is profitable and what mode of instalment is more favourable.

Conclusions

The main challenge for practitioners is to find the right figures to answer their particular questions. Instead of ignoring this powerful tool, a good place to start is to use it to answer long-term planning questions as this pays off for years. To do this, firstly it is important to identify the relevant cost drivers. Second, these costs have to be related to appropriate cost objects. Third, one has to attribute these figures to the appropriate carrier who can actually influence them, if they are to be used for controlling matters. If the numbers are used for investment decisions it is crucial to know the sensitivity of the result to altering the underlying assumptions as the smoothing will not occur in practice. ■

Glossary

Cost object: A cost object is a tangible input for a product manufactured/service provided, like labour or material.
Cost driver: A cost driver is the unit of an activity that causes the change of an activity cost.
Step-fixed costs: are fixed within a wide range of activity but will change outside the range. For example, if demand for an exam increases by a large number of patients, it may be necessary to add another radiographer to the team - the fixed cost then jumps to another step.
Marginal costing: An accounting technique whereby the effect on costs of a small increment or decrease in output may be estimated
Variable costs: A cost of labour, material or overhead that changes according to the change in the volume of production.

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

COMPUTED RADIOGRAPHY SYSTEMS

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 Institute'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.

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ECRI
Ecri Institute's
Recommended Specifications

Carestream HEALTH

MODEL	High-throughput, general-purpose	DIRECTVIEW CR Classic/Elite System
WHERE MARKETED		Worldwide
FDA CLEARANCE		Yes
CE MARK (MDD)		Yes
APPLICATIONS	All radiographic exams	General radiography, centralized radiography, distributed radiography, chest, upright radiography, abdominal, orthopedics, skeletal, emergency department, ICU, remote clinics, bedside/portable
SYSTEM COMPONENTS		Image-plate reader, PC, image processing software, 17" flat-panel touchscreen monitor, UPS, barcode reader
READER/DIGITIZER		
Description	12-bit image plate reader	Single-cassette free standing , 16 bit scan, 12 bit along the whole imaging chain
Cassette buffer capacity	4 (input)	1
Throughput per hour (cassette sizes)	100 (all sizes)	Up to 102 (depending on size).
H x W x D, cm (in)		H: 68.3 cm (26.9 in.) W: 62.2 cm (24.5 in.) D: 65.0 cm (25.6 in.)
Weight, kg (lb)		85.3 kg (188 lb.)
Power requirements		100-120 VAC 10 Amps 50/60 Hz; 200-240 VAC 5 Amps 50/60 Hz;
Power consumption	2 kW	Not specified
PATIENT ID	Manual entry, barcode, DICOM modality worklist	DICOM modality worklist (optional), manual entry, remote patient data entry software web based (optional)
WORKSTATION(S)		
CPU/components	PC, distributed wall-mountable exam entry terminals	Lenovo TM Pentium® IV desktop PC, DIRECTVIEW 19" touch-screen wall-mounted Remote Operation Panel (option) gives technologists the ability to identify patient/exam/cassette and to review and process images of any linked CR system, remotely .
Image storage	40 GB	160 GB, Up to 4800 images
Power requirements		No additional power required
SOFTWARE FEATURES	Automated image processing, image quality assurance (basic image review), quantitative exposure record, system quality control	Built-in automated image processing with DIRECTVIEW PTS software and DIRECTVIEW CR software (some modules included within built-in software : interactive window/leveling, small detail contrast enhancement, zoom/panning, rotate,flip, LUT invert, 48 annotations tags, free text annotations, print composition, true size printing, DICOM Print software, exposure index recording, autorouting); optional software packages available
INTERFACES	PACS, printer	Ethernet, TCP-IP, DICOM
DICOM CONFORMANCE	DICOM 3.0: CD IOD, print (SCU), MWL, MPPS	DICOM: Storage, Storage commitment, Modality Performance Procedure Step, Print, Modality Worklist,
OPTIONS	Orthopedic image tools, oversized image plates	DIRECTVIEW EVP Software, Black Surround/Masking Software, DIRECTVIEW CR Long-Length Imaging system , Remote Patient Data Entry Software, DICOM Work List Management Software, DICOM Storage Service Class User Software, Grid Detection and Suppression Software, IHE Scheduled Workflow Software, Procedure Mapping and Enhanced Trauma Software, Administrative Analysis Reporting Software, Security Audit Log Software, Low Exposure Optimization Software, DIRECTVIEW Capture Link System, CR Mammography feature, Total Quality Tool package , Total quality tool for Mammography.
OTHER SPECIFICATIONS		The DIRECTVIEW Capture Link System option gives technologists the ability to identify and process cassettes, and to review images at any linked CR system or DIRECTVIEW Remote Operations Panel. Technologists can use all linked CR devices to process individual studies during peak periods, enhancing both productivity and workflow. Capture Link also streamlines workflow when a study contains DR and CR images by enabling CR images to be identified and viewed, along with DR images, at the DIRECTVIEW DR system operator console. This capability is especially important for trauma cases, where time saved by this integration can have the greatest impact on patient care. The newest version of Kodak CR operating software offers an IHE Scheduled Workflow feature, which provides real-time status of imaging exams to a HIS/RIS. This feature enhances productivity by eliminating the need for technologists to manually enter status information at a HIS or RIS workstation, and it allows a CR system to automatically notify the PACS and RIS when a procedure is completed, which enables automatic billing.

	DIRECTVIEW CR 975 System	Point of Care VITA System	Point of Care 360 System
	Worldwide	Worldwide	Worldwide (Available Q3 2010)
	Yes	Yes	YES
	Yes	Yes	YES
	General radiography, centralized radiography, chest, upright radiography, abdominal, orthopedics, skeletal, emergency department, ICU, remote clinics, mammography (not available in US)	Centralized general radiography, chest, upright, abdominal, orthopedics, ICU, skeletal, emergency department, remote clinics, bedside/portable.	Centralized general radiography, chest, upright, abdominal, orthopedics, ICU, skeletal, emergency department, remote clinics, bedside/portable.
	Image-plate reader, PC, image processing software, 17" flat-panel touchscreen monitor, UPS, barcode reader	Image plate reader, server PC (acquisition and QC workstation), flat panel monitor, DICOM interfaces, optional Z-cart	Image plate reader, server PC (acquisition and QC workstation), flat panel monitor, DICOM interfaces, optional Z-cart
	Multiple-cassette processing with drop-and-go workflow , 16 bit scan, 12 bit along the whole imaging chain	Single-cassette tabletop , 16 bit scan, 12 bit along the whole imaging chain	Single-cassette tabletop , 16 bit scan, 12 bit along the whole imaging chain
	16 (8 in and 8 out)	1	1
	Up to 101 cassettes (depending on size)	45 plates/hr	60 plates/hr
	H: 132.1 cm (52 in.) W: 104.1 cm (41 in.) D: 76.2 cm (30 in.)	H: 34 cm (13,4 in.) W: 73,5cm (29 in.) D: 65,5 cm (25,8 in.)	H: 34 cm (13,4 in.) W: 73,5cm (29 in.) D: 65,5 cm (25,8 in.)
	433.6 kg (956 lb.)	45 kg (99 lb)	39kg
	100-120 VAC 10 Amps 50/60 Hz; 200-240 VAC 5 Amps 50/60 Hz Includes an uninterruptible power supply (UPS)	Single phase 50/60 Hz, 100-240 VAC 2,5 Amps	Single phase 50/60 Hz, 100-240 VAC 2,5 Amps
	Not specified	Not specified	Not specified
	DICOM modality worklist (optional), manual entry, remote patient data entry software web based (optional)	DICOM modality worklist (optional), manual entry, remote patient data entry software web based (optional)	DICOM modality worklist (optional), manual entry, remote patient data entry software web based (optional)
	Lenovo TM Pentium® IV built-in PC, DIRECTVIEW 19" touchscreen wall-mounted Remote Operation Panel (option) gives technologists the ability to identify patient/exam/cassette and to review and process images of any linked CR system, remotely .	Recommended Pentium® IV 3.0 Ghz , 17" Colour LCD monitor , 1 GB RAM , 80GB hard disk , Microsoft® Windows® XP Professional Z-Cart configuration requires small form factor PC	Recommended Pentium® IV 3.0 Ghz , 17" Colour LCD monitor , 1 GB RAM , 80GB hard disk , Microsoft® Windows® XP Professional Z-Cart configuration requires small form factor PC
	160 GB, Up to 4800 images	Recommended 80GB	Recommended 80GB
	No additional power required	Single phase 50-60 Hz,100-240 AVC	Single phase 50-60 Hz,100-240 AVC
	Built-in automated image processing with DIRECTVIEW PTS software and Kodak DIRECTVIEW CR software (some modules included within built-in software : interactive window/leveling, small detail contrast enhancement, zoom/panning, rotate,flip, LUT invert, 48 annotations tags, free text annotations, print composition, true size printing, DICOM Print software, exposure index recording, autorouting); optional software packages available	Built-in automated image processing with QC software (some modules included within built-in software : interactive window/leveling, small detail contrast enhancement, zoom/panning, rotate,flip, LUT invert, 4 annotations tags, free text annotations, print composition, true size printing, DICOM Print software, measurement tools, magnifying glass); optional software packages available	Built-in automated image processing with QC software (some modules included within built-in software : interactive window/leveling, small detail contrast enhancement, zoom/panning, rotate,flip, LUT invert, 4 annotations tags, free text annotations, print composition, true size printing, DICOM Print software, measurement tools, magnifying glass); optional software packages available
	Ethernet, TCP-IP, DICOM	Ethernet, TCP-IP, DICOM, USB	Ethernet, TCP-IP, DICOM, USB
	DICOM: Storage, Storage commitment, Modality Performance Procedure Step, Print, Modality Worklist,	DICOM: Storage, Storage commitment, Print, Modality Worklist,	DICOM: Storage, Storage commitment, Print, Modality Worklist,
	DIRECTVIEW EVP Software, Black Surround/Masking Software, DIRECTVIEW CR Long-Length Imaging system , Remote Patient Data Entry Software, DICOM Work List Management Software, DICOM Storage Service Class User Software, Grid Detection and Suppression Software, IHE Scheduled Workflow Software, Procedure Mapping and Enhanced Trauma Software, Administrative Analysis Reporting Software, Security Audit Log Software, Low Exposure Optimization Software, DIRECTVIEW Capture Link System, CR Mammography feature, Total Quality Tool package , Total quality tool for Mammography.	Acquisition Software / Military Package; Remote Patient Entry Software; DICOM Print Software; Custom Print Software; CD Archive Software; DVD Archive Software; Teleradiology Send Software; Teleradiology Receive Software; Workstation Viewer Software; Multi-Modality Workstation Viewer Software; Modality Worklist Long Length Imaging package	Acquisition Software / Military Package; Remote Patient Entry Software; DICOM Print Software; Custom Print Software; CD Archive Software; DVD Archive Software; Teleradiology Send Software; Teleradiology Receive Software; Workstation Viewer Software; Multi-Modality Workstation Viewer Software; Modality Worklist Long Length Imaging package
	The DIRECTVIEW Capture Link System option gives technologists the ability to identify and process cassettes, and to review images at any linked CR system or DIRECTVIEW Remote Operations Panel. Technologists can use all linked CR devices to process individual studies during peak periods, enhancing both productivity and workflow. Capture Link also streamlines workflow when a study contains DR and CR images by enabling CR images to be identified and viewed, along with DR images, at the DIRECTVIEW DR system operator console. This capability is especially important for trauma cases, where time saved by this integration can have the greatest impact on patient care. The newest version of CR operating software offers an IHE Scheduled Workflow feature, which provides real-time status of imaging exams to a HIS/RIS. This feature enhances productivity by eliminating the need for technologists to manually enter status information at a HIS or RIS workstation, and it allows a CR system to automatically notify the PACS and RIS when a procedure is completed, which enables automatic billing.	Easy to install - plug and scan. Seamlessly integrates with a broad variety of modalities and RIS or PACS systems. Proven to be ideal for use in demanding physical conditions.	Easy to install - plug and scan. Seamlessly integrates with a broad variety of modalities and RIS or PACS systems. Proven to be ideal for use in demanding physical conditions.

Product Comparison Chart

ECRI
Ecri Institute's
Recommended Specifications

PROTEC medical systems

PROTEC medical systems

MODEL	High-throughput, general-purpose	PROSCAN 35E	PROSCAN 43	
WHERE MARKETED		Worldwide, except USA & Canada	Worldwide, except USA & Canada	
FDA CLEARANCE		No	No	
CE MARK (MDD)		Yes	Yes	
APPLICATIONS	All radiographic exams	General Radiography	General Radiography	
SYSTEM COMPONENTS		PROSCAN 35E IP reader with integrated erasing function, set of imaging plates, protection sleeves, CONAXX Image Acquisition Software	PROSCAN 43 fully automatic IP reader with integrated erasing function, set of imaging plates incl. cassettes, CONAXX Image Acquisition Software	
READER/DIGITIZER				
Description	12-bit image plate reader	16-bit laser scanner for reading imaging plates	16-bit laser scanner for reading imaging plates	
Cassette buffer capacity	4 (input)	Single IP reader, all sizes up to 35 cm (14")	Single IP reader; 18x24, 24x30 & 35x43 cassettes	
Throughput per hour (cassette sizes)	100 (all sizes)	"51 imaging plates/h, 35 x 43 cm (14 x 17") 110 imaging plates/h, 18 x 24 cm (8 x 10"")"	51 imaging plates/h, 35 x 43 cm (14 x 17") "55 imaging plates/h, 35 x 43 cm (14 x 17")	
H x W x D, cm (in)		39 x 38 x 52 (15.4 x 15 x 20.5)	39 x 38 x 52 (15.4 x 15 x 20.5)	
Weight, kg (lb)		20,4 kg (45 lbs)	56 kg (123 lbs)	
Power requirements		100-240 VAC; 50/60 Hz	100-240 VAC; 50/60 Hz	
Power consumption	2 kW	120W	350W	
PATIENT ID	Manual entry, barcode, DICOM modality worklist	DICOM communication, worklist, text file, GDT/BDT interface, manual entry	DICOM communication, worklist, text file, GDT/BDT interface, manual entry	
WORKSTATION(S)				
CPU/components	PC, distributed wall-mountable exam entry terminals	System requirements include Windows Vista, XP or 2000, 2.4 GHz clock rate, min. 2 GB main memory (RAM)	System requirements include Windows Vista, XP or 2000, 2.4 GHz clock rate, min. 2 GB main memory (RAM)	
Image storage	40 GB	Via PROPAXX server/PC main board, min. 80 GB (recommended >400GB)	Via PROPAXX server/PC main board, min. 80 GB (recommended >400GB)	
Power requirements		100-240 VAC; 50/60 Hz	100-240 VAC; 50/60 Hz	
SOFTWARE FEATURES	Automated image processing, image quality assurance (basic image review), quantitative exposure record, system quality control	Automated Image Acquisition through CONAXX, image pre-processing, image quality assurance (image review & modification possibilities)	Automated Image Acquisition through CONAXX, image pre-processing, image quality assurance (image review & modification possibilities)	
INTERFACES	PACS, printer	DICOM communication to PACS, DICOM print to printer, patient CD; GDT/BDT	DICOM communication to PACS, DICOM print to printer, patient CD; GDT/BDT	
DICOM CONFORMANCE	DICOM 3.0: CD IOD, print (SCU), MWL, MPPS	Yes: DICOM 3.0 (incl. Send (SCU), WL (SCU), MPPS, Print (SCU), Query (SCU))	Yes: DICOM 3.0 (incl. Send (SCU), WL (SCU), MPPS, Print (SCU), Query (SCU))	
OPTIONS	Orthopedic image tools, oversized image plates	PROPAXX medical imaging software (viewer) is option, software modules to make the system adaptable from single workstation to a multi modality viewing solution	PROPAXX medical imaging software (viewer) is option, software modules to make the system adaptable from single workstation to a multi modality viewing solution	
OTHER SPECIFICATIONS		"CR system covering all formats of imaging plates up to 35 cm (14") infeed width; best image quality due to high-end-laser technology in combination with CONAXX Image Acquisition Software with Advanced Image Processing (included in package). Special version for veterinarians available. Ideal for mobile use due to size/weight (e.g. vet applications)"	Fully automatic CR system for standard formats; best image quality due to high-end-laser technology in combination with CONAXX Image Acquisition Software with Advanced Image Processing (included in package). Special version for veterinarians available.	

	CR 30-X	DX-G	DX-M
	Worldwide	Worldwide	Worldwide
	Yes	Yes	
	Yes	Yes	Yes
	All radiographic exams	All radiographic exams	All radiographic exams
	Image-plate reader, ID/preview terminal and software, Windows NT processing station and software	Image-plate reader, ID/preview terminal and software, Windows NT processing station and software	Image-plate reader, ID/preview terminal and software, Windows NT processing station and software
	12-bit laser scanner for Powder IP	16-bit laser scanner for Needle and Powder IP	16-bit laser scanner for Needle and Powder IP
	Single-cassette handling system	5-cassette input, 5-cassette output, all sizes	5-cassette input, 5-cassette output, all sizes
	Up to 82 (depending on size and application)	Up to 83 (depending on size and application)	Up to 83 (depending on size and application)
	46.4 x 69.3 x 7.01 (18.2 x 27.2 x 27.6)	123 x 66 x 51 (48.4 x 26 x 20)	123 x 66 x 51 (48.4 x 26 x 20)
	98 (216.05)	180 (397)	180 (397)
	220, 240 V; 50/60 Hz; 16 A fuse	220-240 VAC; 50/60 Hz; 15/16 A; single-phase	220-240 VAC; 50/60 Hz; 15/16 A; single-phase
	Not specified	Not specified	Not specified
	Embedded memory chip, RIS interface for patient list and query by accession number, RIS-link tool kit for standard and nonstandard RIS, DICOM worklist query	Embedded memory chip, RIS interface for patient list and query by accession number, RIS-link tool kit for standard and nonstandard RIS, DICOM worklist query	Embedded memory chip, RIS interface for patient list and query by accession number, RIS-link tool kit for standard and nonstandard RIS, DICOM worklist query
	PC systems with 512 MB RAM, 4-18 GB HD; standard high-brightness VGA or touchscreen monitor options; modem cables	PC systems with 512 MB RAM, 4-18 GB HD; standard high-brightness VGA or touchscreen monitor options; modem cables	PC systems with 512 MB RAM, 4-18 GB HD; standard high-brightness VGA or touchscreen monitor options; modem cables
	Up to 10,000 images	Up to 10,000 images	Up to 10,000 images
	100-240 VAC; 50/60 Hz	100-240 VAC; 50/60 Hz	100-240 VAC; 50/60 Hz
	Musica image processing, dynamic window/leveling, detail contrast enhancement, latitude and noise reduction, densitometry mapping, zoom and dynamic roam, rotate, invert, WYSIWYG hard copy, ORACLE, SQL plus	Musica image processing, dynamic window/leveling, detail contrast enhancement, latitude and noise reduction, densitometry mapping, zoom and dynamic roam, rotate, invert, WYSIWYG hard copy, ORACLE, SQL plus	Musica image processing, dynamic window/leveling, detail contrast enhancement, latitude and noise reduction, densitometry mapping, zoom and dynamic roam, rotate, invert, WYSIWYG hard copy, ORACLE, SQL plus
	DICOM print, store; RIS-link tool kit with modality worklist, soft-copy tool kit (for non-DICOM PACS)	DICOM print, store; RIS-link tool kit with modality worklist, soft-copy tool kit (for non-DICOM PACS)	DICOM print, store; RIS-link tool kit with modality worklist, soft-copy tool kit (for non-DICOM PACS)
	SCU and print class	SCU and print class	SCU and print class
	Test phantoms and auto QC software, dose-monitoring software; pediatric, urology/tomography, dental panoramic, full-leg/-spine software; SmartPrint multiformat printing, annotation, black border, DICOM storage	Test phantoms and auto QC software, dose-monitoring software; pediatric, urology/tomography, dental panoramic, full-leg/-spine software; SmartPrint multiformat printing, annotation, black border, DICOM storage	Test phantoms and auto QC software, dose-monitoring software; pediatric, urology/tomography, dental panoramic, full-leg/-spine software; SmartPrint multiformat printing, annotation, black border, DICOM storage
	Customer training. Meets requirements of CUL and UL.	Customer training. Meets requirements of CUS, ETL	Customer training. Meets requirements of CUS, ETL

MATCHING TALENTS AND JOBS

Programmed to under-perform? This is how some healthcare managers may feel when they go home after a typical day at work, according to a recent white paper 'What Does Being in Over Your Head Look Like'. In reality, the average healthcare organisation creates leadership alignment (the right people in the right roles) approximately 55 percent of the time. Realistic expectations for leadership appointment should target 85 percent alignment, by using a structured approach to determining their future leaders. The difference of having the right leaders in place can show as much as a 75 percent increase in operational performance over time.

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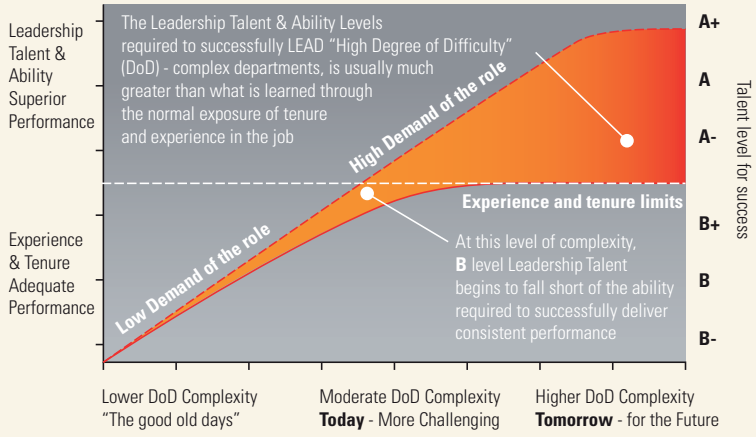
There are several common appointment mistakes that may lead to sub-optimal performance, where newly appointed healthcare leaders and managers whose talents are not best matched to a new role, can end up in over their heads.

The easiest way to describe the condition is where a department's complexity (degree of difficulty) exceeds the threshold at which a manager has higher odds of success (typically above a 50 percent rate). There are different levels of ability. For a 'C' level ability, this is virtually any management job, since their chances of success are at best just 40 percent (in the lowest complexity positions). The decision to appoint a 'C' level manager to high positions is justified only when challenges are easily managed, or if the manager has an exceptional ability to manage day-to-day operations.

How about 'B' level managers? As cited by Thomas J. DeLong and Vineeta Vijayaraghavan in their 2003 'Harvard Business Review Article', 'Let's hear it for B players', managers at the 'B' level are solid, consistent performers. They are competent, experienced, consistent and loyal.

THE GAP BETWEEN LEADERSHIP TALENT AND DEMANDS OF THE ROLE



These managers make up the backbone of any organisation, and typically account for between 50 percent and 55 percent of executives. In our research, the bulk of healthcare IT managers are usually at the 'B' level. For 'B' level leadership talent, the ability to manage low and medium complexity tasks produces favourable results, respectively, 75 percent and 60 percent of the time (see Figure 1). The only cases with low odds of success (and are 'in over their heads') is when they are appointed to complex assignments or departments, accompanied by a high degree of difficulty. It is here that the chances of success dip to 45 percent. This is not to say that they cannot be successful; it is just less likely. If a decision is made to appoint 'B' level IT managers to such a level of complexity, it is crucial for CIOs to ensure that they 'over achievers.

Other attributes of "B" level leaders are:

- They are talented but not usually as ambitious or driven;
- They are interested in advancement but not at all costs or a steep price;
- They define success differently (not purely financially or status motivated);
- While they may work hard, they prioritise "life-work" balance to work 50 hours per week instead of 80 or more;
- They are usually excellent team players avoiding the spotlight of self promotion;
- They may have been "A" level performers at one time and have dialled back their career focus due to outside – personal priorities or possibly "throttling" down to semi-retirement;
- They have longer tenures in organisations because they are less likely to leap from job to job to fast track or advance their careers, or
- They contain a significant amount of an organisation's intellectual capital due to their experience and tenure levels.

In such a light, there are seven typical appointment mistakes which organisations make:

1. Appointing a "B" level ability person to a high degree of difficulty management role based upon their tenure period or technical competency (clinical expertise); the ability to lead others does not correlate with either. Odds of success = 45 percent.
2. Appointing a lower level "supervisor" into a manager position in a bottom quartile department out of convenience. They are usually unsuccessful because of their lack of manager experience. They tend to be part of the previous culture and are less likely to act on the low performers (or make tough decisions). Odds of success = < 20 percent.
3. Failure to recognise that a high degree of difficulty department in the bottom quartile will require a 'turnaround' specialist used to making tough decisions quickly, with responsibility to stakeholders outweighing personal interests. Most 'B' level managers do well in maintenance roles. Odds of success = < 20 percent.
4. Waiting too long to act and failing to set hard (measurable) performance targets and milestones for the first year. If new managers fail to immediately make heavy-lifting decisions (especially in terms of dealing with negative, disruptive, poor performers), turnarounds take longer, are usually more painful and have a lower overall success rate. Odds of success = < 20 percent.
5. Not taking due account of leadership talent or ability. Assigning a 'C' or 'D' level leader in any role has low odds of success: average 30 percent for a 'C' player and 15 percent for a 'D'.
6. Low acceptance rate of a new leader/manager by the staff because of an 'old school' mindset about the importance of prior tenure in a particular department. It can be extremely difficult for some people to handle this situation long enough to persevere. Odds of success = < 33 percent.
7. Competency Alignment: Sometimes, even the most talented leaders ('A' players) can be out of alignment technically, with regard to business models, culturally/behaviourally or in terms of pure maturity or experience. Odds of success = < 33 percent.

Common causes

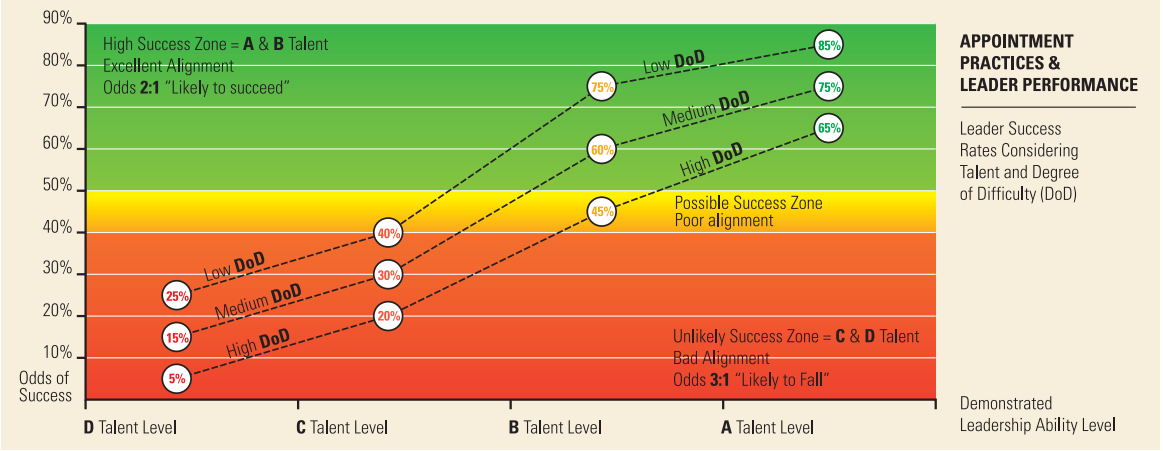
According to the White Paper, the most common causes that create the environment where seemingly good people (but sub-optimised leaders) tend to get in over their heads include:

- Managers are appointed before they are truly ready - they are not quite experienced or mature enough;
- Managers are appointed when their demonstrated leadership talent is deficient;
- Managers are appointed to a department where the degree of difficulty exceed their ability to get good results, and
- Managers are appointed out of necessity or convenience.

Numerous consultants promote the hiring of only 'A' players to leadership and/or total employee positions. If less than .01percent of healthcare organisations can achieve this level of human capital recruitment, hiring and appointment, how realistic is it as an aspiration? The last organisation that tried to create a culture of all 'A' players was Enron.

Another name for this business practice is 'Top Grading', where selection only screens for the best talents, while the performance management practices cut a percentage of the total employment base (GE is famous for cutting 10 percent of its bottom performers every year).

Such a philosophy will simply not work at healthcare organisations. In the final analysis, the healthcare business, like others, is a team sport. ■



MANUFACTURER'S ASSOCIATION COOPERATES ON DOSE SAFETY

New CT Software Features to Minimise Radiation Health Risks

IMAGING Management spoke to David Fisher, Executive Director of the Medical Imaging & Technology Alliance (MITA) and Vice-President of the National Electrical Manufacturers' Association (NEMA) about recent momentum in the drive to address potential health hazards caused by radiation exposure through medical imaging and related procedures. Also concerned about health impacts of radiation exposure, the Federal Drug Agency (FDA) has turned their attention to three types of medical imaging procedures: computed tomography (CT), nuclear medicine studies, and fluoroscopy, said to be "the greatest contributors to total radiation exposure within the U.S. population." The FDA is advocating the adoption of two principles of radiation protection: appropriate justification of the radiation procedure and optimisation of the radiation dose used during each procedure.

Interviewee
David Fisher

Executive Director
Medical Imaging & Technology Alliance

Vice-President
National Electrical Manufacturers' Association

Interview by
Dervla Gleeson

Managing Editor
IMAGING Management

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The FDA has also commenced development of targeted requirements for manufacturers of CT and fluoroscopic devices to incorporate important safeguards into the design of their machines to develop safer technologies and to provide appropriate training to support safe use by practitioners. The goal is development of a patient medical imaging history card that will allow patients to track their medical imaging history and share it with relevant healthcare providers.

Moreover, manufacturers will include an additional safeguard to allow hospitals and imaging facilities to set maximum radiation dose limits that would prevent CT scanning at higher, potentially dangerous radiation levels. This feature will help prevent the use of hazardous levels of radiation that could negatively impact patient health. The new software can be installed on CT scanners to alert operators with a yellow "alert" warning message or red "scans at this dose level are unadvisable" pop-up screen, when recommended radiation dose levels would be exceeded by continuing with the scan. Dose levels are intended to be set by the healthcare providers themselves, in order to begin implementing them as soon as possible. Manufacturers will include the software in new scanners and offer them to existing customers before the end of the year. The software would allow dose information to be standardised and archiveable in a dose registry for monitoring and study. Here, David Fisher explains.

DG: MITA recently announced a new industry-wide commitment to including new radiation dose safeguards on CT technology – can you tell us more about this?

DF: Imaging manufacturers have a long history of reducing radiation dose and the MITA-led CT Dose Check Initiative is one more example of the commitment to reducing medical radiation and medical errors. Currently, CT machines provide radiation dose information. The CT Dose Check Initiative provides additional information for CT operators. MITA's CT manufacturer members have committed to including the new radiation dose check feature on CT machines. This feature will provide an alert when dose levels, as determined by hospitals, imaging centres and clinicians, exceed a level associated with routine use. In addition, manufacturers will include an additional alert when the parameters associated with a scan could potentially be dangerous. This alert is also configurable to prevent scanning at these radiation levels.

DG: Aside from the risks posed by CT for patients, it has had quite an impact on how imaging is performed. How has it transformed healthcare delivery?

DF: The high-resolution, detailed images that CT scans provide play a critical role in disease prevention, early detection, diagnosis and treatment. Not only has The New England Journal of Medicine proclaimed medical imaging one of the top "developments that changed the face of clinical medicine" during the last millennium, but physicians on the front lines of patient care reinforce that belief every day. As one example, in the Dartmouth-Stanford Survey of Medical Innovations, leading general internists ranked MRI and CT technology as the most valuable medical innovations in the last 30 years.

What is the Medical Imaging & Technology Alliance?

The Medical Imaging & Technology Alliance (MITA) is a division of NEMA, the association of electrical and medical imaging equipment manufacturers, which represents manufacturers of medical diagnostic imaging equipment including MRI, CT, x-ray and ultrasound products. Its approximately 450 member companies manufacture products with worldwide sales exceeding 120 billion dollars.

These scans have revolutionised healthcare delivery and saved millions of lives. For example, a study from the National Bureau of Economic Research found that increased utilisation of advanced medical imaging, such as CT and MRI, improved life expectancy by 0.62 to 0.71 years. Also, new applications of CT technology for screenings such as CT colonography for colon cancer and CT angiography for heart disease have improved screening rates and lowered costs.

DG: Medical imaging professionals have called on the industry to do more to regulate and continually re-evaluate reference dose levels – how has the industry responded?

DF: The medical imaging industry collaborates proactively to tackle all issues related to radiation safety. Beyond our Dose Check Initiative and continuous technology innovation, MITA looks forward to assisting stakeholders in the development of radiation dose reference levels, or reference values. Developing reference values will promote additional understanding of radiation dose. Once determined, the radiation dose reference level serves as a data point at which physicians, physicists and technologists can compare the radiation dose level of the specific procedure they are administering to a wide sample of similar tests.

DG: What sort of guidelines can you give our readers, to help them in managing dose levels in CT exams?

DF: Firstly, patients should speak with their physicians to better understand radiation dose and how it is best applied in their specific medical situation. In addition, MITA endorses the following key principles:

- Expanding and integrating appropriateness criteria into physician decision-making.
- Creating a national dose registry to ensure longitudinal tracking of dose levels for patients across America.
- Adopting standardised storage of diagnostic imaging information within electronic health records.
- Expanding mandatory accreditation for advanced imaging facilities.
- Establishing minimum standards for hospital and imaging facility personnel who perform medical imaging exams and deliver radiation therapy treatments.
- Developing minimum standards for training and education for hospital and imaging facility personnel and checklists to reduce medical errors.
- Expanding and standardising the reporting of medical errors associated with medical radiation across stakeholders in a manner that is transparent for patients, families and physicians.
- Working with stakeholders to develop radiation dose reference values to provide a data point to compare the dose level of a specific procedure.

DG: What role does training and education play in dose management?

DF: Training operators on the specific functions of unique machines is important to maintain the proper use of complex medical imaging and radiation therapy equipment. To that end, imaging and radiation therapy equipment manufacturers currently provide comprehensive training and education to the users of their equipment. Some examples of training delivery include:

1) Onsite training at the customer facility using their own installed equipment;
2) Instructor-led classroom training, including lab work as appropriate, delivered at the manufacturer's training centre;
3) Remote instructor led training done via the internet and/or,
4) Customer self-directed e-learning modules produced by the manufacturer.

Training is especially important when radiation is involved. Our members have noted the importance of medical imaging and radiotherapy equipment operators having prerequisite clinical competence and professional training in order to leverage advanced education on specific equipment.

It's also important to remember that training doesn't end when our equipment is installed. Instead, training is an ongoing effort by the hospital and imaging facilities including continuing education, training of new employees, and achieving and maintaining certifications and accreditations. MITA's members work continually with stakeholders to develop additional operational safety procedures and checklists to reduce medical errors and incorporate those new standards into our training offerings.

DG: How close is the United States to having a national electronic registry for patients' dose histories?

DF: MITA endorsed the President's proposal in the fiscal year 2011 budget to provide funds for a National Dose Registry. This registry builds on the MITA-managed Digital Imaging and Communication in Medicine (DICOM) standards, which is the universal language that allows for interoperability of medical images. Thanks to these standards, imaging is without a doubt, the most "networked" aspect of healthcare in the clinical setting. ■

INTERVIEW WITH **PROF. FRANCESCO SARDANELLI**

Prof. Francesco Sardanelli is associate professor of radiology at the University of Milan, Italy, as well as director of the radiology unit at the Scientific Institute Policlinico San Donato in the same city. He is a well-respected expert in research methodology and statistics applied to medical imaging and in multimodality breast investigation, in contrast agents for MR imaging, and MR technology. He is a consultant for the Istituto Superiore di Sanità, an organ of the Italian Ministry of Health, for the project "Multimodality Surveillance of Women at Genetic-Familial High-Risk of Breast Cancer". Moreover, he has expertise in cardiovascular MR, CT and MR imaging of multiple sclerosis. As well as leading more than 400 presentations at courses and scientific meetings, he has published five books, 45 chapters in books, four translations of books or chapter in books, 184 articles – 103 of them on peer-reviewed journals with a total impact factor of 270), and 436 scientific congress abstracts. Since 2009, he is director of EuroAIM (European Network for the Assessment of Imaging in Medicine), a division of the European Institute for Biomedical Imaging Research (EIBIR), which is supported by the European Society of Radiology (ESR).

Interviewee
Prof. Francesco Sardanelli

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How did you end up choosing radiology?

I chose radiology after encountering Prof. Giorgio Cittadini at the University of Genoa School of Medicine. I had the possibility to do a graduation thesis in pharmacology and to go for two years to Temple University following graduation. However, I was fascinated by radiology and by the inspirational teaching abilities of Prof. Cittadini. Moreover, I was highly interested in applying technology to medicine and I did not want to choose a "narrow" specialty. Thus, I selected radiology, which in my opinion is the broadest specialty, due to its applications across the whole body and even beyond medicine, for example as we now see with fMRI in neurosciences.

Please describe a typical working day for you.

I wake up at 5.30 AM, have breakfast and work out for up to an hour at home while watching the news on the TV. I like to remain informed about current affairs in Italy and around the world, and the morning during my workout is a good time for this, especially since I never read newspapers any more. I usually arrive at work between 7 and 7.30 AM, take a very brief break of 15 minutes for a light lunch at 14.00 PM and am usually at work until 19.30 PM.

What are your main 'management' related activities at work?

The top management activity for me is in the area of human resources, in the coordination of co-workers such as staff radiologists, teaching residents, and organisation of work schedules, with particular reference to radiologic technologists, nurses, and administrative personnel. At least two hours per day are dedicated to personal conversations on problems arising from day-to-day activities, necessitating specific solutions. Notably, the door of my office is always open with few exceptions during the day and I am always available for the evaluation of difficult radiological cases.

How did you come to be selected as Director of EuroAIM?

My role in EuroAIM is down to the continuing support of Prof. Gabriel Krestin, Head

of the Research Committee of the ESR. During a meeting of this committee, he asked whether someone was available to guide a group on evidence-based radiology (EBR). I proposed myself, and Krestin accepted. I proposed a first draft of an article and as a result, my colleagues Myriam Hunink, Fiona Gilbert, Giovanni di Leo and Gabriel Krestin contributed to the final version, which has been published in 'European Radiology'. There, we outlined a possible ESR policy for EBR. On this basis, Krestin suggested me for the role of EuroAIM director.

What is the main focus of your tenure within EuroAIM?

The main focus is:

1. To plan a series of gap analyses under the following themes: what radiological topics are covered by recent systematic review and meta-analyses and what topics are not covered; to discern what radiological topics not covered by recent systematic review and meta-analyses have enough original primary studies to be meta-analysed and what topics do not;
2. To select topics to determine which primary studies are available while the systematic reviews and meta-analyses that are necessary to do them are lacking and,
3. To define shared rules for issuing EBR-based European radiological guidelines.

The creation of a dedicated evidence-based radiology website managed mainly by a group of young radiologists and residents, is also likely.

Why is evidence-based radiology so crucial?

The EBR approach to medical imaging is crucial for three reasons, as follows:

1. **Ethics:** To do the best for our patients;
2. **Economics:** To avoid useless imaging exams, and
3. **Professional:** If radiologists don't begin using EBR reliably then other specialists who use medical imaging may apply it themselves, and may draw conclusions in favour of or against certain diagnostic or interventional procedures. In my opinion, it would be better that radiologists avoid having decisions made about the best use of their diagnostic or interventional health technology by other specialists.

> "The start-up of multidetector coronary CT after 2000 and its increasing use obscured the role of cardiac MR imaging. Cooperation with cardiologists is crucial."

What would you describe as the greatest accomplishment of your career so far, and why?

The greatest accomplishments of my career are in the three areas of my work:
Academic – My role of associate professor at Milan University;
Clinical – Being made director of radiology at the Policlinico San Donato, and
Scientific – Recently, a book I wrote entitled "Biostatistics for Radiologists" was published.

What are the most exciting developments taking place in the field of breast imaging?

The most important news in breast imaging is the increasing role of MR imaging. I recently guided a large interdisciplinary group of breast cancer specialists on this topic promoted by EUSOMA (European Society of Breast Cancer Specialists) and the results of this working group are recently published in the European Journal of Cancer.

Indications for breast MRI will increase in the future, in particular for screening (from high to intermediate risk) and presurgical staging. Breast density (calculated with digital mammography or MR imaging) will enter models for predicting the risk of breast cancer. Tomosynthesis will change our way of thinking about mammography, decreasing recall rates and reducing interval cancers.

More difficult is to foresee what will happen with 3D sonography. Imaging-guided treatment (focused ultrasound or radiofrequency ablation) may change the therapy of small breast cancers and radiology should try to capitalise on this momentum.

What are the most interesting developments in cardiac imaging?

On the subject of developments in cardiac imaging, the start-up of multidetector coronary CT after 2000 and its increasing use obscured the role of cardiac MR imaging. Cooperation with cardiologists is crucial. However, we need to increase our awareness of developments in cardiology and to monitor its culture, to maintain our role in managing cardiac imaging procedures and to defend our professional space from competition from cardiologists. For this aim, radiologists need to cultivate abilities in both cardiac MR and CT, taking in high consideration the aim of reducing radiation exposure according to the ALARA (as low as reasonably achievable) principle.

How do you balance your workload, in order to meet all your professional responsibilities?

After 2006, I gave up any professional private activity external to the hospital. The most valuable advice I can pass on is to pay attention to human resources. Spend as much as possible of your time in conversation with your coworkers and fellows. Men and women are more important than technology. Balancing your workload with a personal life, however, is an ongoing challenge – down-time is important. During the weekend I usually write or make reviews for journals, but also I spend time with my family, play the piano and read books. The last one I finished is called "Five equations that changed the world", written by Michael Guillen. ■

AN OVERVIEW OF THE HEALTHCARE SYSTEM IN GREECE

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

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

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

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

In the period between the early 1990s and today, investment in the public sector continued, with greater emphasis placed on managerial and organisational reform to increase the efficiency of the system. An important development in this period was the evolution of the private healthcare sector, which now accounts for more than half of healthcare expenditure. Today, therefore, the healthcare system in Greece is a mixed one where the NHS, public insurance funds and the private sector are all involved significantly in the funding and provision of healthcare services.

Organisation

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

This primary, secondary and tertiary public healthcare system is managed by seven Regional Health Authorities, run by Executive Officers who report to the Ministry of Health and Social Solidarity. The latter has responsibility for developing health policy and coordinating healthcare delivery. The Ministry also supervises bodies such as the National Drug Organisation, the National Emergency Service, the National Centre for Communicable Diseases, and various other specialised institutions.

Role of Social Insurance Funds

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

The IKA covers 50% of the population, the OGA covers 20% of the population, the Fund for Merchants, Manu-

AUTHOR **GUIDELINES**

Content

IMAGING Management welcomes submissions from qualified, experienced professionals active in the imaging industry, related technology companies and medical healthcare professionals with an interest in imaging-related topics and themes. We are particularly interested in articles focusing on management or practice issues and therefore accept scientific papers with a clear connection to these areas. Articles must be written by independent authorities, and any sponsors for research named. Our editorial policy means that articles must present an unbiased view, and avoid 'promotional' or biased content from manufacturers.

Submission guidelines

Authors are responsible for all statements made in their work, including changes made by the editor, authorised by the submitting author. The text should be provided as a word document via e-mail to editorial@imagingmanagement.org. Please provide a contact e-mail address for correspondence. Following review, a revised version, which includes editor's comments, is returned to the author for authorisation. Articles may be a maximum 700 words per published page, but may include up to 1,500 words in total.

Structure

Article texts must contain:

- Names of authors with abbreviations for the highest academic degree;
- Affiliation: department and institution, city and country;
- Lead authors are requested to supply a portrait photo (see specifications below);
- One contact name for correspondence and an e-mail address which may be published with the article;
- Acknowledgements of any connections with a company or financial sponsor;
- Authors are encouraged to include checklists, tables and/or guidelines, which summarise findings or recommendations, and
- References or sources, if appropriate, as specified below.

Images

Main authors are invited to supply a portrait photo for publication with their article, as well as other images and visuals. This and any other relevant images for publication with an article should be sent by e-mail as separate files (only high resolution images with 300dpi) and their order of placement in the article must be clearly indicated. Only the electronic formats _.tif_ or _.jpeg_ can be used for images, i.e. not Microsoft Word or PowerPoint. Images must be no smaller than 9cm x 9cm at 100% scale. Only images meeting these specifications can be published. If an image has been published before, permission to reproduce the material must be obtained by the author from the copyright holder and the original source acknowledged in the text, e.g. © 2004 Dervla Gleeson.

Format for references

Please use the Harvard reference system. Citations within the text for a single author reference should include the author surname and year of publication; for a citation with two authors include both author surnames and year of publication; for more than two authors, include the first author surname followed by "et al." and the year of publication. Multiple citations should be separated by a semicolon, and listed in alphabetical order. Example of within text citation: (Marolt 2008; Marolt and Gleeson 2002; Miller et al. 2003).

The format for listing references in submitted articles should follow the Harvard reference system. Example of standard journal reference: Sydow Campbell, K. (1999) "Collecting information; qualitative research methods for solving workplace problems", Technical communication, 46 (4) 532-544. Readers will be provided with an e-mail contact for references, which will be kept on file and supplied on request. Authors are responsible for the accuracy of the references they cite.

Acceptance

It is at the discretion of our editorial board to accept or refuse submissions. We will respond to submissions within four weeks of receipt. We reserve the right to revise the article or request the author to edit the contents, and to publish all texts in any EMC Consulting Group journal or related website, and to list them in online literature databases.

For further details or to request a copy of the 2010 editorial planner, with topics and focus areas included, please email **editorial@imagingmanagement.org**.

Thank you,
The IMAGING Management Editorial Team

facturers & Related Occupations (OAEE) covers 13% of the population and the Fund of Civil Servants (OPAD) covers 12% of the population. Apart from purchasing services, the funds also provide healthcare services through their own centres.

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

Financing and Expenditure

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

Table 1. Greece vis a vis OECD average in regards to health and healthcare indicators

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

Management in Radiology

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European Society of Radiology

Management in Radiology

Annual Scientific Meeting

October 14–15, 2010, Mallorca/ES

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on **www.mir-online.org**

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

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

Human, Capital and Technological Resources

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

In this context the country has the lowest ratio of nurses to physicians among OECD countries. As in most OECD countries, the number of hospital beds per capita in Greece has fallen over time. This reduction has coincided with a reduction of average length-of-stay in hospitals and an increase in the number of surgical procedures performed on a same-day (or ambulatory) basis. The average length of stay is six days and the occupancy rate of hospitals stands at 79%. In conclusion, the healthcare system nowadays has the same infrastructure as in other OECD countries, but it is characterised by an oversupply of doctors and a shortage of nurses, which causes operational and service distortions and supplier-induced demand phenomena. ■

RADIOLOGY IN GREECE
ORGANISATIONAL STRUCTURE, EDUCATION & THE NATIONAL SOCIETY

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Radiology in Greece has followed the rapid technological evolution experienced by other European countries, despite the financial constraints of the recent times. Social security funding is under heavy pressure and reimbursement policies are facing cutbacks. Nationally, diagnostic imaging, which includes all imaging modalities, sales and services, is worth almost 200 million euro a year in business terms.

Scans themselves are relatively inexpensive. While prices on different imaging modalities vary widely, a typical PET-CT scan might cost 1,100 euros, while an MRI would cost 280 euros and a CT scan would cost 75 – 130 euros according to official reimbursement public lists. Regarding installed imaging systems, the private sector owns the majority of these. For instance, 76 percent of CT units, 84 percent of mammography units and 86 percent of MRI units are installed in private health service institutions. According to the OECD, a considerable increase in available imaging systems was noted during the last decade.

Specifically for 2005, there was an official recording of 25.8 CT units per million inhabitants (compared to 20.2 in the other OECD countries) and respectively 13.2 MRI units per million inhabitants (compared to 11 in other OECD countries). It is a fact that this number today is considerably higher. In addition, it should be mentioned that relatively recently there has been a tendency among all radiological departments in the country toward progressive digitalisation.

Hellenic Radiological Society

The Hellenic Radiological Society is the official educational and scientific association of Greek radiologists. It was founded in 1933, and its purpose is to promote and develop the

Vienna

March 3–7

ECR 2011

European Congress of Radiology

The annual meeting of ESR European Society of Radiology myESR.org

highest standards of radiology, and to exchange scientific information in all fields of radiology and related sciences through education and research. The society is governed by the President, the Executive Board, and the General Assembly.

The society publishes the Hellenic radiology journal in quarterly issues covering all technical and clinical aspects of diagnostic imaging and intervention. Greece leads Europe by a wide margin in the number of doctors per capita. In addition, it should be mentioned that recently there has been a tendency among all radiological departments in the country toward progressive digitalisation.

Education of Radiologists

Radiology is the domain of board-certified doctors in Greece. Radiologists are trained for a total period of five years, which covers all sectors of imaging and interventional techniques. Training is provided by certified state and university hospitals. For the acquisition of the title of specialist, written and oral examinations are required, held by three-member state committees of evaluation after the completion of five years of training, during which a specific number of procedures and radiological examinations must be completed.

The Supreme Scientific Organisation of Greece recently recognised the subspecialties of interventional radiology and neuroradiology, which will be practiced in specialised centres. The total number of doctors in Greece is estimated at approximately 64,000. Of those, 11 percent are unemployed and 14 percent are part-timers. The total number of certified radiologists runs to 1,800, while the total number of radiologists in training is approximately 500. In Greece, radiotherapy and nuclear medicine are distinct specialties, separate from radiology.

Organisational Issues

In every radiological department of the public health system, there is a director or chairman that leads the team, a range of consultants of the various subspecialties and modalities, as well as radiologists-in-training. Radiologists serving in the public hospitals are full-time, with the right to see private patients in the hospital during afternoons. Academic, military, and radiologists appointed by insurance institutions have the right to practice private medicine. Greek radiologists have representatives among the elected members of European scientific societies, including the ESR, ESGAR, ESUR, CIRSE, MIR, the ESSR and others.

Key Figures for Radiology in Greece

- Number of physicians (per 1,000 inhabitants): 5
- Number of hospital beds per radiologist: 19
- Number of radiographers per imaging department: 1.1
- Number of board certified radiologists: 2,600
- Number of radiographers: 1,300

Diagnostic Equipment in Greece

- ~4,000 x-ray machines including general x-ray, dental, mammographical, bone-density, angio and mobile scanners, etc;
- Four filmless imaging departments: two in the public hospitals and two in private hospitals;
- 244 MRI systems: 33 (13%) in the public sector and 211 (87%) in the private sector. There is one MRI system per 46,147 inhabitants or 22 systems per million population;
- One MRI system per 10.6 radiologists;
- 380 CT systems: 123 (32%) in the public sector and 257 (67%) in private sector. The ratio is one CT system per 29,631 inhabitants or 34 systems per million population;
- One CT system per 6.8 radiologists;
- 105 FFDM systems: Three in the public sector and 102 in the private sector, and
- Four PET/CT systems: two in the public and two in the private sector.

(Data from Scanner magazine 31; 2010)

Tight Budgets Limit Imaging Growth

Diagnostic imaging is one of the stand-out success stories of modern medicine, in Greece as elsewhere. However, in recent times it is now under pressure from tight healthcare budgets and from professional competition. Imaging is one of the pillars of modern medicine, halfway between art and science and comprises two parts: the technical and the clinical; numbers and equations and evidence-based medicine.

Besides what technology tells them, radiologists must trust their eyes and rely on their visual perception, their memory and their cognitive processes. Imaging is the fastest-growing component of physician services in Greece. The possibility for over-utilisation in imaging technology is one of the main concerns expressed in government healthcare policies and a major challenge for the future, in the cost-containment movement which must surely lead future developments in modern medicine. ■

CORPORATE UPDATE

Carestream Health Provide PACS in the Netherlands

The long-term RIS/PACS E-health Managed Services (eMS) agreement with Stichting Samenwerkende Ziekenhuizen Oost Groningen (SSZOG) will amount to the management of an estimated 1.3 million radiology studies.

The agreement covers Stadskanaal, Winschoten and Delfzijl in the north part of the country and includes protection of workflow within and across the sites with remote support and proactive monitors. Previously operating on PACS systems from different vendors, the three hospitals now move towards cooperation. One of eight data centres operated by the company in Europe and North America, the Fryslan Data Centre in Leeuwarden, the Netherlands, will provide secure remote archiving and access, along with disaster recovery.

GE Augment Ultrasound Needle Capability

The upgraded electromagnetic sensor tipped needle, designed to improve guidance accuracy, will be included in GE Healthcare's LOGIQ E9 platform. The new volume navigation capability of the sensor tipped needle, added to the image quality of the LOGIQ E9, will increase the accuracy of many procedures while overcoming many of the traditional challenges of existing ultrasound needle guidance, such as needle visualisation and deflection, determining entry points and the avoidance of critical anatomy.

Before the skin is penetrated, the LOGIQ E9's technology projects the path to the target, helping to plan the optimal angle and the point of entry. During the procedure the system displays the needle's position in real-time graphics that are overlaid on the image that appears on the scan plane. The trajectory can then be monitored as it progresses toward the target.

Toshiba Stands Out in Cardiovascular X-ray Survey Rankings

In a report on cardiovascular x-ray system service, Toshiba received the top ranking in 18 of 36 attributes, including overall service performance, overall satisfaction with a manufacturer, reliability of hardware and reliability of software. The survey by IMV Ltd., a provider of independent analysis of service trends in the imaging industry, had customers rate categories on a scale of one to six. Toshiba's cardiovascular x-ray systems received the industry's highest scores including 17 average scores rating better than 5.0 or "Very Good".

Siemens Upgrade Service Plan Offering

Proactive Plans from Siemens deliver service coverage priced by exam volume, providing contract offerings at a variety of budget levels.

Siemens combined their most popular offerings with a completely new selection of service plans based on exam volumes as a response to customer input. The idea is that aligning service coverage with the volume of exams means that any size of imaging department will find service options to meet their needs.

Siemens states that Proactive Plans are not a repackaging of existing service offerings: they include all the standard coverage features as well as the most requested service options, including the Guardian Programme, which offers live remote monitoring alerting customers to potential problems.

Agfa Extends PACS Services Throughout Hospital

The IMPAX Cardiovascular Review Station (CRS) Remote enables access to cardiovascular images and reporting tools from any Windows device. The IMPAX CRS Remote now enables Microsoft Windows devices within the hospital enterprise to become virtual cardiovascular review stations that allow clinicians to access modality-specific toolkits and interact with programs via a single point of access.

The process of accessing resources is transparent to the end user, who accesses IMPAX Cardiovascular remotely by navigating to a secure web page using one's browser. IMPAX CRS Remote provides imaging for cine loops used in cardiovascular imaging through the hospital LAN/WAN or client device network connection.

Sectra Sells Synthetic MRI Application

Sectra has secured the first order for the software SyMRI Suite from the Institute of Forensic Medicine at the University of Bern. The software will enhance quality in conjunction with virtual autopsies. The University of Bern is the first of a handful of pilot customers that have selected the software, which is used together with Sectra PACS workstations.

"We focus on offering our customers powerful clinical applications and foresee major potential for SyMRI Suite," says Per Elmhester, Product Manager Clinical Solutions at Sectra. The SyMRI Suite was rolled out at the beginning of 2010. The software for synthetic magnetic resonance (MR) helps hospital personnel to reduce the time required per patient for MR examinations, thus increasing the availability of the MR equipment. In addition, tissue can be quantified, identified and its volume determined. SyMRI Suite is developed by Sectra's partner Synthetic MR.

AGENDA 2010

Key Conferences & Events

JUNE

2 – 5 **ESGAR 2010: 21st Annual Meeting and Postgraduate Course**
Dresden, Germany
www.esgar.org

7 – 11 **47th Annual Meeting & 33rd Postgraduate Course of the ESPR**
Bordeaux, France
www.espr2010.org

18 – 19 **ESOR GALEN Advanced Course - Urogenital Radiology**
Tallinn, Estonia
www.myesr.org/esor

23 – 26 **CARS 24th International Congress & Joint Annual Meeting of ISCAS, EuroPACS, CAR, CAD & CMI**
Geneva, Switzerland
www.cars-int.org

JULY

2 – 7 **Cardiothoracic Imaging Update**
Montreal, Canada
www.ottawaradcme.com

11 – 13 **Symposium Mammographicum 2010**
Liverpool, UK
www.happen.co.uk/sm2010

13 – 16 **18th Annual Summer Diagnostic Imaging Update**
Whistler, Canada
radiologycme.stanford.edu/2010whistler

19 – 23 **Clinical Imaging Update in Iceland: A Case-Based Approach**
Reykjavik, Iceland
www.ottawaradcme.com

26 – 29 **4th Annual LAVA**
(Latest Advances in Interventional Techniques)
Buenos Aires, Argentina
www.lalca2010.org

AUGUST

11 – 14 **2010 Annual Meeting & Postgraduate Course in Trauma & Emergency Radiology**
Seattle, US
www.erad.org

20 – 21 **ESOR ASKLEPIOS Course on Advanced Abdominal Imaging**
Santiago, US
www.myesr.org

22 – 27 **14th International Congress of Immunology**
Kobe, Japan
www.ici2010.org

SEPTEMBER

2 – 4 **Breast CORE Meeting**
Bruges, Belgium
www.diagnostic-imaging.be

9 – 12 **16th International Society of Radiographers & Radiological Technologists Annual Congress**
Gold Coast, Australia
www.2010issrt.org

9 – 11 **23rd European Society of Head & Neck Radiology Annual Meeting**
Vienna, Austria
www.ezshnr2010.org

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