IMAGING Management

Promoting Management and Leadership in Medical Imaging

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Prof. Iain McCall

Editor-in-Chief

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National health services, whether funded by government or by personal insurance schemes, are being strained by the exponential rise in cost, substantially due to the huge developments in diagnosis and treatment over the last few years. Cancer drug therapy in particular has made major strides in recent years with the promise of more individually tailored treatment protocols. The population is living ever longer and morbidity related to aging is requiring increased and improved interventions both in surgery with joint replacements, coronary bypass surgery and stents, increasing use of transplants and in drug therapy particularly to combat mental deterioration.

Diagnosis has been required to parallel and in many cases lead these therapeutic advances with the result that both imaging and laboratory studies have become increasingly sophisticated, and in many circumstances, complex. It is natural that patients are keen to partake of these advances and for the media to expound their virtues enthusiastically.

Unfortunately, there is a limit to the resources that can be devoted to healthcare even in the most sophisticated and wealthy societies and thus a careful appraisal of the benefit of each advance must be made. This appraisal must take the form of a comprehensive evaluation of the value of a new treatment or diagnostic modality or test against established best practice preferably against a robust gold standard.

This process of assessing cost effectiveness has been a source of much debate both within the scientific community and in the public at large. Apart from the actual cost of the advance, issues surround the numbers of people that may benefit, the level of improvement over existing therapies and the length of time that the benefit may last.

In imaging we have had huge developments in our ability to investigate those with symptoms, and as a screening procedure, through whole body imaging. We are now evaluating physiological processes and matching them with anatomy and pathology through fusion images, the evaluation of functional brain activity is becoming more widely utilised and evaluation of molecular targeting of therapy through imaging is becoming a reality.

All these developments require considerable investment in time, staff and sophisticated hardware and each hospital must decide whether they fit within the strategic plan and that the numbers of patients benefiting will justify the investment. Managers must also be mindful that all these investments are time limited due to the continued developments that will inevitably require a rolling replacement process. It is therefore essential that evaluation of clinical efficacy and cost effectiveness go hand in hand and both are essential to enable informed decision making by all healthcare professionals and managers. This edition looks at some examples of how evaluation of cost effectiveness may affect purchasing decisions.

Prof. Iain McCall

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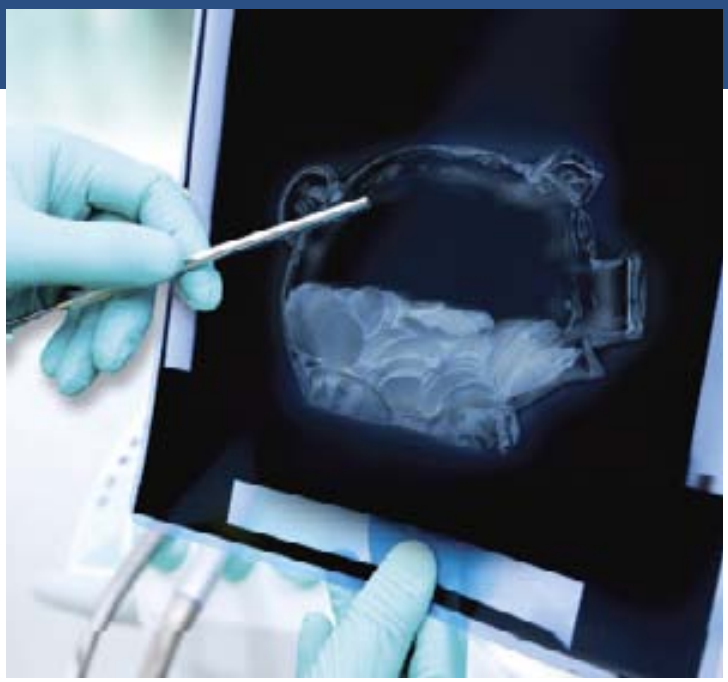

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Healthcare Economics

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Acies

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Pictures Archiving and Communication System

Acies

Picture Archiving and Communication System -- Acies is a Server/Viewer system with high functionality. Medical images generated from all modalities are unified and stored on to a RAID server that can manage data at Terabyte levels while ensuring consistency of information. Helps high capacity image diagnostic imaging relying on simple, high-performance viewer functionality. Web transfer of stored images inside hospital, and also offline link between hospital and clinic. Has selected NAS for backup or storage capacity extension. The simple but high-performance system -- Acies.

KONICA MINOLTA MEDICAL & GRAPHIC IMAGING EUROPE BV.
Frankfurtstraat 40 - 1175 RH Lijnden, The Netherlands

The essentials of imaging

Association News

MIR News

Dear colleagues,

I write to urge you to attend the MIR (Management in Radiology) annual conference to be held in Vouliagmeni, Athens, Greece from Wednesday 29th until Friday 31st October 2008. The local Chairmen are the Greek radiologists, Prof. Nikolaos Batakis, Dr Athanasios Chalazonitis and Dr. Fotios Takis.

Last year the congress in Oxford was very well attended and a great success. We are building on this format and this year will see the introduction and discussion of several new and stimulating topics including the management of private practice in imaging and integrating into a public health system, the financial and human resources management in imaging, the management of change in imaging, the management issues in ultrasound, managing CD/DVD referrals, managing data security, clinical audit and data security, the management of imaging education and many associated ethical issues. All these issues are worthy of detailed debate, and we hope to air them fully at the congress.

There will also be an interesting social aspect to the programme, with a gala dinner, and plenty of opportunity to organise sight-seeing in Athens and its surrounding islands during the weekend after the congress, as an added incentive to come to the attractive congress venue at the attractive port area of Vouglameni, just outside Athens.

I very much hope that as many of you as possible will come to the MIR Annual Congress taking place in Athens this year from 29 – 31 October 2008, so make sure you are a part of it.

We look forward to seeing you there!

Dr Nicola H Strickland
BM BCh, MA Hons (Oxon), FRCP, FRCR
MIR Chairman

General Information

Congress Venue

Astir Palace Complex
The Westin Athens Hotel
Apollonos 40 Street
16671 Vouliagmeni
Athens, Greece

Hotel Accommodation
Please note, that the congress venue is about 40 minutes drive away from the Athens city centre. Therefore, it is recommended to stay directly in the Hotel Astir Palace – where in addition, MIR participants will receive reduced fees.

MIR Promotional Prices:
Single Room/Night incl. Breakfast: 190.00
Double Room/Night incl. Breakfast: 210.00

In order to book a room, please visit the website www.mir-online.org and follow the booking link.

Online Registration
Register now online via the MIR website www.mir-online.org

Registration Fees
Early Fee until October 1, 2008:
- ESR Member: € 325.00
- ESR Non-Member: € 425.00
- ESR Member Resident*: € 150.00
- ESR Non-Member Resident*: € 200.00

Late Fee from October 2, 2008:
- ESR Member: € 425.00
- ESR Non-Member: € 550.00
- ESR Member Resident*: € 200.00
- ESR Non-Member Resident*: € 300.00
- Special Junior Rate**: € 0.00

*Residents have to send or fax a letter from their head of department confirming their status as resident as well as a copy of passport within five days of completed on-line registration. In case this confirmation is not received, the registration fee will be automatically adjusted to a regular fee. The age limit for a registration as a Resident is set at 35 years (incl. the age of 35).

**The special junior rate is limited to participants under the age of 30. A copy of passport within five days of completed on-line registration is required. In case this confirmation is not received, the registration fee will be automatically adjusted to a regular fee.

Please send the required confirmations by fax to +43 1 533 40 64 444 – indicating "MIR Scientific Congress 2008".

CME Credits
The MIR Scientific Congress is accredited by the European Accreditation Council for Continuing Medical Education (EACCME). The EACCME is an institution of Medical Specialists (UEMS), www.uems.be

Accreditation for MIR 2008 has been requested from the UEMS and the number of credit hours of European external CME credits will be announced in the final programme.

CARS News – *President and Organiser Welcome Over 1,000 Delegates at Recent CARS 2008 Congress*

Held over three days from June 25 until 28, 2008, this year's congress proved the ongoing demand for its special focus on computer-assissted medicine.

CARS 2008 in Barcelona was launched, giving special emphasis to the clinical impact of a computer assisted medicine. More than 1,000 participants from 49 countries created an infectious spirit of international and interdisciplinary collaboration.

The department of health of Catalonia, Spain, the societies ISCAS, EuroPACS, CAD, CAR and CMI as well as exhibitors and sponsors of CARS, specifically TicSalut and Indra, enabled the participants to feel that they were an integral part of a pioneering community, jointly working towards better healthcare for all.

The CARS 2008 President, Prof. Javier Herrero Jover, and organiser Prof. Heinz U. Lemke, wish to thank all participants and in particular also the speakers and poster presenters as well as session chairs for their valuable contributions. Their combined effort makes CARS a special type of congress aiming at achieving excellence in computer assisted medicine as its main core value.

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

Management in Radiology

stands for cost-effective management – live this motto and register now on www.mir-online.org for the MIR – Annual Scientific Meeting from October 29-31, 2008 in Athens/GR!

Management In Radiology

Athens, 2008 – Final Programme

MIR Chairman:
Dr Nicola H Strickland

Congress Chairman and
Local Organising Committee:
Professor N. Batakis
Dr A. N. Chalazonitis
Dr F. Takis

wednesday, 29th october

14:00 – 15:50

1

HOW IMAGING IS PRACTISED IN GREECE AND ITS ISLANDS
Chairman: Nikolaos Batakis, Athens/GR

1) 14:00 – 14:20 The structure of Radiology today in Greece
Apostolos Karantanas, Heraklion/GR

2) 14:20 – 14:40 Managing inequalities – European Imaging Practice
Vasilis Bardis, Athens/GR

3) 14:40 – 15:00 Registry for Medical Devices: The Greek Project
Tarsi Gianouli, Athens/GR

4) 15.00 – 15:20 Management of Learning Ways. A Radiographer's prospective
Theodoros Panou, Athens/GR

5) 15:20 – 15:50 3 Proffered Papers

15.50 - 16.20 **COFFEE BREAK**

16.20 - 17.00

2

FINANCIAL AND HUMAN RESOURCES MANAGEMENT IN IMAGING
Chairman: Athanasios N Chalazonitis, Heraklion/GR

1) 16:20 – 16:40 The Financial Management of Imaging Departments
Christos Kazassis, Athens/GR

2) 16:40 – 17:00 Human Resources Management in Imaging
Nikolaos Batakis, Athens/GR

thursday, 30th october

08:30 – 10:20

1

HOW TO MANAGE IMAGING EDUCATION
AURE (Academic and University Radiologists in Europe)
Chairman: Hans Blickman, Nijmegen/NL

1) Debate and future actions
08:30 – 08:50 Steve Baker, Newark/US
08:50 – 09:10 Matthijs Oudkerk, Groningen/NL
09:10 – 09:30 Jean-Yves Meuwly, Lausanne/CH
09:30 – 10:20 Questions

10:20 – 11:00 **COFFEE BREAK**

11:00 – 13:00

2

MANAGEMENT ISSUES IN ULTRASOUND
Chairman: Michel Claudon, Vandoeuvre Les Nancy Cedex/FR

1) 11:00 – 11.40 Managing new techniques and their consequences
Michel Claudon, Vandoeuvre Les Nancy Cedex/FR

2) 11.40 – 12:20 Managing the place of ultrasound: prioritise it!
Lorenzo Derchi, Genoa/IT

3) 12:20 – 13:00 Setting up and managing a walk-in service for ultrasound
Christopher Harvey, London/UK

13:00 – 14:00 **LUNCH**

14:00 – 16:00

3

MANAGING CD REFERRALS
Chairman: Michel Claudon, Vandoeuvre Les Nancy Cedex/FR

1) 14.00 – 14.20 Failure to manage the problem
Nicola Strickland, London/UK

2) 14:20 – 14:40 The robotic solution
Richard Kamman, Nijmegen/NL

3) 14:40 – 15:00 Issues with importing and exporting CDs
Herman Oosterwijk, Aubrey/US

4) 15:00 – 16:00 Industry presentations:
15:00 – 15:15 Cypher IT, Marco Crispini
15:15 – 15:30 Pukka 3, Kevin Wilson, Technical Director
15:30 – 15:45 Sectra, t.b.a.
15:45 – 16:00 Fuji, t.b.a.

16.00 – 16.20 **COFFEE BREAK**

16:20 – 18.00

4

MANAGING DATA SECURITY
Chairman: Nicola Strickland, London/UK

1) 16:20 – 16:40 Managing digital quality control
Hans Blickman, Nijmegen/NL

2) 16:40 – 17:00 The role of HIPAA
(Health Insurance Portability and Accountability Act)
Herman Oosterwijk, Aubrey/US

3) 17:00 – 17:20 Managing selective access
Mark Clark, Hitachi Medical Data Systems

4) 17:20 – 17:40 Restricting data access: do we need to?
Jan Störmer, Tromso/NO

5) 17:40 – 18:00 2 Proffered papers

friday, 31st october

08:30 – 10:40

1 MANAGING IMAGING PRIVATE PRACTICE

Chairman: Philip Gishen, London/UK

1) 08:30 – 08.55 Private imaging practice in the UK
Philip Gishen, London/UK

2) 08:55 – 09:20 Managing a multidisciplinary French private practice
Robert Lavayssière, Sarcelles/FR

3) 09:20 – 09:45 The American model of private practice
Peter Hanson, Eau Claire/US

4) 09:45 – 10:10 The Greek approach to private practice
Vassilis Maniatis, Athens/GR

5) 10:10 – 10:40 3 Proffered Papers

10.40 – 11.10 **COFFEE BREAK**

11.10 - 13.00

2 CHANGE MANAGEMENT

Chairman: Jarl Jakobsen, Oslo/NO

a) 11:10 – 11:40 How to organise a reorganisation
Jarl Jakobsen, Oslo/NO

b) 11:40 – 12:10 Imaging and intervention as an industrial process
Erik Fosse, Oslo/NO

c) 12:10 – 12:40 What is the optimal organisational structure of an Imaging department: the hospital management view
t.b.a.

d) 12:40 – 13:00 2 Proffered Papers

13:00 – 13.30 **LUNCH**

13:30 – 15.30

3 CLINICAL AUDIT AND SAFETY MANAGEMENT

Chairman: Sergei Nazarenko, Tallinn/EE

a) 13.30 – 14.00 How to organise clinical audit in an Imaging department
Seppo Soimakallio, Tampere/FI

b) 14:00 – 14:30 How to organise clinical audit at national level
Hannu Jarvinen, Helsinki/FI

c) 14:30 – 15:00 Developing a safety culture through clinical audit
Antti Servomaa, Helsinki/FI

d) 15:00 – 15:30 3 Proffered Papers

For further information please visit our website
www.mir-online.org

MIR

ECRI Enhances Web-Based Alert and Recall System

ECRI Institute has enhanced its Alerts Tracker™ web-based alert and recall management system with broader coverage of healthcare products and new alert filters.

Alerts Tracker improves a hospital's ability to respond to safety alerts by automating distribution of each alert to appropriate facility staff. Recent enhancements broaden the system's coverage of medical devices to now include blood, food and drug alerts. ECRI Institute's database of alerts includes results from ECRI Institute investigations; medical device, drug, and recall information culled from the FDA, manufacturer information and other sources.

In addition, a geographic filter is included in the system to allow hospitals to limit distribution of alerts to those of potentially affected products distributed in their country. Users benefit from coverage of international alert information sources while saving time and attention by screening out the large number of alerts that are specific to other countries.

IHE Present Interoperability Showcase at World of Health IT 2008

A central feature at the World of Health IT 2008 conference and exhibition to be held in Copenhagen on 4 – 6 November, 2008 is the "interoperability showcase," a technical demonstration that provides a real-time experience of the next-generation of healthcare, where a patient's records follow him or her through the care cycle.

The interoperability showcase features cutting-edge technology and standards that create an interactive environment where attendees can experience interoperability of healthcare IT systems. Attendees will be able to create their own electronic health record and access it across multiple healthcare settings within the showcase. Clinical scenarios that demonstrate a connected healthcare system will be on display.

The showcase also features initiatives, collaborations and focused tours for VIPs and national delegations.

Focus areas for 2008 include demonstrations of healthcare IT support for infrastructure, electronic health records, personal health records, cardiology, radiology, laboratory, healthcare information systems, and patient care devices, technical demonstrations will feature the IHE framework enabling standards-based health information exchange within and across local, regional, and national networks.

The clinical scenarios will focus on clinician and patient access with information sharing across the continuum of care.

Forthcoming IHE Events

IHE workshops, education, events, demonstrations of interoperability and exhibitions are activities of the IHE - Europe national initiatives held as part of larger IT events, or as stand-alone activities. The following will be taking place in 2008:

Journées Françaises de Radiologie in France
October 24 – 28, Paris, France
http://www.sfrnet.org

World of Health IT
November 4 – 6, Copenhagen, Denmark
http://www.worldofhealthit.org

5th Annual IHE Netherlands Congress
November 7, The Netherlands
http://www.ihe-nl.org

CIRSE News - Programme Highlights – CIRSE 2008

The forthcoming CIRSE congress, to take place in Copenhagen, Denmark, September 13 – 17 2008, includes a very comprehensive programme aimed at enhancing clinical as well as technical knowledge. Following the outstanding success of CIRSE 2007, the congress will maintain the same format, enabling delegates specialising in a certain subject to follow one of the main themes throughout the conference without overlap.

The main disciplines will be:
- Vascular Intervention
- Transcatheter Embolisation
- Non-Vascular Intervention
- Interventional Oncology
- Clinical Practice Development
- Imaging in Interventional Radiology

The basic educational sessions for junior interventionalists will include eight foundation courses, focusing on the essentials of defined procedures and conditions. There will be foundation courses on interventional oncology as well as on peripheral vascular disease.

Participants will again have the opportunity to test their knowledge by means of a self-assessment test, which was introduced at CIRSE 2007 and will be further expanded for CIRSE 2008.

A major focus is patient care and clinical practice development as well as marketing in IR. A workshop will provide tips for starting clinical practice in your own hospital. In addition a special exhibition will focus on patient awareness.

In order to facilitate personal itinerary planning for CIRSE 2008, they have defined concrete learning objectives, which will show you what exactly to expect from each session. Another novelty is that conflict of interest declarations will be available at the beginning of each session.

EU News

Helicia Herman
EU Affairs Editor
IMAGING Management
editorial@imagingmanagement.org

MEPS CALL FOR EUROPEAN ORGAN DONOR CARD

On 22 April, the European Parliament adopted a report on the Commission's proposals for EU action on organ donation. The intitiative aims to improve cooperation between member states on the issue and make recommendations on the way forward. Reducing the organ and donor shortage is "the main challenge that EU Member States face with regard to organ transplantation", found MEPs. They proposed a wide range of measures, including a European donor card, to tackle problems like organ shortage, transplantation risks and organ trafficking.

The European Parliament stressed that organ donation must stay "strictly non-commercial" and should be made altruistically and voluntarily, ruling out payments between donors and recipients.

Proposing the introduction of a European donor card, complementary to existing national systems, MEPs also noted that those who are not suitable donors should be encouraged to carry a card to that effect as well in order to facilitate a swift identification of organs. Additionally, Member States should make it possible to appoint a legal representative who can decide on donation after one's death, states the report.

Finally, MEPs recognised that it is "vitally important to improve the quality and safety of organ donation and transplantation" to reduce transplant risks.

Hence, the House looks forward to the Commission's proposal for a directive setting requirements to assure the quality and safety for organ donation across the EU.

SHORT REVIEW: EHEALTH 2008 CONFERENCE IN PORTOROZ

The eHealth 2008 conference, with the theme of 'eHealth without frontiers' was held in Slovenia between May 6-7, 2008. This is the sixth in a series of high-level eHealth conferences that have taken place since 2003, and the first held in one of Europe's new Member States. These conferences are key dates in the eHealth annual policy awareness-raising agenda.

The theme of 'without frontiers' was especially important to the Slovenian presidency as Slovenia removed local, national border crossings at the start of the presidency. In terms of health, 'without frontiers' highlights were among others:
• The collaborative work being done on good practices in eHealth;
• The focus on cross-border healthcare provision;
• Ongoing proposals on eHealth interoperability, and
• The integrating work to be undertaken in the future in the prospective eHealth large-scale pilot and new telemedicine initiatives.

EU to Act on Health Security

During the upcoming French Presidency, the Commission is to launch discussions on health security issues and how the EU action should be structured in this field. The EU executive presented a specific 'health security package' on 25 June. Part of this package was the long-awaited cross-border healthcare proposal confirmed by Public health director Andrzej Rys at DG Sanco at the European Commission. Defining some of the future EU health priorities, Dr. Rys said these were to ensure a safe, efficient and equitable access to cross-border healthcare and tackling major health threats.

According to Commission sources, there could be important developments in the implementation mechanism of the EU health strategy, including an increased EU involvement.

In particular, a specific Commission-Council group could be established to plan the strategy and assure its overall coherence with the real health problems faced by member states.

HIGH-LEVEL CONFERENCE ON MENTAL HEALTH

The European Commission organised an "EU High-Level Conference on Mental Health", which took place on the 13 June 2008 in Brussels.

The conference will be a follow-up to the consultation on the Commission's Green Paper on Mental Health of 2005.
The conference focused on four themes:

- Prevention of Suicide and Depression,
- Mental health in Youth and Education,
- Mental health in Workplace Settings,
- Mental health in the Elderly.

Following the consultation on the European Commission's Green Paper on Mental Health former European Commissioner for Health Mr. Markos Kyprianou had announced the project to launch a Mental Health Pact with proposals for intersectoral action in mental health around the above mentioned four thematic priority areas. The Pact was launched at the conference.

HITACHI
Inspire the Next

GETTING the infrastructure right

The healthcare industry's data storage needs are increasing rapidly. Safe storage is critical and clinicians need access to medical data from many locations. Data structure incompatibilities between clinical modalities introduce further problems. Murdoch Mactaggart reports on the importance of infrastructure.

"Hospitals have islands of information all over the place"
Mark Clark

"We can get full fidelity images ... to a clinician in seconds using pixel streaming"
Mark Clark

"Ultimately it's about having the correct infrastructure in place"
Mark Clark

The output from specialist imaging devices such as CT or MRI scanners or even simple X-rays can generate substantial files. Further, medical records need to be retained for a patient's lifetime and with increasing aging and chronic conditions storage needs can be significant.

Nor is medically related data normally neatly filed away and accessible. Different departments will hold specialist bits of information relating to particular patients and there can often be relevant non-clinical information, email comments from one physician to another or perhaps older paper documents which are still current.

"There are islands of information all over the place," says Mark Clark, Director Healthcare EMEA, Hitachi Data Systems. "Consolidating that fragmented data into a more manageable and accessible source brings considerable benefits, both for hospital efficiency and patient waiting time. That needs the correct information infrastructure, however, and that's what we focus on."

Standards can vary

There's a further problem in how vendors interpret what are meant to be interoperability standards such as DICOM or HL7.

"Standards such as DICOM exist in healthcare but the flow of information from a variety of modalities and instruments into a PACS system or directly attached archive creates its own problems," explains Clark. "PACS systems and modalities were not originally designed to interoperate with diverse systems and so can inhibit processes to streamline workflow and share information between the enterprise healthcare applications. Hitachi has solved this problem by introducing an integration and data management infrastructure capability which allows multiple disparate sources to exchange data regardless of where the data originates and in a way which is active to the applications and passive to the data."

Rapid access to information

Large file sizes and slow or busy networks can also impact on how quickly data can be got to where it's needed. In the past it might have taken a week to order X-ray plates for a patient's visit but clinicians now expect images to be available instantly on whatever workstation they're using.

"We can get full fidelity images of any kind to a clinician in seconds by using efficient pixel streaming techniques," explains Clark. "We do not actually download the whole image data but stream the result after image processing on the central server." That's particularly useful where small bandwidth networks or the internet itself are involved and gives much greater flexibility of location. That improves workflow and the diagnostic process and helps bring the health community closer together. Ultimately, this is better for the patient."

Secure backup is critical

One of the consequences of the Hurricane Katrina disaster was the loss of the medical records of hundreds of thousands of people, many of whom were taking treatment where it might be critical for their future well-being that details such as radiation doses given were known accurately. Perhaps the circumstances were exceptional but it seems clear that failure to secure and backup records properly were among the many other administrative failures. Add in the importance of data integrity – you don't really want important information to be modified arbitrarily – and it's clear that protecting data from loss, change and illicit access is a vital element in managing medical information.

"Ultimately it's about having the correct infrastructure in place," says Clark. "Hospitals are increasingly investing in open standards based infrastructure. This enables scalability, flexibility to change and brings freedom of application choice without vendor lock in. You can mix clinical and non-clinical information, images from different departments and different modalities, but still make them easily and quickly available by using our virtualisation techniques. It's really about improving workflow, reducing cost and ultimately making things better not only for the medical staff but also for the patients."

Hitachi and the Human Genome Project

The Human Genome Project (HGP) is a massive, international scientific research project involving geneticists in the US, UK, China, Japan, France and Germany. Its initial aim was to determine the more than three billion base pairs in the human genome and to identify all the genes there. In 2000 it reached a major milestone when it published a working draft of the genome, the complete version appearing in 2003.

All the relevant information from the HGP is published freely on the internet. A researcher investigating a particular disease with a possible genetic aspect can readily learn what other researchers have written about those genes and can examine in detail structure, occurrence in other species, connections with different genes and so on.

To handle public access to this huge and steadily growing amount of data, the Human Genome Center at the University of Tokyo, one of the partners in the HGP, has set up the H-Inv data retrieval system built on Hitachi's scalable object-oriented (but also relational) DOMS, HiRDB. This provides full-text searching of some 40 million records to date, using parallel processing techniques to make the searching very fast and to avoid the problems of slow-down typically resulting when numbers increase.

"It's about improving workflow, reducing cost and ultimately making things better for everyone"
Mark Clark

NEGOTIATING EQUIPMENT **MAINTENANCE CONTRACTS**

Simplification of a Complex Art

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Maintenance of equipment post warranty is a major challenge to radiology managers. As one of the largest organisational costs, the need for efficient management is paramount. However, the level of complexity is often overwhelming. Service contracts are attractive because of their ease of use and perceived comprehensiveness. Despite this, their costs may be too high. This paper explains the critical components and enables managers to evaluate their performance.

Maintenance has two clear components, 'preventative (or planned)' and 'corrective'. These further subdivide into 'time (labour)' and 'materials (parts)'. Typically, a planned maintenance contract excludes all parts and provides the labour required to carry out only the routine service requirements of the device as stipulated by the OEM. Corrective contracts include 'breakdowns' in addition to planned maintenance and are commonly 'comprehensive' to include both parts and labour, although some suppliers offer 'labour only' contracts exclusive of parts.

Contract Mechanics

OEMs offer a plethora of maintenance options. Comparison is inherently difficult – however, remove the marketing hype and beneath lies a very simple formula. Labour has an 'hourly rate' published by each service provider. The same rate may well be charged for 'travel'.

With the exception of remote areas, one-hour travel time would be reasonable, and prudent customers will fix this limit, perhaps even invoicing engineer travel as a separate entity based on their own regime (e.g. price per km). The maintenance regime for each device includes the number of planned maintenance hours, e.g.;

Hourly Rate x Number of Planned Maintenance Hours = **A**

In principle 'A' should be the maximum price of the planned maintenance contract.

The 'comprehensive' contract represents the opposite end of the spectrum and is inclusive of parts and 'corrective' labour.

Corrective Labour = Hourly Rate x Number of Corrective Hours = **B**
Combining these factor results in:

Comprehensive Contract Price – A – B =
Cost of Parts + Profit

Almost all the major OEMs have implemented six sigma-style quality processes, and are now designing systems to perform with remarkable levels of reliability. The physical requirements for servicing have also changed significantly. Planned maintenance visits have reduced by as much as 50% and the number of corrective maintenance actions resolved remotely has increased by around 50%. This reduces the cost element for labour though is not necessarily reflected in the prices charged.

Insurance-Style Contracts

Though budgeting can only ever provide a rough guideline, the greater number of devices considered, the lower the risk. Insurance-style contracts adopt this principle and can be effective with reliable equipment. Large organisations such as the National Health Service (NHS) in the UK have in principle, tremendous buying power capable of delivering huge economies of scale, though there is no evidence that these are achieved.

The Asset Register

An accurate and complete database of installed equipment is an essential starting point for any asset management process. The opportunity to analyse utilisation facilitates future workload planning. The asset register is 'dynamic' and therefore a spreadsheet is the ideal management tool. Specialist programmes are available although MS Excel is perfectly adequate to provide the necessary granularity and budgetary control.

Up Time and Response Time

There is a subtle difference between 'up time' and 'response time' guarantees. The latter may well result in an engineer being dispatched to site within the allotted time period, but does not ensure an effective repair will be made. Typical up

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FUJIFILM MEDICAL IMAGING

Enhancing the Quality of Life of People world-wide

Innovative Medical Systems:

In medical imaging systems of the company such equipment and materials as computed radiography (CR) and digital radiography (DR) are strongly developed. Amid the steadily growing use of IT, related to medical facilities, SYNAPSE, the medical-use picture archiving and communication systems are very successful. Additionally the company is advancing with moves to create comprehensive healthcare functions by supplementing the field of diagnosis to prevention and pharmaceutical treatment. Highlight in DR is the new MAMMO System AMULET, a completely new innovative x-ray detector in mammography.

The new mammo DR system

Fujifilm has developed a completely new kind of x-ray detector that represents a breakthrough for upcoming applications in digital mammography.

■ **World's best resolution for detectors of its kind**

The detector uses two substrate layers of amorphous selenium and, at 50 µm pixels, offers the world's best resolution in detectors of its kind. A sharper picture and improved signal/noise ratio result, making for significantly enhanced imaging quality in breast cancer diagnostics.

■ **High pixel density and improved signal/noise ratio**

The x-rays are converted into electric signals in the first layer, and are then detected in the second layer with the help of an optical switch and presented as an image. The procedure reduces the amount of time needed for erasing and re-exposing the detector, accelerating the overall exam workflow

AMULET

■ **Optical Switch – as new development**

New procedure for selenium vacuum storage generates extremely pure selenium layers with an even thickness across each layer. Light is used as a switch for detecting electric signals. The data is thus read out from the detector directly, without first being converted. It enables the operator to lower the radiation dose while improving diagnostics and the efficiency of the examination.

■ **Specifications**

- High DQE, high MTF
- Optimised compression feature
- More convenience and safety for the patient
- Detector method: a-Se with optical switch
- Exposure interval: approx. 20 s
- Pixel size: 50 µm
- Grey scale: 14 bit
- Image display after: approx. 10 s
- Availability: end of 2008

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FUJIFILM

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time guarantees are 95% and 98% and are particularly attractive to customers who rely heavily on one specific device.

Failure to meet the target conceptually results in the OEM having to provide a rebate to the customer relative to the excessive down time, although measurement is fraught with challenges.

A radiology asset, over its lifetime, incurs as much as its purchase price in maintenance costs

OEM or Third Party?

Traditionally the OEM provides maintenance cover via its own specialist engineers. Third party servicing may be provided by in-house engineering departments or via unique companies. Regardless, the maintenance regime is dictated by the product licence, which must be adhered to in order to ensure safe use of the device.

Cost reduction in the region of 20% may be achieved by outsourcing to a service provider encompassing equipment from numerous OEMs, commonly known as multi vendor services (MVS). Many OEM service organisations have also developed a multi vendor service channel and compete directly with one another for their maintenance business in addition to the smaller freelance companies.

Diagnostic software is required to repair almost all modern radiology devices. The software is usually proprietary, creating a significant barrier to in-house engineers and other OEM and third party service providers.

Most equipment problems occur within the first year after installation. Major software revision is the next flash point. Standard warranty periods are adequate to identify design flaws and highlight repetitive failures. Inconsistent performance during warranty is a strong indicator of the future trend.

A rogue device will almost certainly incur significant costs and cause infinite operational problems throughout its life. The procurement process should incorporate a clause that allows for rejection of the equipment, transferring all risk back to the OEM.

Upgrades

OEMs often design 'software upgrades' to require a 'hardware component', in order to support a new software product. The total cost of the upgrade can therefore be significantly higher than first envisaged. Once upgraded, the service contract may be invalidated or reopened for negotiation.

By the end of the twentieth century, OEMs realised that customers had a major problem implementing the many new upgrades. For leasing customers, predominantly in the US, the issue was not so acute, as the costs for the upgrade could be built in, either by an extension to the term or by increase in payment.

Either way, the costs were revenue-based. In Europe, the majority of customers operate on a capital and revenue basis, which means that additional capital is required in order to purchase upgrades. Institutions with a rolling programme of replacement may have no spare capital so they have to either defer one of the other systems due to be replaced, or buy an upgrade for an existing asset.

The Price of Risk

Detailed analysis of the asset register can often reveal significant cost saving opportunities. The span of prices for the maintenance of identical equipment can be extensive, not only by country, but within the same hospital. Multiple devices may well be serviced on the same day by the same engineer, yet multiple charges are made for travel.

Utilising the simple models outlined earlier, contract price versus performance can easily be assessed. It is not uncommon to find very reliable equipment covered by highly priced maintenance contracts.

By negotiation, a 'shared risk' approach may allow, at the end of each year, the total costs associated with the maintenance of the equipment to be calculated, and the difference between this figure and the contract price is shared between customer and supplier. Another simple option is to negotiate discount by contract volume to encourage single provider status.

Conclusion

Over its lifetime, a radiology asset incurs as much as its purchase price in maintenance costs, therefore when acquiring new equipment the maximum whole life cost should be assessed. A complete asset register allows benchmarking and the ability to assess value for money. Multi vendor services and insurance offer alternative solutions to the traditional OEM approach, though improvements may be achievable through careful analysis of the existing contract volume and renegotiation.

Many organisations have a preoccupation with meeting budgets, rather than efficient asset management, often opting for annual renewal on demand without evaluation of the true price of risk.

CREATE CUSTOM SOFTWARE **FOR YOUR PACS**

Increase Functionality, Decrease Costs

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Since the introduction of PACS, vendors have gone to great lengths to ensure that the products they supply provide the users with the functionality they most need, from both a clinical and administrative perspective – and generally they succeed. However, no two hospitals are ever exactly alike, and some of the specific requirements for individual hospitals may simply be too small and esoteric for the mainstream vendors to get involved.

In this article, I explain how the creation of a simple and easily built custom software solution can increase functionality in a cost-effective manner. In many cases, functionality errors or problems relate to the interfacing between equipment from different suppliers, and they commonly result from minor errors or discrepancies in the interpretation of standards e.g. DICOM, between different vendors.

Common Interoperability Problems

Problems may not have shown up when the vendors did their own internal testing against their own systems, but are found by users in mixed vendor environments. For example:

• Some imaging equipment, quite legitimately, sends images to PACS using a separate association for each image, but a PACS from a different vendor misinterprets the end of an association as the end of a study, and handles subsequent images inappropriately.

• Likewise, whilst DICOM does not specify the order in which images should be sent, as ordering is defined by internal attributes, some workstation/PACS combinations insist on displaying images in the order received or even worse, sorted by inappropriate keys such as their UIDs.

• Some systems expect to find only their own defined terms in fields that are allowed to have variable text.

• Some systems fail to complete mandatory DICOM fields, or, equally badly, expect to find data in optional fields, and fail if it is missing.

In all these cases, and many more, the end result is that users are unable to use the images or other data, such as radiotherapy records, in the way that they would wish and ex-

pect. Large suppliers can be very slow to admit that they have made mistakes in their implementations and sometimes even try to "justify" their departure from standards. Even if they do admit that they have a problem, they are unlikely to be able to produce a timely fix, so what can a user do?

Most projects should end up costing less than 20,000 euros

What is the Answer?

A solution used by an increasing number of hospitals is to write or buy a small simple custom solution for their own needs, addressing just the problem at hand. Due to the way DICOM works, this often fits into the workflow relatively easily by inserting a "modifier" programme between the items of equipment.

This receives the images or other objects from one system, and makes the changes required before sending them on to the final destination. In my experience, the following features impact on the success and acceptability of the project:

1. Use an established software toolkit
Whilst the changes to be made to the data are normally very minor, or even zero in the case of applications which simply rearrange images onto different associations or a different order, the whole complicated DICOM protocol needs to be handled.

Writing such a project from scratch would therefore be a very large undertaking, and it is important to use an established software toolkit (proprietary or open-source) to handle those aspects, leaving the writer to concentrate on the required functionality.

2. Use the resources at hand
Of course, the writer needs to have the required skills to understand exactly what they are doing and why. In many cases these skills can actually exist in-house, often in the medical physics department, and such a project then provides an excellent staff development project as well as a solution. Where such skills are not available, then there are plenty of small software houses who can do the job for relatively small cost.

3. Keep the project within reasonable limits
It is important that the scope of the project should be well-defined. All too often, once people realise that a facility like this is being built, they find other "nice features" that they would like to add, and if care is not taken, then the scope can grow unmanageably.

4. Quality is key
There needs to be a suitable quality assurance process to ensure that the resulting data is as expected. Of course, not all projects fit so easily into such a simple workflow, and there are many other project types for which custom applications can be used, of which the most common involve unusual combinations of equipment.

These situations typically occur where there has been reorganisation, sharing or merging of services, such that information flows may not follow conventional pathways. For instance, it may be necessary for a workstation or acquisition modality to connect to more than one PACS, or even to more than one RIS, either simultaneously or as alternatives.

Likewise, it may be necessary to connect one PACS to another for data migration, either due to replacement, or because of consolidation of departmental systems into a single PACS.

Such unusual data transfers can be very straightforward when viewed from a logical perspective, and can be equally simple at the technical level as they can normally be achieved using standard interfaces on the existing equipment.

However, every single such application is likely to be different, and small but significant data transformations (e.g., patient ID, accession number, etc.) commonly need to be incorporated into the process.

Such projects are ideal candidates for custom software development, and provided that the above constraints for project scope and management are followed, then the same benefits can be obtained.

Assessing the Cost of Custom Software Development

Whilst custom software development sounds as if it would be expensive, the costs are, in practice, relatively small in comparison to the equipment with which it is used, and most projects should end up costing less than 20,000 euros, including a software toolkit, the inevitable "extra PC" to run them on, development time (whether in-house or external) and testing.

Conclusion

In conclusion, a "standard" PACS installation, with no unusual requirements, no legacy systems, and perfect standards implementation by all vendors should work "off the shelf" with no need for custom software, but if you find that you do have specific needs which cannot be met by your PACS or modality vendors, then the option of custom software development should certainly be considered.

THE UK CENTRE FOR EVIDENCE-BASED **PURCHASING (CEP)**

Assessing Cost-Effectiveness in the Radiology Department

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In September 2005, the Centre for Evidence-Based Purchasing (CEP) was created within the UK National Health Service (NHS) Purchasing and Supply Agency (PASA), as the first key outcome of the Healthcare Industries Task Force (HITF), a joint government and industry strategic group, convened to answer a number of industry criticisms, including that the value of innovative healthcare technologies was poorly understood in the NHS and subsequently their adoption in the UK was low.

The Centre for Evidence-Based Purchasing is funded by the UK Department of Health and aims to be the leading independent source of information supporting the uptake of medical technology solutions in health and social care, focusing on the cost-effectiveness of technology and services, leading to an appraisal of value.

This article will focus on CEP projects in imaging, and report on how we contribute to the evidence-base for demonstrating cost-effectiveness in procurement and cost management in the radiology department.

CEP reviews existing evidence and develops economic models to describe the key costs and benefits of novel imaging solutions, thereby informing decision-making and supporting their uptake in the NHS. Universal benefits demonstrated by technological advances in imaging include improved speed and accuracy of diagnosis, with potential workflow gains from minimising repeat exposures as well as changes in patient pathways for managing clinical conditions, enabling cost-effective imaging strategies and resource usage.

Chest Radiography

One of the first published CEP reports in imaging was an economic report, titled 'Cost-effectiveness of direct digital radiography (DDR) versus computed radiography (CR) for chest examinations'. The aim was to identify whether there was a turning point, in terms of patient throughput, at which the higher initial outlay for a new DDR installation was balanced by a benefit gained in whole-life costs over CR.

If the throughput is less than 80 patients per day, then CR may be more cost effective. Between 80 and 95 patients per day, the difference between the two modalities is negligible and will depend on each individual service. For greater than approximately 95 patients per day with CR, extra resources will be required to manage throughput.

Therefore, above this level of throughput, a DDR room is more cost effective. DDR was shown to have a number of advantages over CR, such as reduced queue sizes, more efficient use of operator time and reduced patient waiting time. Additionally, for DDR, the amount of time a patient spends in the x-ray department was found to be less, with fewer patients having to wait for 30 minutes or more.

Mammography

To inform the future procurement of digital mammography, CEP has published an economic report: 'Cost-effectiveness of full field digital mammography (FFDM) and computed radiography (CR) versus film/screen imaging for mammography'.

Results show that while capital costs may be perceived as a large component of the cost associated with digital mammography equipment, other components also have significant impact. Of particular importance for mammography are per image costs, such as film and image storage, because of the large number of images acquired on mammography systems during their lifetime, and staffing costs, which account for well over half of the total costs regardless of the system type, technology or location. The cost-effectiveness of either CR or FFDM depends heavily on the cost per image for image storage, and it is vital that particular attention is paid to this cost during any purchasing process.

Cost Effective Procurement

CEP delivered draft core technical specifications for nine modalities of imaging equipment to underpin the award of suppliers to the NHS Supply Chain to run a single comprehensive procurement exercise for an imaging framework, which would comply with EU public sector procurement rules.

Ultrasound systems are the largest proportion of sales in percentage terms (over 60%); however, there has also been a significant take up of larger pieces of equipment (MRI, CT, angiography, fluoroscopy and gamma cameras) at around 9%. This demonstrates that a framework approach is proving successful across the range of imaging equipment. By using the framework, trusts are removed from the obligation of submitting their individual capital equipment requirements through the Official Journal of the European Union (OJEU), and are assured best prices for the equipment, saving significant staff time and costs.

Payment by Results and the 18-Week Wait

Many NHS trusts question the value of capital equipment procurement, versus leasing arrangements, such as those offered by managed equipment service providers. The unbundling of many imaging procedures from the whole pathway of provision of patient care means increasing numbers of radiology exams now have mandatory or indicative tariffs under Payment by Results (PbR).

NHS Trusts seeking to procure capital equipment must consider their equipment whole life costs versus the service capacity they can offer to commissioners and projected income generation from PbR. Commissioners now range from primary care direct access, or the more conventional secondary and tertiary care pathways. By maximising utilisation of equipment capacity, including extended and out-of-hours working, imaging departments play a vital role in maintaining short diagnostic waits within the maximum 18-week referral to treatment time (RTT) target.

However, a downside to driving imaging equipment at extended capacity may be reduced lifetimes and more frequent servicing and maintenance intervals, with costly replacement parts, which will need to be budgeted for.

The National Stroke Strategy and the NHS Next Stage Review

In the last six to twelve months, improving access to stroke services has become a driver for change in the NHS. CEP supports this through the following report: Evidence review: 'Diffusion-weighted magnetic resonance imaging and competing imaging technologies for the diagnosis of stroke and transient ischaemic attack (TIA)'.

The CEP verdict from this evidence review is that diffusion-weighted magnetic resonance imaging (DWI) shows significant potential in the study of minor stroke and TIA. In addition, DWI combined with other MRI techniques is currently superior to non-contrast computed tomography (CT) for the exclusion of stroke mimics and shows significant potential in excluding haemorrhage and identifying patients who may experience a better clinical outcome through pharmacological treatment. However, DWI may not be suitable for all patients on account of safety restrictions and there may be considerable practical problems with validating MRI patient suitability within the time-window required for acute TIA and stroke scanning.

OPEN SOURCE **SOFTWARE**

Cost-Effective Solutions for Medical Imaging

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Nowadays, most clinical decisions rely on imaging procedures where the diagnostic report generated by a radiologist is often incomplete without supporting images. Radiologists often have to generate additional images using volume rendering and image processing techniques to communicate their findings to clinicians and surgeons.

An increasing demand from surgeons and clinicians to be able to manipulate and process the images mean they can't rely on radiologists to generate those images.

The concept of open source software is unconventional and challenging in the medical imaging arena. It raises the question of the integrity and quality assurance of software developed by a community of users and does not follow the traditional conformity certification required for commercial medical software programmes. On another hand it provides a means for development of innovative solutions designed by the users themselves that are better suited for their specific tasks.

The Open Source Revolution in Medicine

The concept of open source software promotes the development and sharing of software source codes under special licensing agreements that protect author copyrights while maintaining the distribution of free and open derivative work based on the original code.

The rationale behind open source is very simple. When a community of programmers can review and modify the source code of a programme, they can contribute to the improvement and evolution of the software code. With the combined synergy of numerous developers this can happen at a speed that exceeds by far the slow pace of conventional software development.

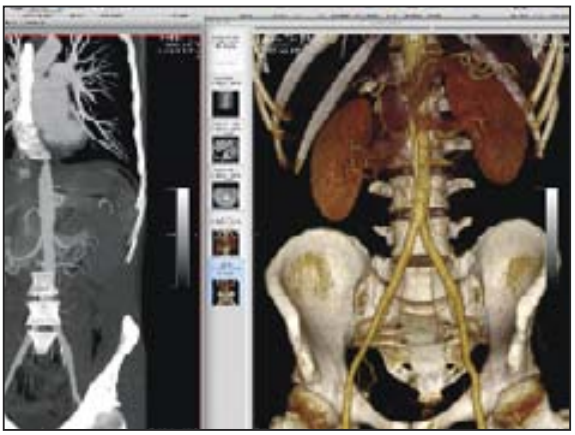
Open source software is slowly emerging in medical applications and in particular in electronic patient record management systems, in medical imaging and PACS applications. The impact of open source is even greater in specialised areas of medicine such medical imaging. These vertical markets have always been a challenge for vendors and manufacturers due to the small size of specialised users and high expectations in terms of complexity and performance.

This has naturally driven the market to high-end and high-cost developments and marketing strategies that also try to cope with very rapid evolution of computer technologies and software developments that make most products obsolete in very short time intervals, which does not allow manufacturers to generate sustainable return on investment. Most manufacturers will cover the cost through revenues from other business avenues such as sales of imaging modalities, scanners and imaging devices, or by charging high costs for implementation and support and maintenance contracts of complex integrated information systems.

What is OSIRIX Designed to Do?

OSIRIX was initiated at the University of California in Los Angeles (UCLA) in 2004 by the authors of this article. Together, we designed and developed this new open source image-processing platform developed on Apple Macintosh computers with the intention to allow users to efficiently and conveniently navigate through large sets of multi-dimensional data without the need for high-end expensive hardware or software.

OSIRIX software was specifically designed to provide advanced image visualisation in a new graphic user interface (GUI) that is more suitable for clinical applications and image interpretation of large multidimensional datasets. It allows one to easily and quickly develop new generation of



multi-dimensional viewers that could replace many of the existing functions that are available only on high-end expensive 3D workstations.

We also elected to integrate new emerging technologies from the consumer market industry to expand the capabilities of PACS workstations beyond their current limitations. We selected a set of new products and services recently released by Apple Computers for their general computer products and adapted them for medical imaging applications:

• The iPod, a popular portable music player, was integrated to serve as a high capacity portable DICOM storage with a high-speed transfer rate.

• iChat AV instant messaging and videoconferencing software was adapted to allow real-time radiology videoconferencing tool for remote image viewing and screen sharing.

• iDisk, an internet service provided by Apple for secure data storage on a virtual hard disk was adopted as a DICOM data storage and communication alternative.

What are the Advantages?

Manipulate and visualise large sets of image data
One of the most attractive features of OSIRIX remains its ability to manipulate and visualise large sets of image data using advanced volume rendering and 3D navigation tools. OSIRIX user interface was designed to allow physicians to rapidly become familiar with the manipulation of 3D objects and navigate through large sets of images.

Suits multimodality and molecular imaging devices
With the advent of multimodality imaging and molecular imaging devices such as hybrid PET/CT scanners, it is possible now to generate functional images that represent metabolic and biological dimensions superimposed over morphological and anatomical data. OSIRIX was designed to conveniently handle the fusion of metabolic images and anatomical images in a 5D image rendering mode, where the anatomical information is referred to as the fifth dimension.

It promotes global collaborations to customise the application for maximum convenience
Developers from all around the world have contributed to the extension of OSIRIX by adding innovative and specialised image processing features. Its software architecture allows for separate processing modules to be added to the programme as plug-ins. Such plug-ins will be embedded in the programme when it is launched but don't have to be integrated in the core of the main programme.

Who is Using OSIRIX?

According to our latest surveys, an estimated 25,000 active users correspond with us on a regular basis around the world. This number does not account for users that have simply downloaded the software and are using it on their own workstation with no interaction with the rest of the user community. Industry has also started to adopt OSIRIX as a base for new business models where they provide the support and integration services as well as training and customisation of the generic platforms.

Several certified versions for Europe and for the FDA in the US have already appeared on the market recently. And finally, and probably most importantly, the academic community has started to regroup its efforts to support and promote open source initiatives in medical imaging and medical informatics.

OSIRIX software and its source code are available under an open source licensing agreement and can be downloaded free of charge at: http://www.osirix-viewer.com

QUALITY MANAGEMENT IN RADIOLOGY

Defining the Parameters

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Radiologists may find the terms of quality control (QC), quality assurance (QA) and continuous quality improvement (CQI) confusing. In short, in radiology, QC involves regular, intermittent technical testing of medical equipment and evaluation of image quality to ensure conformity to the regulations.

Quality control establishes ranges of acceptability for very specific measurements or data points, and only when a measurement falls outside a QC tolerance, is an action is taken. Any data point inside the established tolerance is deemed acceptable. Quality control typically deals with issues such as acceptance testing and preventive maintenance of imaging equipment, the evaluation of shielding around x-ray facilities; and measurement of processing parameters like developer temperature, developer pH, base and fog, speed, and contrast.

Quality Assurance (QA) uses the systematic collection and evaluation of data to ensure excellence in healthcare. QA involves QC. QA focuses on specific indicators believed to affect the quality of services. These indicators are usually related to structure, process, or outcome. They may include repeat rate, pathology correlation, appropriateness of utilisation, availability of old films, and the timeliness of scheduling.

Through quality assurance, it becomes possible to make decisions about the clinical and operational functioning of the clinical imaging practice. In fact, because hospital accreditation programmes in healthcare in particular have emphasised the quality assurance concept, its primary objective is to enhance patient care.

Continuous Quality Improvement (CQI) is more a holistic philosophy than a strict operational methodology for improving the quality of a process. CQI attempts to combine professional knowledge with knowledge about making improvements. In essence, CQI is a philosophy of the continuous improvement of the processes associated with providing goods or services that meet or even exceed customer expectations.

In radiology, CQI dictates that every activity in an imaging facility be identified, and that clear standards (indicators) be set and measured to allow processes to be continuously improved. It is assumed that the resources devoted to this aim will yield a more efficient operation, thus saving money and increasing the quality of healthcare service provided. Quality assurance is a reactive approach. CQI attempts to anticipate problems and to improve the way a system functions.

Resources devoted to this aim will yield a more efficient operation, saving money and increasing quality

Continuous Quality Improvement: How Does it Work?

CQI follows a straightforward process called the Deming or Shewkart cycle. The whole process is dependent both on data collected through observation and statistical analyses.

• During the first stage of cycle, the quality department identifies a problematic functional work system, for example patient scheduling, equipment performance, image interpretation or report distribution. Once the department has identified an opportunity for improvement, a work is selected.

• The second stage of the process involves making observations, initiating tests, and selecting a course of action to make changes to improve the system being studied.

• In the third stage of the cycle, the team observes the effects of changes made to the system. It includes monitoring and feedback functions and uses some of the same means to identify the problem or opportunity for improvement at the beginning of CQI process.

• The fourth stage asks the question: "What did we learn?" The entire cycle is repeated continuously to fine-tune changes and explore the possibility of additional improvements.

One of the most important keys to a successful CQI programme is a critical process called "empowerment", which necessitates strong leadership. Empowerment involves the transfer of authority and responsibility from the department manager to front-line supervisory personnel of the improvement team.

Quality Management Models

Healthcare institutions and radiology departments use a variety of CQI systems or models, including the models of:

- the Joint Commission on Accreditation of Healthcare Organisations;
- the Six Sigma Model;
- the Model for Business Excellence of the European Foundation for Quality Management (EFQM); and,
- the International Organisation for Standardisation (ISO) 9000, which creates a suitable organisational environment for the implementation of a CQI system.

Key Performance Indicators for Academic Radiology

Quality generally consists of two related but distinct components: technical or outcome quality and service delivery as perceived by the customer. Technical quality is measured in terms of how well the service is performed. Competence and expertise are major determinants of technical quality.

In radiology, a product of "good" technical quality is accurate diagnostic information obtained at the lowest possible exposure to all hazardous factors and at a minimal, realistic cost. Repeat exposures due to poor image quality, for example, by increasing patient risk and cost, lower the quality of the product.

Adverse reactions due to contrast material are also considered in this context. In radiology, regular monitoring of technical quality indicators such as repeat rate, pathology correlation, and frequency of adverse reactions is commonplace.

The second component of quality, measured in terms of service delivery as perceived by the customer, is sometimes referred to as delivery quality and differs from technical quality by also including the subjective experience of the customer with the product.

In radiology, customers are not only patients but are also referring physicians and employees of the department, and their satisfaction is based on impressions formed at all points of contact with the institution.

In particular, because patients lack the knowledge to assess technical quality, typically their quality judgment is based entirely on their subjective experiences throughout the process, necessitating the measurement and assurance of both quality components in a radiology department.

According to a survey of the members of the Society of Chairmen of Academic Radiology Departments (SCARD) in the US, the three main categories of quality management performance indicators used are: customer satisfaction, patient access to appointments and reporting time. See the attached table (Fig. 1) to review the most common indicators in each category.

Indicator	Count (Total = 55)	Frequency (%)
Customer satisfaction		
Patient satisfaction	44	80
Patient complaints	46	83,6
Ambulatory Waiting time	35	63,6
Referring physician satisfaction	27	49,1
Employee satisfaction	25	45,5
Others	0	0
None	9	16,4
Patient access to appointment		
MRI	44	80
CT	40	72,7
Mammography	38	69,1
Nuclear medicine	27	49,1
Others	14	25,5
None	11	20
Radiology reporting time		
Report turnaround time	45	81,8
Transcription time	39	70,9
Signature time	37	67,3
Others	4	7,3
None	3	5,5

(Fig. 1) Contingency Counts and Relative Frequencies of Use of Indicators of Delivery Quality by Academic Radiology Departments in the United States.

NSF AND OMNISCAN

GE Healthcare Pharmacovigilance Perspective

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Nephrogenic systemic fibrosis (NSF) is a rare, but potentially serious, acquired systemic disease that has been associated with the use of gadolinium-based contrast agents (GBCA) including Omniscan (gadodiamide). It can be a painful and debilitating condition that may contribute to a fatal outcome. To date, it has only been reported in patients with renal insufficiency, particularly those with severely impaired renal function with glomerular filtration rate of less than 30 mL/min/1.73m2, who are on or approaching dialysis and those in acute renal failure. At present, there is no evidence that patients without renal impairment are at risk of developing this disease.

The global pharmacovigilance function at GE Healthcare is responsible for reporting of adverse drug reactions, periodic reporting, evaluation of consequences for prescribing information and detection of safety signals. The GE Healthcare safety database includes spontaneous adverse reaction reports, serious reports from clinical trials irrespective of causality, cases published in the literature and reports received from authorities.

At GE Healthcare, all reports concerning nephrogenic systemic fibrosis (NSF), are submitted with no attempt to limit the data by applying an internal set of diagnostic criteria, to help understand this rare disease. Reports are sent worldwide for mandatory regulatory reporting within 15 days after receipt of new information. This article describes activities focused on patient safety and presents data from the global safety database.

NSF Data Collected and Collated by GE Healthcare

In April 2006, when the association between Omniscan and NSF became apparent to GE Healthcare, the global safety database was searched for symptoms and signs compatible with NSF to identify potential cases reported under different terminology. As a result, follow-up information was obtained in two cases. They were subsequently reported as NSF cases.

GE Healthcare has logged and reported all individual case safety reports in which Omniscan was claimed to be associated with NSF. Most of the cases where the age was reported were adult or elderly, specifically two children and two adolescents reported to have developed NSF.

The latency period between last exposure to a gadolinium-based contrast agent and onset of symptoms was between a few days and several years, most frequently reported was a latency between a few days to a few months.

New Standard Developed to Evaluate Cases

During the period these cases were reported, there was no widely agreed clinical definition of NSF. Therefore reports could not be held to a consistent medical standard. As a result, GE Healthcare worked with industry partners in conjunction with the American College of Radiology (ACR) to support the development of a common clinical definition of NSF.

However, currently logged cases have not been evaluated against this new standard as much of the patient data collected has been from retrospective analysis of clinical databases. Also many patients are not currently available for clinical follow up. New versions of case reports were created as soon as follow-up information became available. This labour-intensive collection and collation of individual case data from different sources has helped authorities to eliminate duplicate reports from their databases.

However, 157 reports (36%) were not medically confirmed, i.e., provided by lawyers or patients. These reports include basically only the minimum criteria, thus prohibiting duplicate checks. During the past three months, up to the end of July 2008, about 90% of the 70 reports received were not medically confirmed.

The distribution of reported cases among countries is presented in Figure 1. Most of the reports, medically and not medically confirmed, are from the US. The comparatively frequent reports from Denmark are remarkable, even more as they originate from a single institution with the exception of a single case. The reason for this clustering of cases, a common feature, is not yet known.

Our Response to the NSF Alert

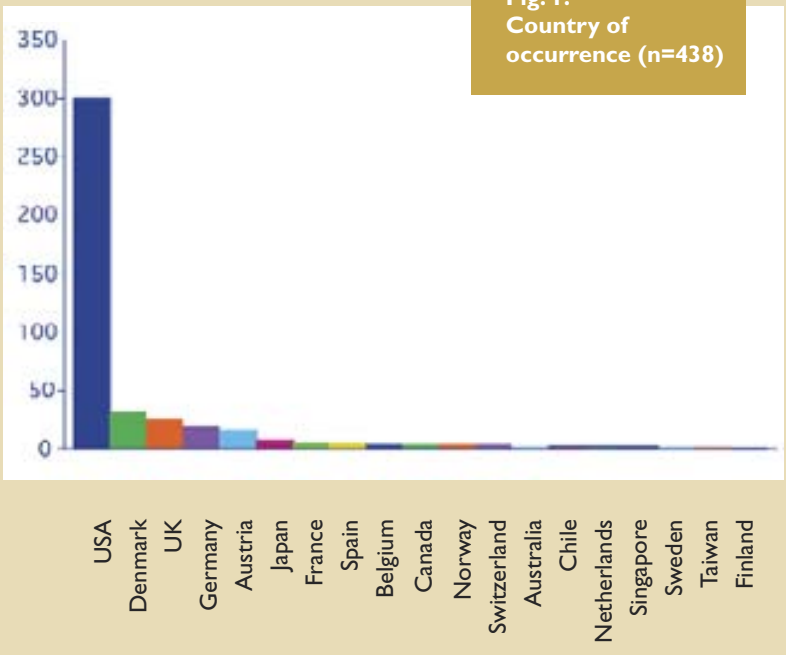
As well as GE Healthcare's 'Dear Doctor' letters to health professionals since June 2006, research has advanced both internally and with third party investigators. No cases of NSF with onset have been received since August 2007, indicating the effectiveness of precautionary measures. It is difficult to reliably estimate an incidence rate or to determine the relative safety of GBCA. Factors affecting the number of known NSF cases may include different reporting policies between institutions and differences in case definition and handling by manufacturers. GE Healthcare expedites relevant pharmacovigilance data after receipt of the minimum reporting criteria, thus contributing to rapid signal detection.

Conclusions

It is not yet known what causes NSF and why only a select group of patients, considered to be at high risk, contract the disease. GE Healthcare advises all physicians not to use Omniscan in patients with a glomerular filtration rate <30 mL/min/1.73m2 or in acute renal failure. As there is no clear evidence that any product is safer than another with respect to the risk of NSF in these patients, physicians should use extreme caution whichever product is considered in these patients. The sharp decline in number of cases with recent onset of NSF reinforces the necessity to use gadolinium-based contrast agents including Omniscan in line with the prescribing information.

A full version of this article (including references) is available upon request to editorial@imagingmanagement.org.

Fig. 1: Country of occurrence (n=438)



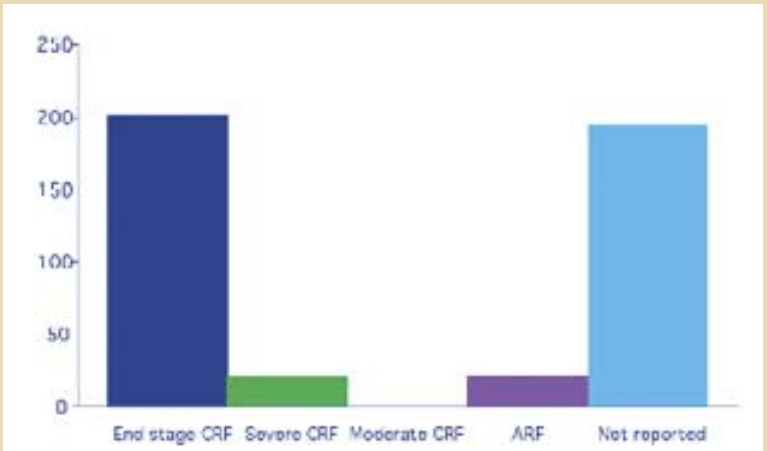


Fig. 2: Type and degree of renal impairment in NSF patients (n=438)

GE Healthcare has not received any reports of NSF in patients with moderate or mild chronic renal failure. However, there is a considerable number of cases where the renal status was not reported, especially those reports not medically confirmed.

Annotation: CRF, chronic renal failure; ARF, acute renal failure

ECRI Institute

COMPUTED TOMOGRAPHY SCANNERS

Product Comparison Chart

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.

For more information, visit www.ecri.org

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<1>These recommendations are the opinions of ECRI Institute's technology experts. ECRI Institute assumes no liability for decisions made based on this data.

BRAND	ECRI INSTITUTE'S RECOMMENDED SPECIFICATIONS<1>	SIEMENS
MODEL	Midrange/Wide Bore CT Scanners	SOMATOM AS
WHERE MARKETED		Worldwide
FDA CLEARANCE		Pending 510(k)
CE MARK (MDD)		Yes
TYPE	Multislice	Multislice
Number of slices acquired simultaneously	16	40 or 64
DETECTOR		
Total detector width, z-axis, mm	20	28.8
Standard rotation times, sec, 360°	0.5-2	0.33, 0.5, 1 sec
RADIATION DOSE		
Dose-modulation technique	Yes	CARE Dose4D
Pediatric-specific dose control	Yes	Special pediatric protocols included
Axial cardiac		
Low-dose cardiac (axial acquisition)	No	Optional
Maximum heart rate	NA	Not specified
Arrhythmia correction	NA	Optional
CLINICAL APPLICATIONS AND FUNCTIONALITY		
Coronary artery calcification scoring	Optional	Yes
Quantification	Yes	Optional
Ventricular output		Optional
Myocardial evaluation		
Lung nodule assisted reading	Yes	Optional
Lung nodule CAD		Optional
Respiratory gating	Optional	Optional
Virtual colonoscopy assisted reading	Yes	
Virtual colonoscopy CAD		Optional, polyp enhanced viewing
Vessel analysis (noncardiac)		Optional
Brain perfusion		Optional
Z-axis coverage for brain perfusion		Not specified
Auto bone removal		Optional
Highest achievable temporal resolution		165 ms with single segment
IMAGE RECONSTRUCTION		
Computer CPU		2 x Xeon 3.0 GHz processor
Scan FOVs, cm	50	50; optional 78 extended FOV
Reconstruction matrices	512 x 512	512 x 512
Maximum reconstruction rate, (512 x 512), ips	10	30
Per slice, sec	0.5	30 images/sec
Real-time partial image reconstruction	Yes	Real-time display
No. of online images	40,000 (512 x 512)	260,000 (512 x 512)
Archival storage	MOD, CD, DVD	CD-R, DVD DICOM
Image sharing	DVD,USB	Not specified
SYSTEM INTEGRATION		
DICOM	Yes	Yes
CT image storage SCU/SCP	Yes	Yes
Enhanced CT storage SCU/SCP	Yes	Yes
ECG waveform SCP/SCU	No	Yes
Modality worklist SCU	Yes	Yes
Query/retrieve SCU and SCP	Yes	Yes
Storage commitment SCU	Yes	Yes
Modality performed procedure step SCU	Yes	Yes
IHE profiles supported	SW, PIR, CPOI, PGI, KIN, BS, EDM, PDfi, CT	Yes
OTHER SPECIFICATIONS		Adaptive Dose Shield, 4D Adaptive Spiral (64 only), SureView; CARE Dose4D; CARE Vision; CARE Bolus; syngo InSpace4D; syngo Fly Through; syngo Dental; syngo Osteo; syngo Pulmo; HeartView; syngo Circulation; syngo InSpace4D Advanced Vessel Analysis; syngo Calcium Scoring; syngo Neuro Perfusion; syngo Body Perfusion; syngo Image Fusion; syngo LungCARE; syngo LungCARE with Nodule Enhanced Viewing (NEV); syngo Colonography; syngo Colonography with Polyp Enhanced Viewing (PEV); z-UHR, 3-D interventional package.
LAST UPDATED		March 2008
Supplier Footnotes		

SIEMENS	SIEMENS	SIEMENS	SIEMENS
SOMATOM AS+	SOMATOM Definition	SOMATOM Emotion	SOMATOM Sensation
Worldwide	Worldwide	Worldwide	Worldwide
Pending 510(k)	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Multislice	Multislice	Multislice	Multislice
128	Dual-source technology	6, 16	24, 40, 64
38.4	28.8	18 (6); 19.2 (16)	28.8
0.30. 0.5, 1.0	0.33, 0.37, 0.42, 0.5, 0.75, 1, 1.5	0.6 (16), 0.8, 1, 1.5	1, 1.5, (open); 0.37, 0.42, 0.5, 0.75, 1, 1.5 (40); 0.37, 0.42, 0.5, 0.75, 1, 1.5, (64)
CARE Dose4D	CARE Dose4D	CARE Dose4D	CARE Dose4D
Special pediatric protocols included	Special pediatric protocols included	Special pediatric protocols included	Special pediatric protocols included
Optional	Optional	Not specified	Optional
Not specified	All heart rates	Not specified	Not specified
Optional	Optional	Optional	Optional
Yes	Yes	Yes	Yes
Optional	Optional	Optional	Optional
Optional	Optional	Optional	Optional
Optional	Optional	Optional	Not specified
Optional	Optional	Optional	Optional
Optional	Optional	Optional	Optional
Optional	Optional	Optional	Optional
Optional	Optional	Optional	Optional
Optional, polyp enhanced viewing	Optional, polyp enhanced viewing	Optional, polyp enhanced viewing	Optional, polyp enhanced viewing
Optional	Optional	Optional	Optional
Optional	Optional	Optional	Optional
Not specified	Not specified	Not specified	Not specified
Optional	Optional	Optional	Optional
150 ms with single segment	83 ms with single segment	250 ms with single segment	165 ms with single segment
2 x Xeon 3.0 GHz processor	2 x Xeon 3.6 GHz processor	2 x Dual Core Intel Xeon 3.0 GHz processor	2 x Xeon 3.6 GHz processor
50; optional 78 extended FOV	50; optional 70, 78	50; optional 70	50; optional 70 extended FOV (82 standard for open)
512 x 512	512 x 512	512 x 512	512 x 512
40	Up tp 25	Up to 8 (6); up to 16 (16)	Up to 20
40 Images/sec	Up to 25 Images/sec	0.125 (6); 0.0625 (16)	Up to 20 Images/sec
Real-time display	Real-time display	Real-time display	Real-time display
260,000 (512 x 512)	260,000 (512 x 512)	240,000	260,000 (512 x 512)
CD-R, DVD DICOM	CD-R, DVD DICOM	DVD DICOM	CD-R, optional MOD
Not specified	Not specified	Not specified	Not specified
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Adaptive Dose Shield, 4D Adaptive Spiral, SureView; CARE Dose4D; CARE Vision; CARE Bolus; syngo InSpace4D; syngo Fly Through; syngo Dental; syngo Osteo; syngo Pulmo; HeartView; syngo Circulation; syngo InSpace4D Advanced Vessel Analysis; syngo Calcium Scoring; syngo Neuro Perfusion; syngo Body Perfusion; syngo Image Fusion; syngo LungCARE; syngo LungCARE with Nodule Enhanced Viewing (NEV); syngo Colonography; syngo Colonography with Polyp Enhanced Viewing (PEV); z-UHR, 3-D interventional package.	Dual-energy (DE) applications include DE Direct Angio, DE Virtual Enhanced, DE Hardplaque Display, DE Calcuil Characterization, DE Musculoskeletal, DE Lung Perfusion Blood Volume (PBV), DE Brain Hemorrhage, DE Heart PBV, DE Lung Vessels, and DE Gout; Adaptive 4D-Spiral, SureView; CARE Dose4D; CARE Vision; CARE Bolus; syngo InSpace4D; syngo Fly Through; syngo Dental; syngo Osteo; syngo Pulmo; HeartView; syngo Circulation; syngo InSpace4D Advanced Vessel Analysis; syngo Calcium Scoring; syngo Neuro Perfusion; syngo Body Perfusion; syngo Image Fusion; synago LungCARE; syngo LungCARE with Nodule Enhanced Viewing (NEV); syngo Colonography; syngo Colonography with Polyp Enhanced Viewing (PEV); z-UHR; Dual Source CT (work in progress).	SureView; CARE Dose4D; basic intervention; CARE Vision CT; advanced interventions; CARE Bolus CT; syngo VRT; syngo CT Oncology; syngo InSpace4D; syngo Fly Through; syngo Dental CT; syngo Osteo CT; syngo Pulmo CT; syngo HeartView CT; syngo Circulation; syngo Plaque Analysis; syngo InSpace4D Advanced Vessel Analysis (AVA); syngo Calcium Scoring; syngo Neuro Perfusion CT; syngo Neuro Digital Subtraction Angiography (DSA) CT ; syngo Neuro Perfusion Weighted Map (PWM); syngo Colonography CT; syngo Colonography with Polyp Enhanced Viewing (PEV); syngo LungCARE CT; syngo LungCAD; syngo Body Perfusion; syngo Image Fusion; respiratory gating and triggering CT.	SureView; CARE Dose4D; CARE Vision; CARE Bolus; syngo InSpace4D; syngo Fly Through; syngo Dental; syngo Osteo; syngo Pulmo; HeartView; syngo Circulation; syngo InSpace4D Advanced Vessel Analysis; syngo Calcium Scoring; syngo Neuro Perfusion; syngo Body Perfusion; syngo Image Fusion; syngo LungCARE; syngo LungCARE with Nodule Enhanced Viewing (NEV); syngo Colonography; syngo Colonography with Polyp Enhanced Viewing (PEV); z-UHR.
March 2008	March 2008	March 2008	March 2008

Product Comparison Chart

BRAND	ECRI INSTITUTE'S RECOMMENDED SPECIFICATIONS<1>	TOSHIBA Leading Innovation >>>	TOSHIBA Leading Innovation >>>	TOSHIBA Leading Innovation >>>
MODEL	Midrange/Wide Bore CT Scanners	Aquilion 16	Aquilion 32	Aquilion 64
WHERE MARKETED		Worldwide	Worldwide	Worldwide
FDA CLEARANCE		Yes	Yes	Yes
CE MARK (MDD)		Yes	Yes	Yes
TYPE	Multislice	Multislice helical	Multislice helical	Multislice helical
Number of slices acquired simultaneously	16	16	32	64
DETECTOR				
Total detector width, z-axis, mm	20	32	32	32
Standard rotation times, sec, 360°	0.5-2	0.5, 0.75, 1, 1.5, 2, 3	0.5, 0.75, 1, 1.5, 2, 3	0.5, 0.75, 1, 1.5, 2, 3
RADIATION DOSE				
Dose-modulation technique	Yes	XYZ	XYZ and ECG modulation	XYZ and ECG modulation
Pediatric-specific dose control	Yes	Yes	Yes	Yes
Axial cardiac				
Low-dose cardiac (axial acquisition)	No	No	Yes	Yes
Maximum heart rate	NA	120	120	120
Arrhythmia correction	NA	Yes	Yes	Yes
CLINICAL APPLICATIONS AND FUNCTIONALITY				
Coronary artery calcification scoring	Optional	Optional	Optional	Optional
Quantification	Yes	Optional	Optional	Optional
Ventricular output		Optional	Optional	Optional
Myocardial evaluation		Optional	Optional	Optional
Lung nodule assisted reading	Yes	Optional	Optional	Optional
Lung nodule CAD		Optional	Optional	Optional
Respiratory gating	Optional	Not specified	Optional	Optional
Virtual colonoscopy assisted reading	Yes	Optional	Optional	Optional
Virtual colonoscopy CAD		Optional	Optional	Optional
Vessel analysis (noncardiac)		Optional	Optional	Optional
Brain perfusion		Optional	Optional	Optional
Z-axis coverage for brain perfusion		32 mm	32 mm	32 mm
Auto bone removal		Standard	Standard	Standard
Highest achievable temporal resolution		40 msec	35 msec	35 msec
IMAGE RECONSTRUCTION				
Computer CPU		32-bit processor x 2	32-bit processor x 2	32-bit processor x 2
Scan FOVs, cm	50	18, 24, 32, 40, 50	18, 24, 32, 40, 50	18, 24, 32, 40, 50
Reconstruction matrices	512 x 512	512 x 512	512 x 512	512 x 512
Maximum reconstruction rate, (512 x 512), ips	10	Up to 12	Up to 16 fps; optional up to 28 fps	Up to 16 fps; optional up to 28 fps
Per slice, sec	0.5	0.08	0.04	0.04
Real-time partial image reconstruction	Yes	12 fps	12 fps	12 fps
No. of online images	40,000 (512 x 512)	200,000 (512 x 512)	160,000 (512 x 512)	160,000 (512 x 512)
Archival storage	MOD, CD, DVD	9.4 GB DVD-RAM	9.4 GB DVD-RAM	9.4 GB DVD-RAM
Image sharing	DVD,USB	Not specified	Not specified	Not specified
SYSTEM INTEGRATION				
DICOM	Yes	Yes	Yes	Yes
CT image storage SCU/SCP	Yes	Yes	Yes	Yes
Enhanced CT storage SCU/SCP	Yes	Yes, SCU	Yes, SCU	Yes, SCU
ECG waveform SCP/SCU	No	No	No	No
Modality worklist SCU	Yes	Yes	Yes	Yes
Query/retrieve SCU and SCP	Yes	Yes	Yes	Yes
Storage commitment SCU	Yes	Yes	Yes	Yes
Modality performed procedure step SCU	Yes	Yes	Yes	Yes
IHE profiles supported	SW, PIR, CPOI, PGI, KIN, BS, EDM, PDfi, CT	IHE (SWF, PIR, CPI, PGP, PDI, charge posting, ED) as acquisition modality actor	IHE (SWF, PIR, CPI, PGP, PDI, charge posting, ED) as acquisition modality actor	IHE (SWF, PIR, CPI, PGP, PDI, charge posting, ED) as acquisition modality actor
OTHER SPECIFICATIONS		Cerebral blood-flow analysis system; quantitative bone-mineral analysis; CT fluoro; full DICOM feature set; pediatric scanning; SureStart Contrast Tracking; SureScan Real-Time Imaging; volume-rendered 3-D; ECG gating; cardiac function analysis; SureCardio Imaging; autovessel measurement; perfusion; 32 recordable voice commands; 378 programmable protocols; Kit (marketing resource); Multiview MPR; AutoFilm; AutoSend; AutoArchive; SUREExposure; SureSubtraction Neuro CTA Subtraction; SureCardiac Scoring.	Cerebral blood-flow analysis system; quantitative bone-mineral analysis; CT fluoro; full DICOM feature set; pediatric scanning; SureStart Contrast Tracking; SureScan Real-Time Imaging; volume-rendered 3-D; ECG gating; cardiac function analysis; SureCardio Imaging; autovessel measurement; perfusion; 32 recordable voice commands; 378 programmable protocols; Kit (marketing resource); Multiview MPR; AutoFilm; AutoSend; AutoArchive; SUREExposure; SureSubtraction Neuro CTA Subtraction; SureCardio Prospective Low-Dose Cardiac Exam; Variable Helical Helical Pitch; SureCardiac Scoring.	Cerebral blood-flow analysis system; quantitative bone-mineral analysis; CT fluoro; full DICOM feature set; pediatric scanning; SureStart Contrast Tracking; SureScan Real-Time Imaging; volume-rendered 3-D; ECG gating; cardiac function analysis; SureCardio Imaging; auto vessel measurement; perfusion; 32 recordable voice commands; 378 programmable protocols; Kit (marketing resource); Multiview MPR; AutoFilm; AutoSend; AutoArchive; SUREExposure; SureSubtraction Neuro CTA Subtraction; SureCardio Prospective Low-Dose Cardiac Exam; Variable Helical Helical Pitch; SureCardiac Scoring.
LAST UPDATED		March 2008	March 2008	March 2008
Supplier Footnotes				

TOSHIBA Leading Innovation >>>	TOSHIBA Leading Innovation >>>	TOSHIBA Leading Innovation >>>	TOSHIBA Leading Innovation >>>
Aquilion 64 CFX	Activion16	Aquilion Large Bore	Aquilion ONE
Worldwide	Europe and Asia	Worldwide	Worldwide
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Multislice helical	Multislice helical	Multislice helical	Dynamic volume CT
64	16	16	16 cm volume
32	20	32	160
0.35, 0.4, 0.5, 0.75, 1, 2, 3	0.75, 1, 1.5, 2, 3	0.5, 0.75, 1, 1.5, 2, 3	0.35, 0.375, 0.4, 0.45, 0.5, 0.6, 0.75, 1, 1.5
XYZ and ECG modulation	XYZ	Z	X,Y and ECG modulation
Yes	Yes	Yes	Yes
Yes	No	Yes	Yes
120	No	No	Not specified
Yes	NA	Yes	Yes
Standard	Optional	Optional	Standard
Optional	Optional	Optional	Standard
Standard	Optional	Optional	Standard
Standard	Optional	Optional	Standard
Optional	Optional	Optional	Optional
Optional	Optional	Optional	Optional
Optional	Not specified	Prospective and retrospective	Optional
Optional	Optional	Optional	Standard
Optional	Optional	Optional	Optional
Optional	Optional	Optional	Standard
Optional	Optional	Optional	Standard including 4D CTDSA
32 mm	20 mm	32 mm	16 cm volume
Standard	Standard	Standard	Standard
35 msec	37,5 msec	50 msec	Not specified
32-bit processor x 2	32-bit processor x 2	32-bit processor x 2	2 Intel Quad Core Xeon processors
18, 24, 32, 40, 50	18, 24, 32, 40, 50	24, 32, 40, 55, 70	18, 24, 32, 40, 50
512 x 512	512 x 512	512 x 512	512 x 512
Up to 16 fps; optional up to 28 fps	Up to 10	Up to 12	As low as 10 sec per volume
0.04	0.1	Up to 0.1	Volume scanner
12 fps	12 fps	12 fps	Volume scanner
160,000 (512 x 512)	200,000 (512 x 512)	200,000 (512 X 512)	800,000
9.4 GB DVD-RAM	9.4 GB DVD-RAM	9.4 GB DVD-RAM	9.4 GB DVD-RAM DL
Not specified	Not specified	Not specified	Not specified
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Yes, SCU	Yes, SCU	Yes, SCU	Yes, SCU
No	No	No	No
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
IHE (SWF, PIR, CPI, PGP, PDI, charge posting, ED) as acquisition modality actor	IHE (SWF, PIR, CPI, PGP, PDI, charge posting, ED) as acquisition modality actor	IHE (SWF, PIR, CPI, PGP, PDI, charge posting, ED) as acquisition modality actor	IHE (SWF, PIR, CPI, PGP, PDI, charge posting, ED) as acquisition modality actor
Cerebral blood-flow analysis system; quantitative bone-mineral analysis; CT fluoro; full DICOM feature set; pediatric scanning; SureStart Contrast tracking; SureScan Real-Time Imaging; volume-rendered 3-D; ECG gating; cardiac function analysis; SureCardio Imaging; autovessel measurement; perfusion; 32 recordable voice commands; 378 programmable protocols; Kit (marketing resource); Multiview MPR; AutoFilm; AutoSend; AutoArchive; SUREExposure; SureSubtraction Neuro CTA Subtraction; SureCardio Prospective Low-Dose Cardiac Exam; Variable Helical Pitch; SureCardiac Scoring.	Cerebral blood-flow analysis system; quantitative bone-mineral analysis; CT fluoro; full DICOM feature set; pediatric scanning; SureStart Contrast Tracking; SureScan Real-Time Imaging; volume-rendered 3-D; ECG gating; autovessel measurement; perfusion; 32 recordable voice commands; 378 programmable protocols; Multiview MPR; AutoFilm; AutoSend; AutoArchive; SUREExposure; SureSubtraction Neuro CTA Subtraction.	Cerebral blood-flow analysis system; quantitative bone-mineral analysis; CT fluoro; full DICOM feature set; pediatric scanning; SureStart Contrast Tracking; SureScan Real-Time Imaging; volume-rendered 3-D; ECG gating; cardiac scoring; cardiac function analysis; SureCardo Imaging; autovessel measurement; perfusion; 32 recordable voice commands; 378 programmable protocols; ImageMaker Kit (marketing resource); Multiview MPR; AutoFilm; AutoSend; AutoArchive; SURE-Exposure.	Multifunctional dynamic volume CT scanner; performs routine multislice imaging and covers entire organs dynamically with lower radiation and less contrast dose; 16 cm coverage of 0.5 mm Quantum V detector acquires whole volumes of the entire brain, heart, and other organs in a single rotation.
March 2008	March 2008	March 2008	March 2008

Product Comparison Chart

BRAND	ECRI INSTITUTE'S RECOMMENDED SPECIFICATIONS<1>			
MODEL	Midrange/Wide Bore CT Scanners	BrightSpeed Elite	LightSpeed VCT	LightSpeed Xtra
WHERE MARKETED		Worldwide	Worldwide	Worldwide
FDA CLEARANCE		Yes	Yes	Yes
CE MARK (MDD)		Yes	Yes	Yes
TYPE	Multislice	Multislice	Multislice	Multislice
Number of slices acquired simultaneously	16	16	64	16
DETECTOR				
Total detector width, z-axis, mm	20	20	40	20
Standard rotation times, sec, 360°	0.5-2	0.5, 0.6, 0.7, 0.8, 0.9, 1, 2, 3, 4 (VariSpeed provides 0.1 sec increments from 0.5 to 1 sec)	1, 2, 3, 4	0.5, 0.6, 0.7, 0.8, 0.9, 1, 2, 3, 4
RADIATION DOSE				
Dose-modulation technique	Yes	Volara DAS, OptiDose, Color Coding for Kids, 3-D dose modulation, ECG dose modulation, beam tracking, short gantry geometry	Volara DAS, OptiDose, 3-D dose modulation, ECG dose modulation, beam tracking, short gantry geometry	Volara DAS, OptiDose, Color Coding for Kids, 3-D dose modulation, ECG dose modulation, beam tracking, short gantry geometry
Pediatric-specific dose control	Yes	Color Coding for Kids	Color Coding for Kids	Color Coding for Kids
Prospective ECG gating	Yes	NA	Optional	NA
Axial cardiac				
Low-dose cardiac (axial acquisition)	No	NA	Optional	NA
Maximum heart rate	NA	NA	NA	NA
Arrhythmia correction	NA	NA	Optional	NA
CLINICAL APPLICATIONS AND FUNCTIONALITY				
Coronary artery calcification scoring	Optional	Optional, SmartScore 4.0	Optional	Optional, SmartScore 4.0
Quantification	Yes	Optional, CardIQ Xpress 2.0	Yes	NA
Ventricular output		Optional, CardIQ Function Xpress	NA	NA
Myocardial evaluation		Optional, CardIQ Function Xpress	NA	NA
Lung nodule assisted reading	Yes	Optional	Optional, Long VCAR	Optional
Lung nodule CAD		Not specified	Not specified	Not specified
Respiratory gating	Optional	Optional	Optional	Optional
Virtual colonoscopy assisted reading	Yes	Optional	Optional	Optional
Virtual colonoscopy CAD		Not specified	Not specified	Not specified
Vessel analysis (noncardiac)		Optional, Vessel IQ Xpress	Optional, Vessel IQ Xpress	Optional, Vessel IQ Xpress
Brain perfusion		Optional Perfusion 4	Optional Perfusion 4	Optional Perfusion 4
Z-axis coverage for brain perfusion		20 mm	Optional 80 mm VolumeShuttle	20 mm
Auto bone removal		Optional	Optional	Optional
Highest achievable temporal resolution		Not specified	Not specified	Not specified
IMAGE RECONSTRUCTION				
Computer CPU		Open architecture/Linux	Open architecture/Linux	Open architecture/Linux
Scan FOVs, cm	50	25, 50	25, 50	25, 50
Reconstruction matrices	512 x 512	512 x 512	512 x 512	512 x 512
Maximum reconstruction rate, (512 x 512), ips	10	Not specified	Not specified	Not specified
Per slice, sec	0.5	Up to 16 frames/sec	Up to 16 frames/sec	Up to 16 frames/sec
Real-time partial image reconstruction	Yes	Not specified	Not specified	Not specified
No. of online images	40,000 (512 x 512)	250,000 (512 x 512)	250,000 (512 x 512)	250,000 (512 x 512)
Archival storage	MOD, CD, DVD	2.3 GB MOD, DICOM 3.0	2.3 GB MOD, DICOM 3.0	2.3 GB MOD, DICOM 3.0
Image sharing	DVD,USB	Not specified	Not specified	Not specified
SYSTEM INTEGRATION				
DICOM	Yes	As defined in DICOM Conformance Statement	As defined in DICOM Conformance Statement	As defined in DICOM Conformance Statement
CT Image storage SCU/SCP	Yes	Yes	Yes	Yes
Enhanced CT storage SCU/SCP	Yes	No	No	No
ECG waveform SCP/SCU	No	No	No	No
Modality worklist SCU	Yes	Yes	Yes	Yes
Query/retrieve SCU and SCP	Yes	Yes	Yes	Yes
Storage commitment SCU	Yes	Yes	Yes	Yes
Modality performed procedure step SCU	Yes	Yes	Yes	Yes
IHE profiles supported	SW, PIR, CPOI, PGI, KIN, BS, EDM, PDFi, CT	Yes	Yes	Yes
OTHER SPECIFICATIONS		SmartmA-3-D dose modulation, in-room start, remote tilt, rear gantry control, breathing lights with timer, MPR, AutoScan, AutoFilm, AutoVoice, AutoTransfer, AutoArchive, SmartPrep, ProtocolPro, ProView, ConnectPro, View/Edit Wizard, ImageWorks; optional: CardIQ, colonography, advanced lung analysis, SmartScore, CardEP, CardIQ function, advanced vessel analysis, perfusion.	AutoScan, AutoArchive, AutoFilm, AutoVoice, AutoTransfer, SmartPrep, ProtocolPro, View/Edit Wizard, DynaPlan Plus, ImageWorks, ProView, remote tilt, in-room start, rear gantry control, breathing lights, SmartmA-3-D dose modulation, ECG dose modulation with optional cardiac; optional: SmartScore, colonography, advanced lung analysis, CardIQ, Card EP, CardIQ function, advanced vessel analysis, perfusion.	SmartView Fluoro, AutoScan, AutoArchive, AutoFilm, AutoVoice, AutoTransfer, SmartPrep, ProtocolPro, View/Edit Wizard, DynaPlan Plus, ImageWorks, ProView, PNR, ConnectPro, remote tilt, in-room start, rear gantry control, analysis, breathing lights, SmartmA.
LAST UPDATED		March 2008	March 2008	March 2008
Supplier Footnotes		-		

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Improving the Performance of Mammography

Contributors
Andrew Smith, Ph.D.
Loren Niklason, Ph.D.

Breast tomosynthesis is a three-dimensional imaging technology that involves acquiring images of a stationary compressed breast at multiple angles during a short scan. The individual images are then reconstructed into a series of thin high-resolution slices that can be displayed individually or in a dynamic ciné mode. Reconstructed tomosynthesis slices reduce or eliminate the problems caused by tissue overlap and structure noise in single slice two-dimensional mammography imaging.

This paper outlines the theory of tomosynthesis, its expected clinical benefits, and summarises the results of a multi-centre, multi-reader clinical trial conducted by Hologic to measure the clinical performance of tomosynthesis in a screening environment.

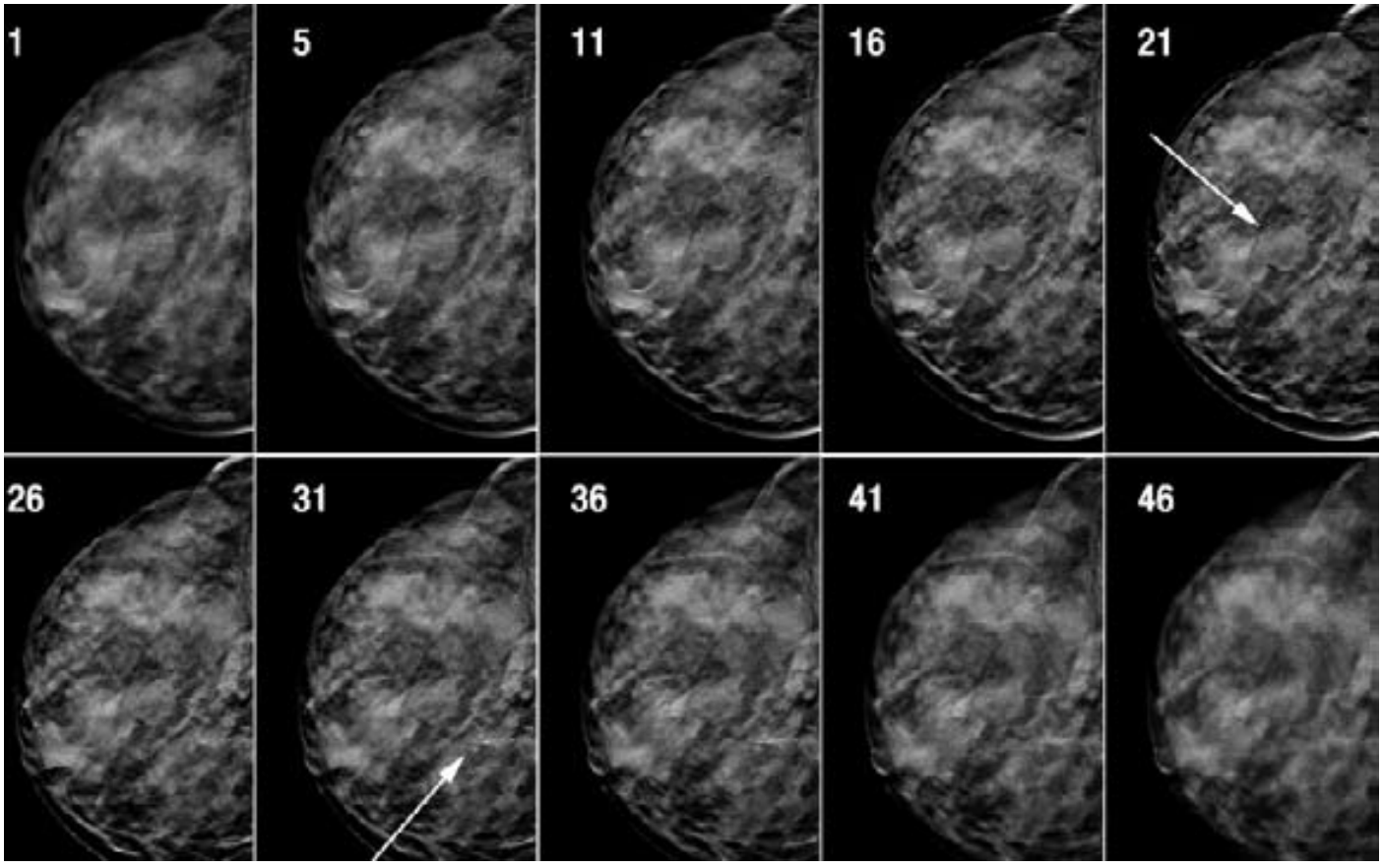
HOW IS THE IMAGE ACQUIRED?

The breast is compressed in a standard way. While holding the breast stationary, the x-ray tube is rotated over a limited angular range. A series of low dose exposures are made every degree or so, creating a series of digital images. Typically, the tube is rotated through 10 - 20 degrees and 10 - 20 exposures are made every 1° or so during a total scan of five seconds or less. Individual images are projections through the breast at different angles and these are what are reconstructed into slices.

Normally the breast would be placed in the MLO or CC view, though the tomosynthesis system should support the ability to acquire images in any desired orientation. One consideration in the design of tomosynthesis systems is the motion of the x-ray source during acquisition.

The x-ray tube can move in a continuous or step-and-shoot motion. With continuous motion, x-ray exposures must be short enough to avoid image blurring due to focal spot motion. If step-and-shoot motion is employed, the gantry must come to a complete stop at each angular location before turning on the x-rays, otherwise vibration will blur the image.

The angular range and number of exposures acquired during the scan also need to be optimised. In general, more exposures allow reconstructions with fewer artifacts. This must be balanced against the fact that for a given total exam dose, more exposures mean smaller signals for each of the individual shots. For sufficiently small exposures,



Reconstructed tomosynthesis slices through the breast platform up to compression paddle reveal objects at differing heights in the breast, such as cysts and calcifications shown by arrows

< Selenia Dimensions™ Breast Tomosynthesis System*

* Caution. Investigational device in the U.S. FDA clearance pending

imager receptor noise dominate the image and degrade reconstructed image quality.

Increased numbers of exposures also increase raw data size and reconstruction times. In regards to angular range, a larger angular range gives increased reconstructed slice separation, where smaller angular ranges keep more structures in focus in a given slice.

Increased separation theoretically might be desired for resolving two closely lying structures, but could greatly impair the appreciation of a cluster of microcalcifications by having individual calcifications appear in different slices, or the appearance of spiculations lying in more than one narrow plane.

DETECTOR EFFICIENCY AND DOSE

Tomosynthesis imaging consists of a series of low dose exposures, with every acquisition about 5 - 10% of a normal single-view mammogram. Because each exposure is low dose, it is essential that the image receptor have a high quantum efficiency and low noise. Because images are being acquired at a rate of several images per second, rapid imaging is another requirement.

DISPLAY METHODOLOGY

The reconstructed tomosynthesis slices can be displayed similarly to CT reconstructed slices. The operator can view the images one at a time or display them in a ciné loop.

The original projections are identical to conventional projection mammograms, albeit each one is very low dose, and these can be viewed as well, if desired. If the system acquired a 2D and a 3D mammogram in the same compression, images from these two modalities are completely co-registered.

Workstation user interfaces that allow rapid switching between the two modes will facilitate image review, and allow rapid iden - tification of lesions in one modality with the corresponding lesion in the other modality.

Tomosynthesis should resolve many of the tissue overlap reading problems that are a major source of the need for recalls and additional imaging in 2D mammography exams. The biopsy rate might also decrease through improved visualisation of suspect objects.

Some pathologies that are mammographically occult will be discernable through the elimination of structure noise and tomosynthesis may therefore allow improved detection of cancers.

TOMOSYNTHESIS CLINICAL TRIALS

Hologic has completed a multi-centre, multi- reader trial investigating the performance of tomosynthesis. The purpose of the study was to compare radiologists' cancer detection rate and screening recall rate using conventional digital mammography (2D) plus breast tomosynthesis (3D), to the cancer detection rate and recall rate observed when using 2D alone.

In the study, 1,083 women from five clinical centres underwent 2D and 3D imaging of both breasts. Cases were collected from a screening population and enriched with patients from diagnostic mammography. Both 2D and 3D imaging consisted of CC and MLO images of both breasts. The CC and MLO 3D images were performed using the Hologic Selenia tomosynthesis prototype. 316 imaging data sets were chosen randomly for review by 12 radiologists. The 2D images were scored first, and then the readers reviewed and scored the 2D and 3D exams together. For all 12 readers, clinical performance was superior for 2D plus 3D imaging compared with 2D alone, as measured using the area under the ROC curve.

CONCLUSION

Breast tomosynthesis provides a 3D imaging capability that allows the more accurate evaluation of lesions by enabling better differentiation between overlapping tissues.

A lower recall rate, higher positive predictive value for a biopsy recommendation, higher cancer detection rates, fewer recalls, fewer biopsies, and improved radiologist confidence are expected to result from the use of this technology.

Breast tomosynthesis should be valuable in both screening mammography and diagnostic mammography.

BENEFITS OF ISO 9001/2000 CERTIFICATION

Greater Transparency Leads to Improved Workflow

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ISO 9001:2000 is a quality management system that promotes greater responsibility among staff, better use of time and resources, risk and failure management, as well as greater traceability of products and services. The department of Nuclear Medicine and Special Endocrinology (NMSE), PET-CT centre Klagenfurt, Austria has been accredited according to ISO 9001:2000 since December 2003. In this article, we will explain how setting up the Quality Management (QM) system has led to a more transparent and comprehensible presentation of processes and workflows in the department for diagnosis, therapy and follow-up of diseases.

Setting up a QM system has enabled the state hospital Klagenfurt to develop quality goals shaped with respect to four levels of what we call the "Balanced Score Card", or "People, Processes, Learning and Development, and Budget". During this process, responsibilities and competences were defined. Inputs and outputs of each process, as well as the process owner and the action holder of each subtask were listed. Finally, quality scores and measurement categories were defined which were consecutively used to control and check overall compliance at regular intervals.

Mistakes based on lack of information were avoided by structuring the flow of information and implementing regular team and process meetings that allowed us to encourage communication and specific feedback. Documentation was structured and streamlined and templates for fast and efficient reporting implemented. Thus, risks were identified and prevented, and errors resolved in an efficient way.

Processes, Tasks and Information

To increase traceability of services, the main tasks performed at the NMSE were depicted as process charts (see fig. 1).

Each step in the process was determined, and necessary responsibilities documented. Here I will use the PET-CT examination workflow as an example to depict process charts generated and process descriptions set in place.

Fig. 1: Services / tasks of the NMSE

The process depicted in Fig. 2 and Fig. 3 describes and regulates the patient's management, the PET/CT investigation itself and the reporting of investigation results during PET-CT. In total, process information defined and documented for each single process comprises of:

- A short method description of the process itself;
- Aim and goal of the process, and
- A definition of the final output/results expected

at the end of the process.

Measurable key quality data and quality scores determining the performance quality of the process are used to check the effectiveness of each process later on. This also includes actions to be taken in case of perceptible deviations or interferences in the process flow and the nomination of a person who is responsible overall, for correct process work.

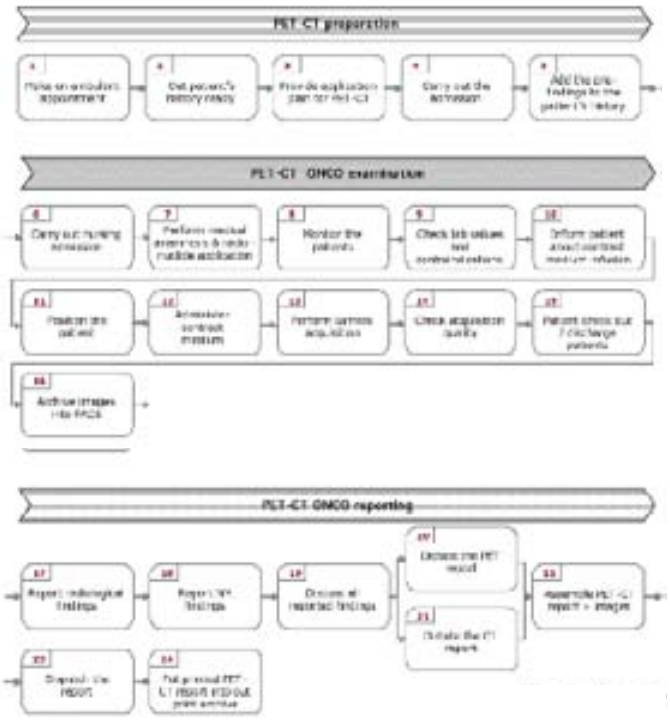
Quality Goals and Traceability

This process enabled the department to define a clear mission and vision (see fig. 4). Its specific goals were defined and actions set to optimise goal realisation by considering the four levels of the Balanced Score Card and taking local and international laws into account (see fig. 5). To enable the measurement of each single goal achievement, relevant and efficient quality scores (key quality data) were defined, which in succession led to more controllable processes and fast and traceable optimisation of work.

The quality understanding of the department is shaped by the principle that technical and service quality is defined through "a set of inherent characteristics". Thus, services provided must fulfil both objectively measurable parameters, as well as subjective expectations of the customers. Customer contentment is regularly questioned via patient questionnaires, and continuous learning and development guaranteed. The management defined quality goals for all areas of the department and all professions were defined with clear actions and projects set in place to achieve them.

Fig. 2: PET CT Processes - Overview

Fig. 3: PET CT ONCO Process - detailed view



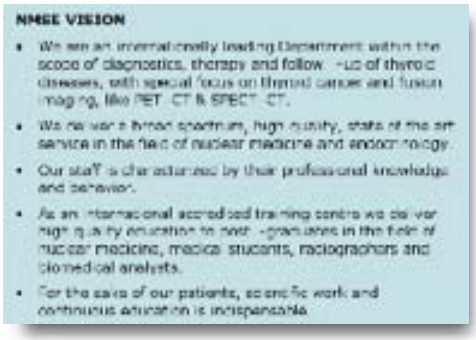


Fig. 4: NMSE Vision

Risk and Failure Management Tools

To use ISO 9001:2000 as a process for continuous improvement in the most effective way, various risk and failure management tools were implemented. Amongst these, internal and external process audits to check compliance, root cause analysis (RCA) to analyse mistakes and Failure Mode Effect Analysis (FMEA) for preventative quality assurance.

Internal audits, performed by local QM representatives, take place at least once a year. Audits are carried out in all areas of the department. Results, failings and necessary correction measures are reported by the audit leader and affected employees informed. The head of the department can delegate partial management tasks to staff, and is responsible for correction measures. Supervision of the conversion occurs through the QM representative who documents the effective elimination of the cause of error in the audit divergence report. Also, an annual external audit of the QMS is performed by accredited institutions.

The head of the department examines the total QMS once a year. In this management review, available relevant information like audit reports, process protocols, quality scores, internal and external communication issues, regular quality conversations and corrective and preventative actions taken are critically examined/appraised. The goal is to identify necessary system improvements early on and enable suitable changes.

Benefits of ISO 9001:2000 Certification

Depicting all main processes and workflows of the department in detail as well as underlying tasks with clear responsibilities and competences, has promoted a greater responsibility and quality consciousness among staff and led to a greater consistency and traceability of services. Certification has resulted in more exact definition of processes, competences and responsibilities, better management of medical and non-medical interfaces and greater consistency of medical services.

Clearly defined interfaces (for example between medical and non-medical staff) have improved and eased communication. Process driven meetings result in prevention of mistakes, faster detection of errors, more rapid and efficient handling of errors, better adaptation to new requirements and a more purposeful information exchange.

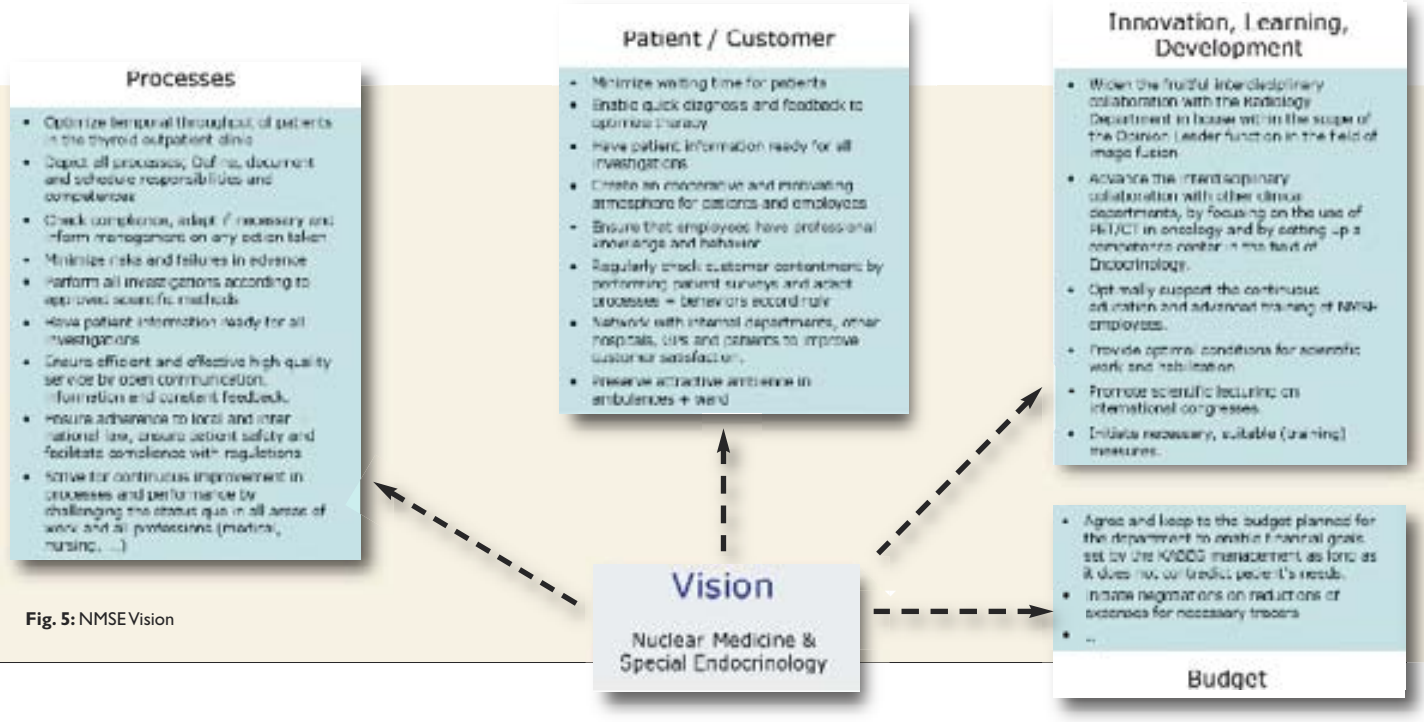


Fig. 5: NMSE Vision

STANDARDISING NATIONAL CLINICAL IMAGING CODES

The UK Approach

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The national deployment of Picture Archive & Communication Systems (PACS) and imaging information systems as part of the English National Programme for IT combined with the move towards a shared summary care health record brought about a compelling need for all imaging departments to adopt a single standard for procedure coding.

To ensure interoperability between systems within and outside the imaging domain and to allow the seamless sharing of information, a common standard terminology is required. For the broader English National Programme for IT the chosen standard is SNOMED CT.

Due to the pace of implementation of the PACS programme in England this requirement was relaxed in the immediate term to enable "off-the-shelf" systems not employing this standard to be deployed, however the argument to standardise was still as persuasive.

Development of Interim Standard Descriptions

A stakeholder management group, the Clinical Imaging Procedures Management Group (CIMG), set up originally to create a National Standard SNOMED CT subset of imaging procedures, recognised the opportunity to develop an interim solution that could be easily adopted by the systems being implemented as part of the PACS programme.

It was recognised that any interim solution needed to be developed with a migration path towards the future standard for the Shared Summary Care Record so the interim standard code set was designed such that is was closely aligned to the longer term strategic standard of SNOMED CT.

The "National Interim Standard Descriptions for Clinical Imaging Procedures" enable the consistent description of imaging procedures.

The codes and terms facilitate the identification of patient images and the communication of clinical information associated with identified procedures such as imaging service requests, patient imaging reports and statistical measures of activity.

This consistent representation of imaging procedures can thus be used for order catalogues, image identification in PACS, workflow within service departments and KH12 radiation monitoring returns.

It can also potentially support activity analysis, audit, and remuneration strategy. Treatment options would consequently be based on a common understanding of the procedures performed or planned and activity between all service providers directly compared.

Editorial principles exist to cover all elements necessary for the accurate and complete description of imaging procedures such as modality, body site, laterality, use of contrast and a whole host of administrative type aspects. There is also implementation guidance to assist users in migrating to this code set and to understand how to use it most effectively.

Take-up

Some 75% of imaging departments in hospital trusts in England have already adopted the standard. Other than SNOMED CT, existing standards as mandated in England, typically include only those required for statutory reporting such as:

- OPCS-4 represents a classification of procedures that lends itself to various reporting initiatives such as 18 -

week wait targets and commissioning.
• The KH12 return is designed to capture imaging activity related to population exposure to ionising radiations.

Relationship of Interim Representation to SNOMED CT

The code set has been developed in such a way that every entry in the standard has a direct relationship to a SNOMED CT concept. Not only does this support the interoperability between systems/organisations using the two coding schemes but also allows some of the properties of SNOMED CT to be utilised – for instance the mapping from SNOMED CT to OPCS-4.

The new 'interim' code set is designed to bridge the gap until all clinical systems can support SNOMED CT, and whilst additional concepts are introduced into SNOMED CT to fully support UK clinical imaging practice. In time, when all clinical systems are utilising SNOMED CT, it is anticipated that the representation of DI procedures in NCRS applications will be entirely by the use of SNOMED CT coded concepts.

What is SNOMED CT?

SNOMED CT® (Systematised Nomenclature of Medicine-Clinical Terms) is a comprehensive, multilingual clinical healthcare terminology, jointly developed between the NHS in England and the College of American Pathologists (CAP) to develop an international clinical terminology and formed in 1999 by the convergence of SNOMED RT and the UK's Clinical Terms Version 3 (formerly known as the Read Codes).

SNOMED CT® provides the core general terminology for the electronic health record (EHR) and contains more than 357,000 concepts with unique meanings and formal logic-based definitions organised into hierarchies. When implemented in software applications, SNOMED CT® represents clinically relevant information consistently, reliably and comprehensively as an integral part of producing electronic health records.

In April 2007 the intellectual property rights of SNOMED CT were transferred to a new organisation called the International Health Terminology Standards Development Organisation (IHTSDO). This organisation was created by a number of countries working together specifically, Australia, Canada, Denmark, Lithuania, Sweden, the Netherlands, New Zealand, the UK and the US.

The IHTSDO® seeks to improve the health of humankind generally by owning, distributing, operating and developing suitable health terminology products. This improvement is to be achieved through the sharing of more accurate clinical and related health information, allowing the implementation of semantically accurate health records that are interoperable.

SNOMED CT® contains the vast majority of concepts required to record the process of care across the range of clinical professions in practice. These concepts, with their inherent unique meanings and formal logic-based definitions, are arranged into 19 hierarchies covering the following areas:

- Clinical findings
- Procedures/interventions
- Observable entities
- Body structure
- Organism
- Substance
- Pharmaceutical/ biologic product
- Specimen
- Qualifier value
- Physical object
- Physical force
- Environments / geographic locations
- Social context
- Situation with explicit context
- Staging and scales
- Link concepts
- Special concepts
- Record artifact and event

New content within existing areas of the terminology are added to each release in response to user requests driven by advances in clinical knowledge over time. At the same time existing content is subject to regular review and refinement where necessary. In addition, new content domains are considered for inclusion on a regular basis.

Further Reading:

• NHS Connecting for Health – Data Standards
http://www.connectingforhealth.nhs.uk/systemsandservices/data/terminology/national-interim-clinical-imaging-procedure

• Royal College of Radiologists PACS and Teleradiology Group
http://www.pacsgroup.org.uk

• SNOMED CT
http://www.ihtsdo.org

INTERVIEW WITH **PROF. JIM REEKERS**

Interviewee:
Prof. Jim Reekers

Professor of Radiology and Interventional Radiology, University Hospital AMC, University of Amsterdam
Amsterdam, The Netherlands

President
Cardiolovascular and Interventional Society of Europe (CIRSE)

j.a.reekers@amc.uva.nl

Please give us some background information on your professional achievements and current role.

I have been a full-time interventionalist for over 20 years. My main focus is on vascular diseases. I work as an academic professor in interventional radiology at the University Hospital AMC, of the University of Amsterdam. I see it as my personal achievement that I have been able to work, along with many others, to build the house of IR as it is today. Currently, I am the President of CIRSE.

Your contributions to the field of interventional radiology (IR) have been much honoured – which if these has been most significant to you personally?

The SIR Dotter Lecture in 2008 was one of the highlights of my interventional career. The understanding that evidence-based medicine is of vital interest to interventional radiology was the topic of this lecture. But the most significant honour any interventionalist can get is the satisfaction that you and IR have made a difference to the patient. That is, after all, the core business. Of the many things I have been working on, if I have to mention one, it is the pioneering work I have been doing on subintimal angioplasty.

The evolution of interventional radiology has been a relatively recent and innovative branch of radiology – what excites you about it?

When Charles Dotter performed the first PTA, 45 years ago, interventional radiologists were already achieving many things before others, like vascular surgeons, "discovered" this new and exciting medical specialty and called it "endovascular surgery". Interventional radiologists have been innovating for the last four decades. What currently really excites me are the advantages IR is creating in the field of local cancer treatment. We are only at the beginning of a new boom.

Is interventional radiology adequately funded in Europe? Is it well known here?

In the vast majority of countries, there is still inadequate funding for IR. It is not yet seen and funded as an alternative to surgery, mainly due to the fact that interventional radiologists are not acting or practicing as doctors but more as "skilled hands", working in the shadow of the clinicians. When this changes, I am convinced the funding will change accordingly. Interventional radiologists are still very unknown to the general public, again, because patients don't see them as primary care takers. Yes, we have a huge image problem. CIRSE is addressing this by training the interventional radiologist to be a clinician and to promote new IR techniques in the popular press.

You are leading the creation of a European training curriculum for interventional radiology – please tell us about this.

To improve the quality of IR in Europe it is necessary to improve and to standardise IR training in Europe. CIRSE together with the European Society of Radiology (ESR), has produced a basic curriculum for IR. This document is adopted in many European countries. Along with this, CIRSE has produced a syllabus about what IR is and what you should know if you want to be a full-time interventional radiologist. We hope to work together with UEMS to bring this document to a European level. Finally, we hope that this will lead to a European IR certificate, recognised throughout the European community.

How can increasing educational opportunities expand the future of IR?

We are open to any medical specialist who wants to be trained in IR, according to the curriculum. Education is one of the most important things is this regard. Only through training can we educate enough qualified interventional radiologists to do all the work. It is often the absence of a local and well-

trained IR that still supports the use of old and redundant surgical techniques.

What are your predictions for how the range of treatments covered by IR will blossom in the decades to come?

It is my solemn belief that IR is here to replace the old techniques, which have been so prominent ever since the days of Billroth. Surgery has been a very important step forward in medicine but will soon be replaced by minimally invasive techniques. Probably this has already happened for most of vascular surgery. Vascular intervention will continue to blossom, independent of who will be doing it. Interventional oncology, treatment of uterine fibroids, trauma care and many others will have a prominent place in our daily work.

Finally, please share one of your favourite memories from your days as a trainee.

When I was a trainee, I once visited the famous Prof. Merlant, who was a neuroradiologist in Paris. As a trainee, I accompanied a patient with a vascular malformation, who was sent to him from our hospital for treatment. Prof. Merlant did not treat me like a junior but took my picture for his guestbook, a great honour as I found out many years later, and after the procedure, invited me for dinner. We talked like equal colleagues about the future of IR and new ideas for procedures. He was a very inspiring man, with a huge imagination, who at that time spurred my imagination for new products, techniques and inventions.

By the way, this same neuroradiologist, many years later, was the first to introduce the technique of uterine fibroid embolisation. It not only shows that IR is a wonderful profession but also that being an interventional radiologist is a mentality, a state of mind.

Dear Professor McCall,

I wanted to respond to your inspiring editorial in IMAGING Management (Vol 8, issue 3, 2008), to ask for advice regarding radiology training in Malta.

As a consultant radiologist in Malta, I have just taken up the post of post-graduate training coordinator for radiology.

Malta is the smallest European Union State. Since joining the EU, there has been a push to organise post-graduate training in various specialties, including radiology. The island's one large and brand new teaching hospital has furnished the department of radiology with RIS/PACS, 1.5 Tesla MRI, 16 slice CT, etc. Although still a bit short on consultant radiology personnel, I believe that we can deliver the majority of general training in medical imaging.

We plan to have five to six trainees for our first intake in October of this year. After that we will probably take three or four trainees maximum every two years. Training will be based on the ESR and RCR curricula. Trainees will be encouraged to sit the FRCR examinations.

Although we can offer the majority of training, I think that our local training will need to be supplemented by further training in specialised centres abroad. My view is that trainees should spend the equivalent of three months a year in the first four years and the whole fifth year abroad. The main reason for this is to obtain experience in areas like neuroradiology, paediatric radiology etc in the pre-FRCR training and to spend 'fellowship-type' training in fifth year.

My vision is that we team up with a centre in the UK, Ireland or mainland Europe and organise an exchange-type programme for trainees. Alternatively, our trainees can spend a training period in centres abroad through mutual agreement between the respective health authorities. The idea is that the trainees get full training rather than simple observer-type attachments. The health department in Malta is funding post-graduate training. It will provide subsidies for trainees whilst they are abroad and pay for any fees that are incurred in the process.

I would be grateful to receive any advice regarding the above and how I could take this project forward.

Yours sincerely

Dr. Adrian Mizzi
Consultant Radiologist
Mater Dei Hospital, Malta

HAVE YOUR SAY!

To respond to this letter, please email editorial@imagingmanagement.org

OVERVIEW OF THE HEALTHCARE **SYSTEM IN IRELAND**

Investing in Health

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The Irish health system is a mix of both public and private institutions and funders. It is primarily tax-financed and around 50% of the population has private health insurance. The Irish Health Service has recently come through a radical reform programme and is going through a bedding down process. The Government has invested significantly in the health service in recent years with notable results. The focus has now moved to consolidation and improved quality and efficiency. Any person, regardless of nationality, ordinarily resident in Ireland, is eligible for health and personal social services. To be eligible means that a person qualifies to avail of services, either without charge (full eligibility) or subject to prescribed charges (limited eligibility). Just under 30% of the population has full eligibility. Any person ordinarily resident in Ireland who does not have full eligibility is entitled to free hospital treatment subject to a statutory levy of 55 euros per day up a maximum payment of 550 euros in any twelve consecutive months.

History, Development, Future

The Department of Health was established in 1947. Prior to its establishment, public and health services were the responsibility of the Department of Local Government and Public Health. The local authorities continued to administer health service provision until the Health Act of 1970 which provided for the establishment of health boards. Eight boards were established primarily on a population basis. Population growth, together with new and changing demands on the health services led to a decision to replace the Eastern Health Board with three new health boards under the aegis of a new authority (ERHA) in March 2000. In June 2003 the government announced a radical health service reform programme. The Health Act 2004 provided for the establishment of a Health Service Executive (HSE) on a statutory basis which took over responsibility for the management and delivery of health and personal social services from the Eastern Regional Health Authority (ERHA), the health boards and a number of other specified agencies with effect from 1st January 2005.

Primary Care

The current primary care system is delivered by a combination of disciplines such as general practitioners (GPs), public health nurses, physiotherapists and others, very often working alone, either as private practitioners or as direct employees of the public health system. Fees for general practice services are met by the individual. GPs are paid an annual capitation fee per eligible patient (i.e. persons with full eligibility). Additional payments are also made to GPs in relation to certain specific services provided by them and not covered by the capitation scheme. In 2005 funding was allocated to allow 230,000 more people to have free GP visits. Since 2002, ten multi-disciplinary primary care teams have been developed and are delivering an enhanced and expanded range of services. Between 2000 and 2005, approximately 105 million euros has been provided for the development of Out-of-Hours GP services.

Hospital Services

Broadly speaking, there are three types of hospitals in Ireland:

- HSE hospitals, owned and funded by the HSE;
- Voluntary public hospitals, most of whose income comes directly from the State. These hospitals are generally owned and controlled by religious orders or by lay boards of governors. Almost half of acute hospital beds are in the voluntary hospitals;
- Private hospitals, which receive no state funding.

There is very little difference in practice between HSE hospitals and voluntary public hospitals. Both sets provide both public and private care. People are admitted to hospital either via a referral from their GP or through the hospital's accident & emergency department. About 80% of beds in the public hospital system are designated as 'public beds'. The remaining 20% or so of beds are designated as 'private beds'.

Financing/Management of Healthcare Costs

The health budget for 2005 is 11.941 billion euros (3.6 billion euros in 1997). The total funding envelope for the Health Capital Investment Framework (CIF) 2005 - 2009 is 3.255 billion euros (2.734 billion euros for 2004 - 2008).

The extra investment over recent years has enabled record levels of activity in the acute hospital system and a wide range of additional services across all care programmes. During the preparation of the current national Health Strategy in 2001, the relative merits of social insurance, private insurance and tax-based systems were carefully examined. It was concluded that the present centrally funded tax-based system of funding, complemented as at present by private health insurance will be retained.

PROFILE OF THE FACULTY OF **RADIOLOGISTS IN IRELAND**

Promoting Education, Training and Research

The Faculty of Radiologists at the Royal College of Surgeons is the professional and academic body for clinical radiologists in Ireland. It offers specialist training and post-graduate examinations in radiology. The faculty's objectives are to advance the science, art and practice of radiology and its allied sciences and to promote education, study and research in radiology

Author:

This profile is provided by the Faculty of Radiologists in Ireland. A full version can be found on the website of the Faculty at: www.rcsi.ie

History of the Faculty

In 1960 the Radiological Society of Ireland, established in 1932 to develop radiology in Ireland, set up a committee to examine the developing role of radiologists in education and training. It was decided to establish a Faculty of Radiologists, associated with the Royal College of Surgeons in Ireland.

The new Faculty was primarily concerned with postgraduate training programmes and examinations in radiology. The first task was to design an examination structure. A Primary Fellowship examination consisting of radiation physics, pathology, surgery, radiological anatomy and medicine, and separate Final Fellowship Examinations in Diagnostic Radiology and Radiotherapy were established. The first examinations of the Faculty were held in May 1966.

An Irish training programme in radiology was then established. This was supported by the Irish Department of Health and was a landmark in the development of radiology in Ireland. Up to that time, an Irish graduate undertaking a career in diagnostic radiology had to obtain a training post in a recognised centre in the United Kingdom or North America. At that time there were a significant number of fellowship trained radiologists returning to Ireland from the UK and the US.

Now, for the first time, radiologists could be trained in Ireland. The Irish Radiology Training Programme was the first structured medical postgraduate medical training programme, in any discipline, in Ireland. The four-year course led to the qualifying degree of "Fellowship of the Faculty of Radiologists, Royal College of Surgeons in Ireland" (FFRRCSI). This remains the qualifying examination for the Faculty.

Faculty Structures

The board of the Faculty of Radiologists is elected by all the Fellows of the Faculty. Each board member serves for a term of five years, one of whom is elected Dean of the Faculty for a term of two years. There are a number of board subcommittees including education, science, research, radiation protection, radiation oncology, continuous medical education, academic, and a general purposes committee. The education subcommittee is primarily involved in organising the Irish radiology training programme, the core function of the Faculty. The science subcommittee organises scientific meetings, seminars, training courses and continuous professional development (CPD) meetings.

The academic subcommittee includes the academic professors from all the university institutions. This subcommittee allows a beneficial liaison with the medical schools to promote the development of radiology as an undergraduate subject and to work with the universities in the area of postgraduate radiology education.

The faculty has also developed subspecialty interest groups within its structures including breast, nuclear medicine, interventional radiology and paediatrics. On a five yearly cycle the faculty inspects and accredits participating departments of radiology.

Irish Radiology Training Programme

Recent European Community rules for specialist accreditation now require five years of approved postgraduate education. In the past it was customary for trainees, on completion of three to four years on the Irish radiology training programme, to complete their further years abroad; mainly in the UK, USA, Canada, other European countries or Australia.

In 1996 the Faculty formally established a fifth year of training, involving rotations through subspecialty diagnostic and/or interventional radiology services. The curriculum of the Irish radiology training programme continues to evolve paralleling changes in the wider medical education curricula and changing education methods. The current programme allows optional participation in a number of university-based postgraduate training courses. These courses, together with the evolving faculty programme, address such areas as communication, teaching methods, research methods, evidence based radiology, management skills and molecular imaging in a modular based format. The faculty recently also received agreement in principle from the Irish Health Service Executive to fund a fully digitised examination programme.

A SNAPSHOT OF **RADIOLOGY IN IRELAND**

Interview with Dr. Risteard O'Laoide

I work as a consultant radiologist for a national referral centre.

I am a consultant radiologist in St. Vincent's University Hospital in Dublin, Ireland, part of the St. Vincent's Healthcare Group (SVHG). SVHG is composed of a large university teaching hospital, a smaller teaching hospital and a private hospital. There are 850 beds in SVHG. The hospital is the national referral centre for a number of specialties including liver transplantation and cystic fibrosis. I have been Medical Director of SVHG since 2003, allowing me to see and appreciate the vital role of the radiology department within the medical institution as a whole. The radiology group at SVHG is composed of twelve consultant radiologists and thirteen registrars in radiology. The SVHG radiology group undertakes approximately 210,000 examinations per year including all modalities.

A capital development programme has transformed the SVHG in recent years.

St. Vincent's has undergone and continues to undergo a considerable capital development programme in the last number of years. This has included a new modern radiology department including the development of a hospital-wide PACS system, with RIS/PACS integration and integrated voice recognition reporting. There are three multi-slice CT scanners and two 1.5 test scanners on site. Plain film imaging is all DR-based. A comprehensive range of imaging is undertaken in the department including newer developments in cardiovascular imaging such as Cardiac CT/MRI and CTA /MRA. The department has a strong interventional unit, as the hospital is a national referral centre for liver disease including liver transplantation.

I will soon begin my period as Dean of the national radiology society.

The professional body for radiologists in Ireland is the Faculty of Radiologists, Royal College of Surgeons in Ireland. I am currently the Honorary Secretary of the Faculty and Dean-Elect. I will begin my period of office as Dean in November 2008; this will last for two years.

Finding an optimal solution to waiting lists in radiology is proving challenging.

As in other countries, the demand for radiology continues to increase inexorably due to a combination of new techniques and a growing and ageing population. At SVHG the single greatest limiting factor is the availability of radiographic staff, particularly in the context of an extended working day. This has led to waiting lists particularly in ultrasound and to a lesser extent in CT/MRI.

The government in Ireland has responded to the growing waiting lists using an initiative called the National Treatment Purchase Fund. Patients on radiology waiting lists for more than three months are referred to private clinics for imaging. This obviously creates difficulty in the context of multidisciplinary care and as such is a less than optimal solution. Consequently most radiology departments filter their waiting lists to ensure that oncology patients and patients requiring complex imaging are retained within a university hospital setting.

Numbers are insufficient to take advantage of the significant basic science funding available

Demand for radiologic services is outstripping supply.

The number of radiologists practicing in Ireland per head of population is less than many of our neighbouring jurisdictions. The vast majority of radiologists in Ireland work in the public health system. The number of radiologists in the public health system is controlled centrally and unfortunately, although there is an increasing number of radiologists in the country, this has not matched radiological need.

Migrant workers are being absorbed into the Irish healthcare system.

The Medical Council in Ireland is responsible for the accreditation of doctors to work within the healthcare system. Radiologists from the EU with a Certificate of Specialist Doctor (CSD) are automatically entitled to have their name placed on the specialist register for radiologists. The Medical Council seeks the advice of the Faculty of Radiologists for radiologists whose names cannot automatically be placed on the specialist register. While the faculty advises the Medical Council with respect to the experience and accreditation of the Radiologists, the ultimate decision is made by the Medical Council.

There are many radiographers from outside Ireland now working within the Irish healthcare system; these radiographers are accredited by the Irish Institute of Radiography. The faculty for many years ran a supernumery training programme for radiology registrars, which trained many radiologists particularly from the Middle East and Libya. This programme is no longer active. More recently however, the Irish radiology training programme has attracted candidates from other countries within the EU.

PACS is about to become a standard national tool in radiology departments.

There are a number of hospitals throughout Ireland who have installed hospital-wide PAC systems. More recently, however, a national RIS/PACS project has been initiated by the national authority for the provision of health services (Health Service Executive/HSE) with circumscribed funding. Its aim is to roll out RIS/PACS to all radiology departments in the country with a large central storage capacity. It is hoped that all the radiology institutions and hospitals will be linked.

Irish radiology needs a focus on quality standards in order to increase public confidence.

One of the main issues facing the Faculty of Radiologists in Ireland due to recent high profile radiology errors is to regain the confidence of the public in our diagnostic systems. The faculty is hoping to adopt a twin track approach. The faculty is engaging with the HSE to institute an integrated quality assurance programme in all radiology departments. In tandem with this, the faculty has to educate the public and the health service agencies to the limitations of even best practice radiology.

The focus on academic radiology is increasing.

Funding for radiology equipment in Ireland has generally been organised centrally. In the last number of years, thanks to the so-called 'Celtic Tiger' there has been a significant increase in funding for radiology equipment. Many departments have state-of-the-art equipment. As previously noted, however, there has been a shortfall in funding for radiologists.

Another benefit of increased economic prosperity in Ireland has been the significant funding which is available for research through government agencies such as the Health Research Board and Science Foundation Ireland. Unfortunately, most radiologists in Ireland have an overwhelming service commitment. Nonetheless, the radiology departments on the Irish radiology training programme have a strong commitment to ongoing clinical research with a significant pro rata output.

While the number of academic radiologists has increased somewhat in the last five to ten years, numbers are insufficient to take advantage of the significant basic science funding available. This is one of the challenges facing Irish radiology. There is a move in Ireland to develop academic health centres, combining the governance of a number of sister hospitals with a university medical faculty.

Interviewee
Dr. Risteard O'Laoide

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Faculty of Radiologists
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Recently, Dublin academic healthcare has been formed by integrating SVHG, our sister hospital the Mater Misericordiae University Hospital and the Faculty of Medicine in University College Dublin. Such models may provide a more appropriate environment for the evolution of academic radiology.

Advice to other Radiology Managers.

1) As radiology services are a significant central platform service in all healthcare institutions, radiologists should endeavour to be among the clinical leaders within healthcare organisations to advance best patient care.

2) Radiologists should institute integrated quality assurance programmes within their departments to validate and improve best patient care and to protect themselves as professionals from a perception of an inadequate, opaque and poorly-governed system.

3) The institution of a high-quality RIS/PAC system within a radiology department has huge benefits in optimising workflow and hence patient care. Our recent experience in St. Vincent's with the introduction of a hospital-wide PAC system has not been without pain but it has undoubtedly had a significant positive impact on patient care within our institution.

Carestream Health Transforms Irish Hospitals

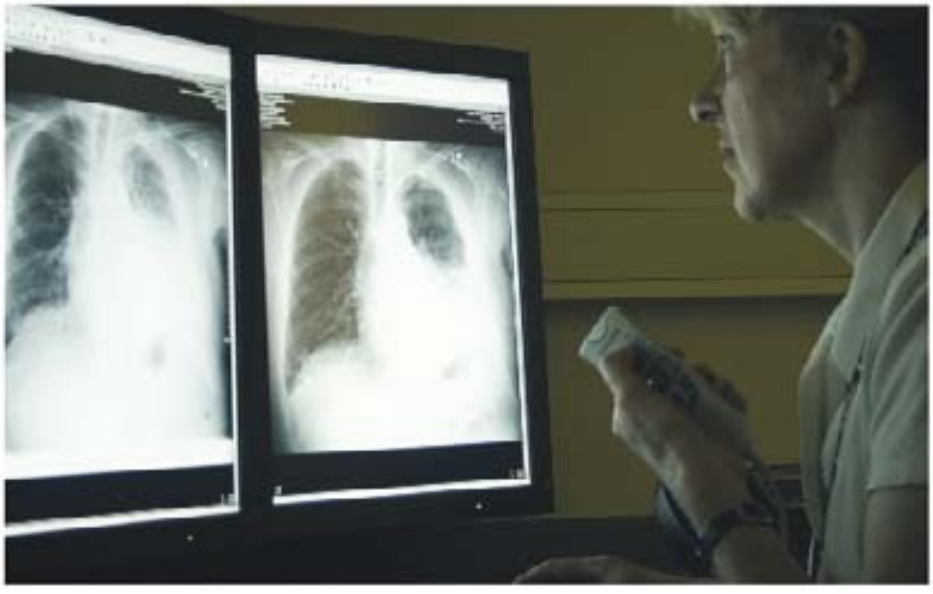
with Integrated RIS/PACS and Voice Recognition Software

Carestream Health's new integrated RIS/PACS with voice recognition software and regional archive has now been successfully rolled out at the Irish Health Service Executive's Midland Area Regional Hospital at Tullamore and Mullingar Hospital, two acute service hospitals. RIS Web electronic ordering capability will shortly be added to the already deployed RIS Web system to enable ward staff to remotely facilitate order entry.

Here, we speak to Pauric Greenan, Project Coordinator for the Health Service Executive (HSE) Midland Area about the impressive workflow benefits that have become part of a new and systematic IT solution.

The Midland Health Board is committed to developing world class services to optimise patient care over the three acute hospital sites in the region. As part of this, funding was granted a number of years ago for a major capital development project, of which this plays a significant part.

Says Greenan, "I have been involved as PACS Project Co-ordinator for the capital project, building the new hospital in Tullamore (Midlands Regional Hospital at Tullamore), which subsequently became a Regional Project. We have just completed the second hospital in the region, the Midlands Regional Hospital at Mullingar and are waiting for funding to proceed to the Midlands Regional Hospital at Portlaoise." Carestream Health were the obvious choice for this project simply because: "We liked the system and it was competitively priced. It also came out top of our selection procedure."



Pauric Greenan

This new hospital development was vital to addressing shortfalls in its facilities and to provide services in accordance with the requirements of a modern acute hospital service. By increasing workflow, amongst other hospital-wide measures, this serves to reduce patient flows to other regions and in particular helps to alleviate further service pressures in the Eastern Region.

Benefits

The single, enterprise-wide IT solution facilitates better hospital management, and in particular the benefits are seen in the radiology department. Greenan's experience backs this up: "It's of great benefit to our regional clinics particularly orthopaedics. The patient can be X-rayed at one site with their images available in the other immediately. This removes the need for copies to be constantly sent between sites which is laborious and expensive."

The solution is providing all operational requirements from voice recognition, diagnostic reporting and e-ordering to RIS deployment and image viewing over Citrix. The benefits to the hospitals are immense, particularly in reducing report turnaround time. This subsequently has the knock on effect of reducing patient bed occupancy periods as they sometimes are unable to be discharged until the result of an X-ray is known. Users are particularly satisfied with the system's flexibility and ease of use.

Voice Recognition Software Compensates for Staff Shortages

Voice recognition software has revolutionised workflow in radiology departments, often compensating for staff shortages and saving considerable amounts of time. Within the Midlands project, "VR has been a revelation, continues Greenan. "It was easy to implement, it adapted to individual voices very quickly. In one site it has brought our reporting time down from a week to about 20 minutes (during 9-5 hours) to 3 hours posted out. The new digital services were quickly adapted to by existing staff, when they saw the real benefits of the technology for themselves."

Remote services will soon be a part of this new IT package—Greenan anticipates great workflow benefits. "Remote monitoring will be great as Carestream Health will be able to see a problem before we do, hence get it fixed a lot quicker, even before we have realised it has happened."

Structure

The KODAK CARESTREAM RIS/PACS will manage local image capture from a variety of modalities and support the diagnostic reporting process. A single KODAK CARESTREAM RIS will integrate with the PACS to facilitate enterprise-wide referrals, scheduling, worklist generation and diagnostic reporting. KODAK CARESTREAM Information Management Solutions, powered by KODAK Versatile Intelligent Patient Archive (VIParchive) software, will manage the central regional repository for long-term image storage and retrieval.

The solution met specific clinical and business requirements set by the HSE Midland Area. Integration of the RIS with multiple Patient Administration Systems (PAS) required a number of unique customised developments to ensure correct query routing and for the RIS to prefix PAS IDs on import to avoid different patients being assigned the same number from different systems.

"We liked the system and it was competitively priced. It also came out top of our selection procedure"

Carestream HEALTH

For more information visit:

it.carestreamhealth.com

MANAGING IMAGING EDUCATION IN IRELAND

Maintaining High Academic Standards

I am presently consultant radiologist and chairman of the department of radiology at the Mater University Hospital, Dublin, Ireland. This is a large teaching hospital, and along with St. Vincent's Hospital, Dublin, and University College Dublin, is a constituent of the Dublin Academic Healthcare Centre.

I am immediate past Dean of the Faculty of Radiologists, Royal College of Surgeons in Ireland. This is the national body, which oversees teaching and training for consultant radiologists in this country. My prior roles in the national governing body, the Faculty of Radiologists in Ireland, include past examiner, honorary treasurer and past Dean.

I play a role at European level, as Chairman of the education committee of the European Society of Radiology (ESR) and am a member of the executive of that society, and I am one of two faculty representatives for the UEMS medical radiology section

I am also a member of the Irish Medical Council, which is the body that regulates and oversees the profession generally.

Background

Training and standards are issues that have always been of great interest to me. Our professional body, the Faculty, is fundamentally a training body and it advises the overall Medical Council in Ireland, an entirely separate statutory entity on registration and continual medical education for radiologists.

Acting as a statutory regulatory body, the Medical Council and not the faculty itself provides an overall structure, overseeing standards of registration, undergraduate education, specialist education and regulation, continuing medical education and disciplinary matters.

Structure of Radiological Training and Education in Ireland

Radiology education in Ireland is structured in a highly competitive way. After six years of general medical training, an intern year and a further clinical year are mandatory before even commencing training as a radiologist.

In fact, the majority of residents start their radiological education with already three years of clinical exposure under their belt. They must also have published at least three to four articles before radiological training begins.

Training is ideally carried out in an active department in an academic teaching environment

Radiological training itself consists of five years, in which the fifth year leads to qualification as a specialist. They then travel to work in either the US or Europe for further fellowship training for two to three years before they return. Most radiologists qualify while in their early thirties as a consultant radiologist.

This stringent structure allows residents to attain significant clinical experience, and it adheres completely to the European

structure of "3 + 2", though it includes even more clinical and other training than officially recommended.

In fact, in a recent ESR survey of publications submitted to ECR, on a pro rata basis, for number of consultants, Ireland is amongst the top three. On completion of their five-year training period, most radiologists will travel either to North America or Europe for further subspecialty training and consultants to teaching institutions are generally not appointed in less than eight years from commencing training.

There are approximately 230 practicing radiologists in Ireland. There is a separate private healthcare system and most consultant radiologists are also active in the private sector.

The Examination System

There are two parts to the Irish examination system for radiologists, conducted by the fellowship of the Faculty. Part one, an oral and written exam, occurs after the first year and means that residents are examined in anatomy, radiographic technology and physics.

Part two occurs three-and-a-half to four years after specialist radiological training begins, and consists of one oral and one written exam that covers all subspecialties in radiology in a general format. Exams are internationally and externally assessed. We generally anticipate an overall 75% pass rate at first attempt in part two of this examination process.

Only four attempts are allowed at part two of this examination. As a result, we have a considerable experience with developing examination methods in Ireland, and in fact could be a model for the development of a Europe-wide diploma in radiology.

Positive Impact of Ties With Europe

The development of closer links between radiology in Ireland and in Europe has been beneficial to the development of the profession. Ireland has a population of only four million. As the ESR is a 'one man, one vote' society, it is not easy for professionals from smaller countries such as ours, to become elected to office within the organisation.

Thus, we see our presence within the society as extremely important. Previously the practice of medicine in Ireland, including radiology, tended to follow either the UK or US structures. Now we are becoming more harmonised with Europe, due to these positive links.

eLearning

Due to the small size of this country, educational methods such as eLearning are not highly developed. In the UK, by comparison, eLearning academies are highly developed as one way to address their national shortage of trained radiologists.

In Ireland, by contrast, our methods remain more hands-on and an apprenticeship is served. eLearning is very much a component of CME processes. Demonstration of adequate CME standards will shortly be a legal requirement for maintenance of entry on the specialist medical register.

Challenges For Young Irish Radiologists Today

The main challenges facing a young radiologist today are that he or she must maintain clinical autonomy within complex and ever-expanding management structures, as well as continuing to remain up-to-date on one of the fastest developing branches of medicine today. Subspecialisation is an inevitable fact that will alter the face of the radiology profession.

Radiologists are going to have to have an indepth understanding of a given subspecialty, and become authorities in that area to prevent their ending up as mere technicians rather than 'clinical specialists'.

The clinical nature of radiology must be emphasised. Furthermore, we need to develop better relationships with primary care physicians by opening a direct dialogue between the related professional teaching bodies.

The ESR is currently promoting discussion in these areas, and it is hoped that white papers on these issues will become available in the very near future. Irish radiology looks forward to playing a positive role in maturing these concepts.

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Industry News

Agfa HealthCare Awarded New Contract

Agfa HealthCare has been awarded a new three-year contract with Premier Purchasing Partners, L.P., to provide film and medical imagers to the healthcare alliance's 2,000 member hospitals and 53,000 other alternate healthcare sites in the US.

Effective September 1, 2008, this agreement adds to existing relations between Agfa HealthCare and Premier, namely Enterprise Image Management Solutions (EIMS) and Computed Radiography (CR) solutions.

Sonosite Shows 25% Revenue Rise

SonoSite, a provider of portable ultrasound technology, showed a 25% rise in revenue and a 48% surge in income for its fiscal 2008 second quarter, which ended June 30. They also reported favourable results in an ongoing patent dispute over its technology with GE Healthcare.

The company stated that its worldwide revenue rose to 59.2 million dollars for the period, a 25% gain compared with the 47.4 million dollars it booked for the same quarter last year. For the first half of the fiscal year, the company has seen revenue of 111.7 million dollars, a robust 24% increase compared with the 90.2 million dollars in revenue SonoSite recognised for the first two quarters of fiscal 2007.

PACSGEAR Partners With Three Palm Software

PACSGEAR has partnered with Three Palm Software, developers of software products for mammography. PACSGEAR has added Three Palm's MammoViewer, an application designed for viewing mammography images, to MediaWriter, its line of DICOM CD/DVD burning solutions. MammoViewer can be included on CDs, DVDs and portable media to let patients and physicians view mammography images, as well as electronic markers that are generated by computer-aided diagnosis applications. The markers draw attention to regions of interest on mammograms.

Philips Electronics Relocates its North American HQ

Philips Electronics North America announced that Andover, Mass., will serve as the company's new North American headquarters, where Philips Healthcare currently is based. As a result of the move, Philips said that Massachusetts now houses its largest presence in North America, with nearly 5,000 employees, six major worksites and manufacturing facilities.

The company estimated that its presence will inject more than $266 million dollars in payroll into the Massachusetts economy annually, when taking into account the various Philips facilities, including executive and administrative offices, R&D, warehousing and manufacturing. During the last twelve months, Philips said it has grown from approximately 20,000 to more than 30,000 employees in the United States, with offices and operations at 50 major facilities in 22 states.

MarkeTech Launches ImagePRO Panel

The MarkeTech Group (TMTG) has launched ImagePRO, a longitudinal panel of more than 600 US hospital-based imaging directors and managers. The ImagePRO panel membership represents an estimated 25% of US hospital diagnostic imaging purchasing power and provides information that is calibrated to the market.

"ImagePRO will change the nature of voice-of-the-customer research studies in medical imaging," said Christian Renaudin, MD, TMTG founder and CEO. "In the last 10 years at TMTG, we have witnessed a dramatic shift in power between clinicians and administrators in medical imaging purchase decisions. We thought it was time to give a formal voice to radiology administrators."

Fujifilm releases FCR GO in the US

Fujifilm Medical Systems have launched the FCR Go portable digital x-ray system for commercial release. The FCR Go is a portable digital x-ray system that aims to provide remote users with all of the same functionality and image processing features available at the fixed technologist workstation.

The company said its portable system can be used in nearly every imaging environment. It also accommodates a wireless or hardwired connection to a facility's network, so the patient worklist is available from the RIS/HIS and images can be transmitted to PACS immediately following study completion for interpretation.

Hologic Complete Third Wave Technologies Tender

Hologic, Inc. have completed the tender offer by its direct wholly-owned subsidiary, Thunder Tech Corp., for all outstanding shares of Third Wave Technologies, Inc. at a price of 11.25 dollars per share in cash.

Hologic is in the process of completing the acquisition of Third Wave through a short form merger in which Third Wave will become a wholly owned subsidiary of Hologic. In the short form merger, all outstanding shares of Third Wave not purchased in the tender offer, and not held by a holder who demands appraisal rights for such shares, will be converted into the right to receive $11.25 per share in cash.

Following the merger, detailed instructions will be mailed to Third Wave stockholders who did not tender their shares in Third Wave in the offer outlining the steps to be taken to obtain the merger consideration.

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Medical Doctors (respond below)

1. What is your occupation? (check only one)
   - ❑ Diagnostic Radiologist
   - ❑ Other Physician (please specify)

1a. I am Chief of my Department
   - ❑ Yes
   - ❑ No

1b. What is your radiology sub-specialty? (check only one)
   - ❑ General Radiology
   - ❑ Neuroradiology
   - ❑ Nuclear Medicine
   - ❑ Vascular & Interventional
   - ❑ Nuclear Radiology
   - ❑ Cardiovascular Diseases
   - ❑ Paediatric Radiology
   - ❑ Other (please specify)

Non-physician professionals (respond below)

1c. What is your occupation? (check only one)

Administrator/Manager:
- ❑ Radiology Administrator
- ❑ Radiology Business Manager
- ❑ PACS Administrator

Executive
- ❑ Chief Information Officer / IT Manager
- ❑ Chairman / Managing Director / Executive Director
- ❑ Chief Financial Officer / other executive titles

Other
- ❑ Medical Physicist
- ❑ Academic
- ❑ Chief Technologist / Senior Radiographer
- ❑ Manufacturer
- ❑ Business Consultant
- ❑ Distributor / Dealer

All respondents reply to the questions below

2. In what type of facility do you work? (check only one)
   - ❑ Private clinic
   - ❑ Hospital (check number of beds)
   - ❑ More than 500 beds
   - ❑ 400-499 beds
   - ❑ 300-399 beds

3. With what technologies or disciplines do you work? (check all that apply)
   - ❑ Diagnostic X-ray
   - ❑ Nuclear Imaging
   - ❑ Interventional Radiology
   - ❑ CT
   - ❑ Ultrasound
   - ❑ MRI
   - ❑ Mammography
   - ❑ Bone Densitometry
   - ❑ PACS/Teleradiology
   - ❑ Cardiac Imaging
   - ❑ PET
   - ❑ Echography
   - ❑ Angio/Fluoroscopy

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AGENDA

Key Seminars & Conferences

October 2008

2 – 4 **ESMRMB 2008 Annual Scientific Meeting**
Valencia, Spain
www.esmrmb.org

9 – 11 **3rd ESGAR Liver Imaging Workshop**
Munich, Germany
www.esgar.org

10 – 11 **ESIR Non-Vascular Upper GI Interventions**
Novi Sad, Serbia & Montenegro
www.esir.org

16 – 18 **59th Annual Scientific Meeting of the Royal Australian & New Zealand College of Radiologists**
Adelaide, Australia
www.ranzcr.edu.au

24 – 28 **12th Asian Oceanian Congress of Radiology**
Seoul, Korea
www.aocr2008.org

29 – 1 **International Skeletal Society 35th Annual Refresher Course**
New Delhi, India
www.internationalskeletalsociety.com

29 – 31 **Management in Radiology Annual Scientific Meeting**
Athens, Greece
www.mironline.org

31 – 1 **ESIR Carotid & Renal Stenting Course**
Prague, Czech Republic
www.esir.org

November 2008

2 – 4 **ESMRMB 2008 Annual Scientific Meeting**
Valencia, Spain
www.esmrmb.org

6 – 8 **School of MRI Advanced MR Imaging in Paediatric Radiology**
Brussels, Belgium
www.school-of-mri.org

7 – 8 **ESIR Vascular Interventions, Basic Course**
Moscow, Russian Federation
www.cirse.org

9 – 11 **3rd ESGAR Liver Imaging Workshop**
Munich, Germany
www.esgar.o

13 – 15 **School of MRI Advanced MR Imaging of the Vascular System**
Valencia, Spain
www.school-of-mri.org

31 – 5 **RSNA 2008 Annual Scientific Congress**
Chicago, IL, US
www.rsna.org

December 2008

15 – 20 **27th Annual Head-to-Toe Imaging Conference**
New York, US
www.med.nyu.edu/courses/cme/headtotoe08

January 2009

5 – 9 **17th Annual Winter Diagnostic Imaging Update**
Beaver Creek, US
http://radiologycme.Stanford.edu/2009vail

5 – 9 **Essentials of Radiology Imaging**
Costa Rica, Costa Rica
www.med.nyu.edu/courses/cme/costarica09

7 – 11 **Indian Imaging Association Congress**
Patna, India
www.iria2009.com

8 – 10 **3rd Leuven Course on Head and Neck Imaging**
Leuven, Belgium
www.headandneckimaging.be

27 – 31 **NYU Radiology Imaging Congress**
Hawaii, US
www.med.nyu.edu/courses/cme/hualalai09

February 2009

2 – 4 **10th ESGAR CT Colonography Hands-on Workshop**
Harrogate, UK
www.esgar.org

16 – 20 **ERASMUS Course on Head and Neck MRI**
Vienna, Austria
www.emricourse.org

Coming in issue five:

> *Improving Teamwork: All You Need to Know*
> *The EU Respond to Teleradiology Challenge*
> *Managing NSF*
> *Radiology in the US*

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Molecular imaging.
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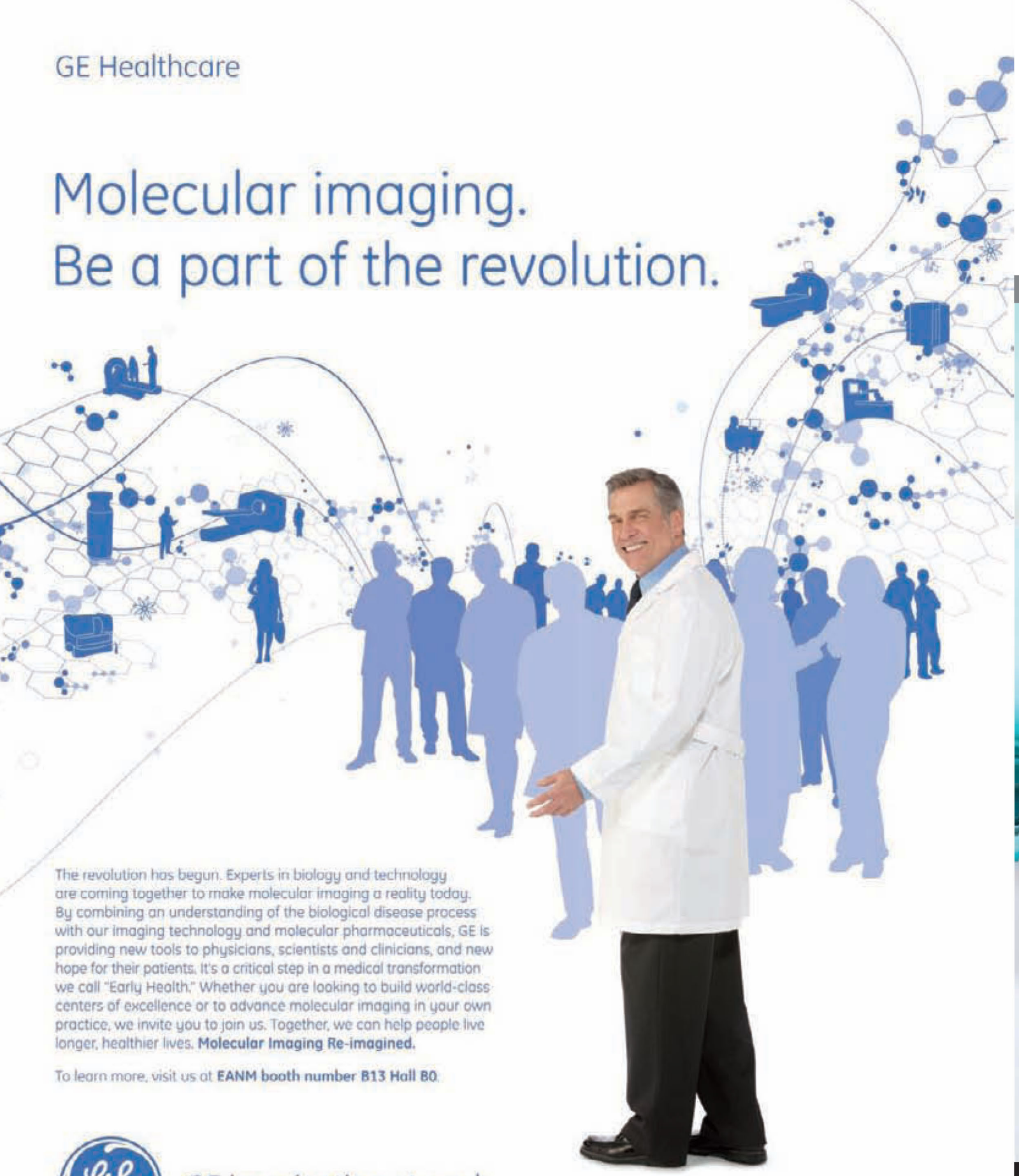

The revolution has begun. Experts in biology and technology are coming together to make molecular imaging a reality today. By combining an understanding of the biological disease process with our imaging technology and molecular pharmaceuticals, GE is providing new tools to physicians, scientists and clinicians, and new hope for their patients. It's a critical step in a medical transformation we call "Early Health." Whether you are looking to build world-class centers of excellence or to advance molecular imaging in your own practice, we invite you to join us. Together, we can help people live longer, healthier lives. **Molecular Imaging Re-imagined.**

To learn more, visit us at **EANM booth number B13 Hall B0**.

GE imagination at work