IMAGING Management

Promoting Management and Leadership in Medical Imaging

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Prof. Iain McCall
Editor-in-Chief
editorial@imagingmanagement.org

Dear readers,

Delivering a first-class imaging service to emergency departments is a major challenge for many radiology departments around the world. Traditionally most radiologists are not resident in the hospital and specialists have a large inpatient and outpatient workload during the day, which often precludes providing immediate service to emergency patients and anything other than an on-call after-hours service.

The European working time directive has also had a major impact on the availability of radiologists to provide a 24/7 dedicated service to emergency departments. In addition, the massive rise in the use of ultrasound, multi-slice CT and even MR as immediate diagnostic investigations for a multitude of injuries, abdominal pain and stroke have resulted in an explosion of complex studies requiring experienced radiologists to interpret. Traditionally in those hospitals where training of radiologists takes place, much of the provision of radiological support to emergency departments was provided by the trainees with varying degrees of back-up support by their specialist tutors.

While this model still persists it is increasingly untenable as the diagnostic skills required have increased and the time juniors have for this work is reduced. It is also unacceptable that juniors' training in the whole field of radiology should be jeopardised by the need to cover the emergency services.

The high use of CT and ultrasound in the emergency department has also had a major impact on the provision of equipment as it is no longer possible to fit urgent multi-trauma cases requiring virtually whole body CT studies into routine CT lists within most departments. Equally it is unacceptable to move patients around the hospital, who are receiving resuscitation for multi-organ injury.

The solution has been to place dedicated CT and in some cases MR machines within emergency departments, but these require constant servicing by radiologists. This isolates the equipment from the main department, which in itself poses further logistical problems, reduces staff flexibility and may increase the inefficient use of expensive assets.

All these issues have resulted in a re-evaluation of the way emergency services are provided. At a macro level there has been closure of smaller departments and the creation of regional major trauma units that can be serviced by all the key clinical services. This has enabled radiology to reorganise the way the imaging is provided with dedicated staff specialising in emergency work providing appropriate shift coverage, and the advent of PACS and teleradiology has enabled some of the continuous urgent reporting to be performed off-site.

Ultimately it would be better to have experienced radiologists in major emergency departments 24/7 who would work as and be recognised as a fundamental part of the emergency team. Such models are functioning around the world although the lack of sufficient radiology staff and training posts in many countries is acting as a barrier to further progress.

This issue of the journal gives insight into the way that major emergency radiology services can be provided in an efficient, clinically- and cost-effective manner, and I hope that it provides some ideas for those grappling with this previously intractable problem.

Prof. Iain McCall

HAVE YOUR SAY! **Letters to the Editor at editorial@imagingmanagement.org**


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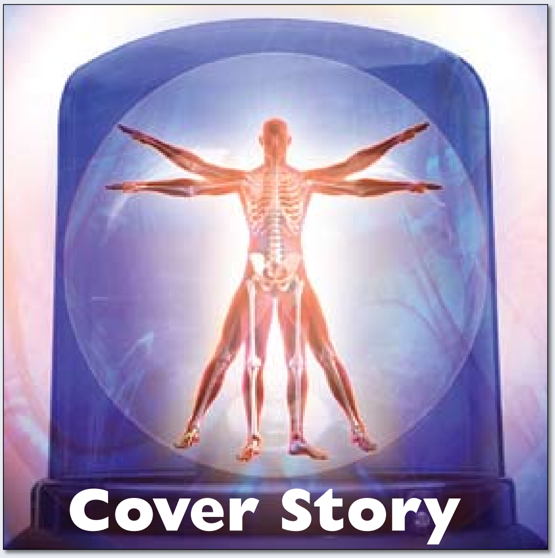

Association News

MIR Announces Call for Abstracts

Management in Radiology (MIR) has announced that the deadline for abstract submission for its forthcoming annual scientific congress, to be held in Athens, Greece from October 29 – 31, 2008, will be Friday, July 18, 2008.

Submissions should be no longer than 350 words and delivered by sending an email in Microsoft® Word format - including purpose/methods and materials/results/conclusions to Mrs. Amanda Jelley at the following email address: amanda.jelley@imperial.nhs.uk.

A preliminary list of programme topics for this annual imaging management congress will soon be available online.

The congress will be held in Athens, Greece, at the following location:
Hotel Astir Palace, Apollonos 40 Str.,
16671 Vouliagmeni, Athens/GR

Congress registration information is available on the MIR website at www.mir-online.org.

Registration Fees:
Early Registration - until October 1, 2008:
- ESR Member Early Fee: 325 euros
- ESR Non-Member Early Fee: 425 euros

Late Registration - from October 2, 2008:
- ESR Member Late Fee: 425 euros
- ESR Non-Member Late Fee: 550 euros

Topics Announced for 2008 Congress

The annual CARS, ISCAS, EuroPACS, CMI, and CAD four-day congress 2008, to take place in Barcelona, Spain from June 25 – 28, 2008, consists of invited talks by internationally recognised experts, over 200 paper presentations, as well as exhibits and posters. Special focus sessions as well as product exhibits in the industrial exhibition are planned, to give participants access to hot topics and new CARS-related products.

Congress Topics

22nd International Congress and Exhibition on Computer Assisted Radiology

- Medical Imaging, e.g. CT, MR, US, SPECT, PET, DR, Molecular Imaging, and Virtual Endoscopy
- Computer Assisted Cardiovascular Imaging
- Image Processing and Display
- Medical Workstations
- Interventional Radiology
- Minimally Invasive Spinal Therapy
- Image Guided Diagnosis and Therapy of the Prostate
- Ablation Therapies
- Image Guided Radiation Therapy
- Nanotechnology for Imaging and Therapy
- Telemedicine, e-Health and Multimedia EPR
- Expert Systems and Computer Assisted Education
- Economic and Management Issues
- Security, Legal and Ethical Aspects

Submissions Welcome

Abstracts or papers including new methods, devices and applications, clinical studies, position papers, and poster topics for presentation at the congress are welcomed. Submissions will be peer-reviewed by members of the international programme committee. Abstracts of accepted lecture and poster presentations will be published in the proceedings, a supplement of the International Journal of CARS, which will be distributed to all congress participants. Paper contributions will be included in regular issues of the international journal of CARS. Authors should send their submissions through the CARS website, see further information and guidelines at http://www.cars-int.org/Authors/cars_2008call_for_papers.htm.

ECRI Institute Provides Guidance to Broadlane CT Buy

ECRI Institute will serve as an unbiased expert, offering equipment purchasing clients the inside track on the latest medical equipment at Broadlane's upcoming Computed Tomography (CT) Live Group Buy.

"Roughly 41 percent of hospitals will be purchasing a CT this year," said Kerry Tucker, Vice-President, supply chain services, Broadlane. "By combining ECRI Institute's state-of-the-art technology and marketplace insight with Broadlane's rigorous Live Group Buy process, attendees should achieve double-digit savings and confidence they are making wise product choices based on the best information available."

ECRI Institute will provide event participants insight into:

- The state of the marketplace: What technologies are available now and where are they heading?
- Key clinical issues: What issues are most important when considering a purchase?
- Recent technological advances: How do these advances impact performance and value?

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Visit us at ECR EXPO A: Booth #103

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Association News

Dates Announced for CIRSE 2008, Copenhagen, Denmark

The CIRSE congresses have become Europe's most comprehensive interventional meetings focusing on raising the profile of cardiovascular and interventional radiology, and attracting public awareness and political attention.

Next year's edition is scheduled to take place from September 13 - 17, 2008, in Copenhagen, Denmark. CIRSE 2008 is a unique forum where medical professionals can meet their colleagues from all around the world, and exchange ideas and information in the field of minimally invasive, image guided therapies. The best recent scientific developments and novel research will be presented.

Vascular Interventions

Vascular interventions represent a major component of the work of many interventional radiologists. This year CIRSE will again devote an important part of its programme to vascular intervention, including a "Foundation Course, the essentials on technical and clinical management of peripheral vascular disease". The course will be followed by a self assessment test all attendees are invited to take.

The special sessions at CIRSE 2008 will range from aortic and visceral aneurysms to TIPS, stroke management, carotid artery stenting, diabetic foot, dialysis shunts and much more. Controversy sessions in which experts will debate topics such as below-the-knee stenting, IVC filters and thrombolysis for DVT will help attendees to form their own opinion on these constantly evolving fields.

Two interactive case discussions will focus on abdominal stent grafts and aortic dissection. They will allow interacting with world-renowned experts on technically and clinically challenging cases.

Imaging plays a pivotal role in our daily practice, in terms of guiding, patient eligibility, intervention and follow-up. Attendees will get updated in new imaging modalities, including cardiac imaging, 3D road mapping, flat panel CT, fusion imaging and whole body 3T MRA in various special sessions.

One special session will focus on key imaging features which should lead to the proposal of the corresponding intervention for the patient. Another new feature will be a "Peripheral MRA and CTA: tips for better imaging" workshop.

Next Connectathon Announcement

The next European IHE Connectathon is to take place in Oxford, UK from Monday 7 April to Friday 11 April 2008 and will be held at Saint Catherine's College.

IHE is an initiative by healthcare professionals and industry to improve the way computer systems in healthcare share information. IHE promotes the coordinated use of established standards such as DICOM and HL7 to address specific clinical needs in support of optimal patient care.

IHE provides a detailed implementation and testing process to promote the adoption of standards-based interoperability by vendors and users of healthcare information systems. The process culminates in the Connectathon, a weeklong interoperability-testing event. The Connectathon provides the most detailed validation of the participants' integration work. Participating companies prepare for the event using testing software—the MESA test tools—developed for this purpose.

During the Connectathon, systems exchange information with complementary systems from multiple vendors, performing all of the transactions required for the roles they have selected, called IHE Actors, in support of defined clinical use cases, called IHE Integration Profiles. Thousands of vendor-to-vendor connections have been tested overall, and tens of thousands of transactions passed among the systems tested.

EuroPACS Annual Congress: Topics Announced

EuroPACS is Europe's most intensive PACS congress, covering all the important subjects that are useful not just for healthcare IT personnel, but for all those concerned with efficient workflow management and the latest IT developments involving radiology. Sessions will be chaired by expert topic leaders including Dr Jarmo Reponen, Prof. Davide Caramella and Prof. Berthold Wein.

This year's annual edition to take place in Barcelona, Spain from June 25 – 28, 2008, will include between 400 – 600 delegates from different countries. The conference programme will offer information on the latest and most significant developments in clinical practice, research and education within digital radiology, including:

- PACS Planning and Purchasing Strategies
- PACS Evaluation and Economical Aspects
- PACS Beyond Radiology
- Image Distribution, Storage and Archiving Strategies
- Workflow and Data Flow in Radiology
- Regional PACS and Teleradiology
- Cross-Border Experiences
- Security and Privacy, Quality Assurance, Legal Aspects

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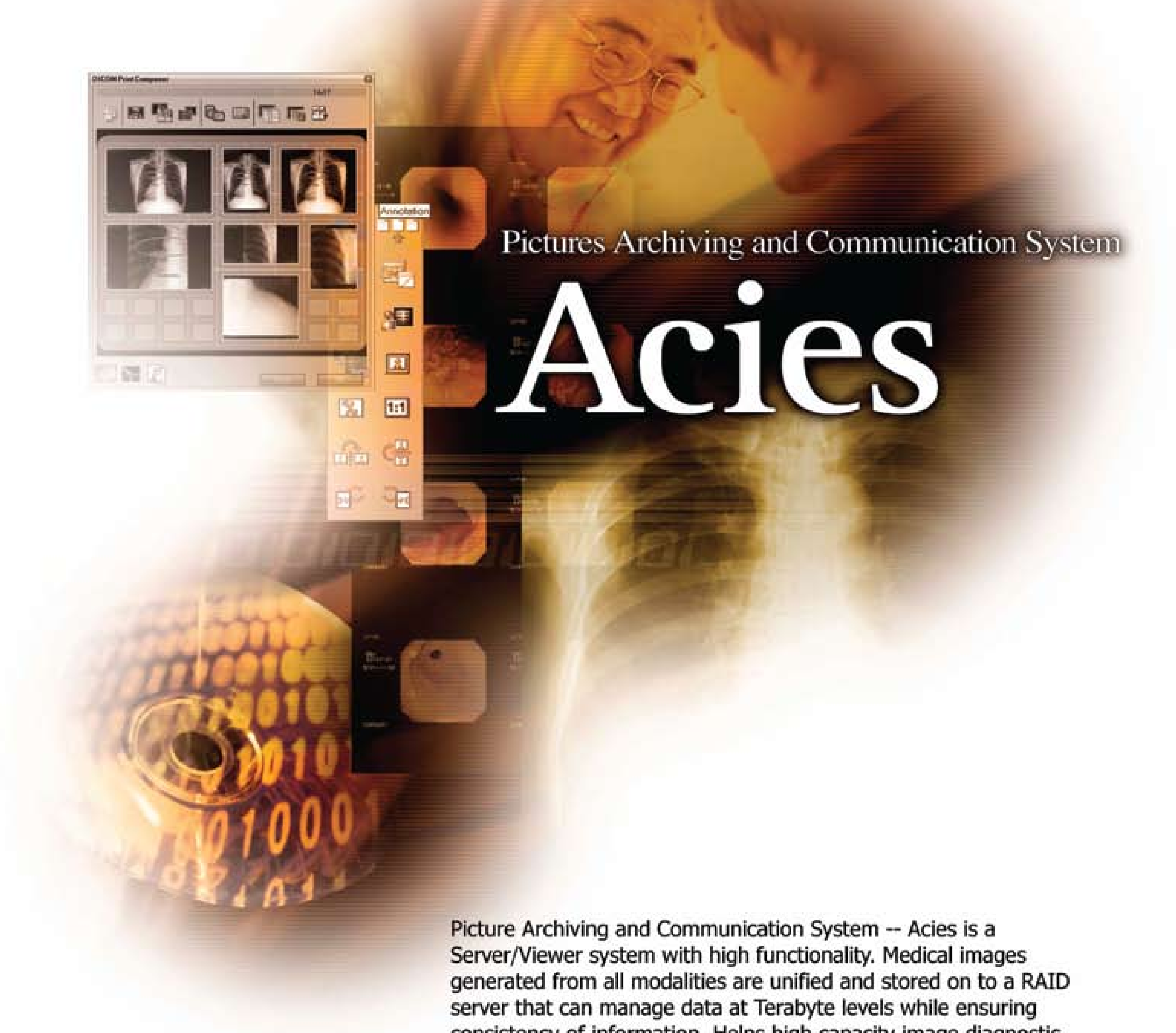

Picture Archiving and Communication System -- Acies is a Server/Viewer system with high functionality. Medical images generated from all modalities are unified and stored on to a RAID server that can manage data at Terabyte levels while ensuring consistency of information. Helps high capacity image diagnostic 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.

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The essentials of imaging

CORDIS LAUNCHES FP7 HEALTH RESEARCH WEB SERVICE

CORDIS, the European Community Research and Development Service, has launched a new health research web service for the Seventh Framework Programme (FP7) to provide information on health research, a part of the FP7 Cooperation programme.

On this website, an 'About Health' page gives comprehensive details of the three pillars of health research focus. Emphasis on biotechnology and ensuring that research is specifically geared towards the improvement of human health are the first two themes. Maximising the delivery of the outcomes of research to relevant recipients, including healthcare professionals, practitioners and patients is the third.

The 'Get Support' link provides a list of National Contact Points (NCPs) for obtaining further information. Users will also find support for research applicants, proposal negotiation, project management and small and medium-sized enterprises (SMEs). A page on the site will be dedicated to 'International Cooperation', which explains the strategies involved in the realisation of this theme throughout FP7.

FP7 has increased funding, which constitutes 15% of the overall budget of the Health programme. Intellectual property has been given more protection.

For other information, the 'Library' page lists all relevant documents on Health Research under FP7 and the 'Useful Links' page outlines all areas relating to Health within FP7. These include current health research in FP7 as well as details of 'Life sciences, genomics and biotechnology for health', the FP7 theme's forerunner from FP6.

http://cordis.europa.eu/fp7/health/home_en.html

EUROPEAN PARLIAMENT APPROVES POSTPONEMENT OF CONTROVERSIAL MRI DIRECTIVE

The European Parliament has recently approved the request by the European Commission to postpone the Directive on the use of MRI for a period of four years in order to have sufficient time to review the EU Physical Agents Directive 2004/40/EC (EMF).

The European Parliament approved the postponement with a clear majority. The Directive will be delayed by four years until April 30, 2012, to allow time for a substantive amendment to be adopted. Prior to this, the European Commission will be undertaking a comprehensive impact assessment of the Directive and a broad stakeholder consultation.

The Alliance for MRI, an initiative launched with the aim of addressing the impact of the directive on the use of MRI in healthcare in Europe, while welcoming this recent development, remains concerned that a number of member states have proceeded with transposition of the Directive. It has called on the European Commission to address this situation.

The current published Directive prevents healthcare staff from assisting or caring for patients during MR imaging. As a result, some patients who cannot be imaged without this care – if they are young, elderly, frail or confused – would either be denied imaging or have to undergo alternative procedures such as x-rays.

Derogation Necessary to Ensure Future of MRI

The Alliance for MRI has stated that a derogation for MRI from the scope of the EU Physical Agents Directive 2004/40/EC (EMF) is necessary to ensure the future unimpeded use of MRI, particularly for research and MR-guided interventions. The safety of MRI workers is already regulated by the EU Medical Devices Directive (amend. Direct 93/42/EEC) and the established MR safety standard IEC/EN 60601-2-33 (as amended to include users and workers). The IEC standard establishes limit values for time-varying electromagnetic fields which have been set so that any danger to patients and workers is excluded.

http://allianceformri.org

Dervla Gleeson

Managing Editor, IMAGING Management
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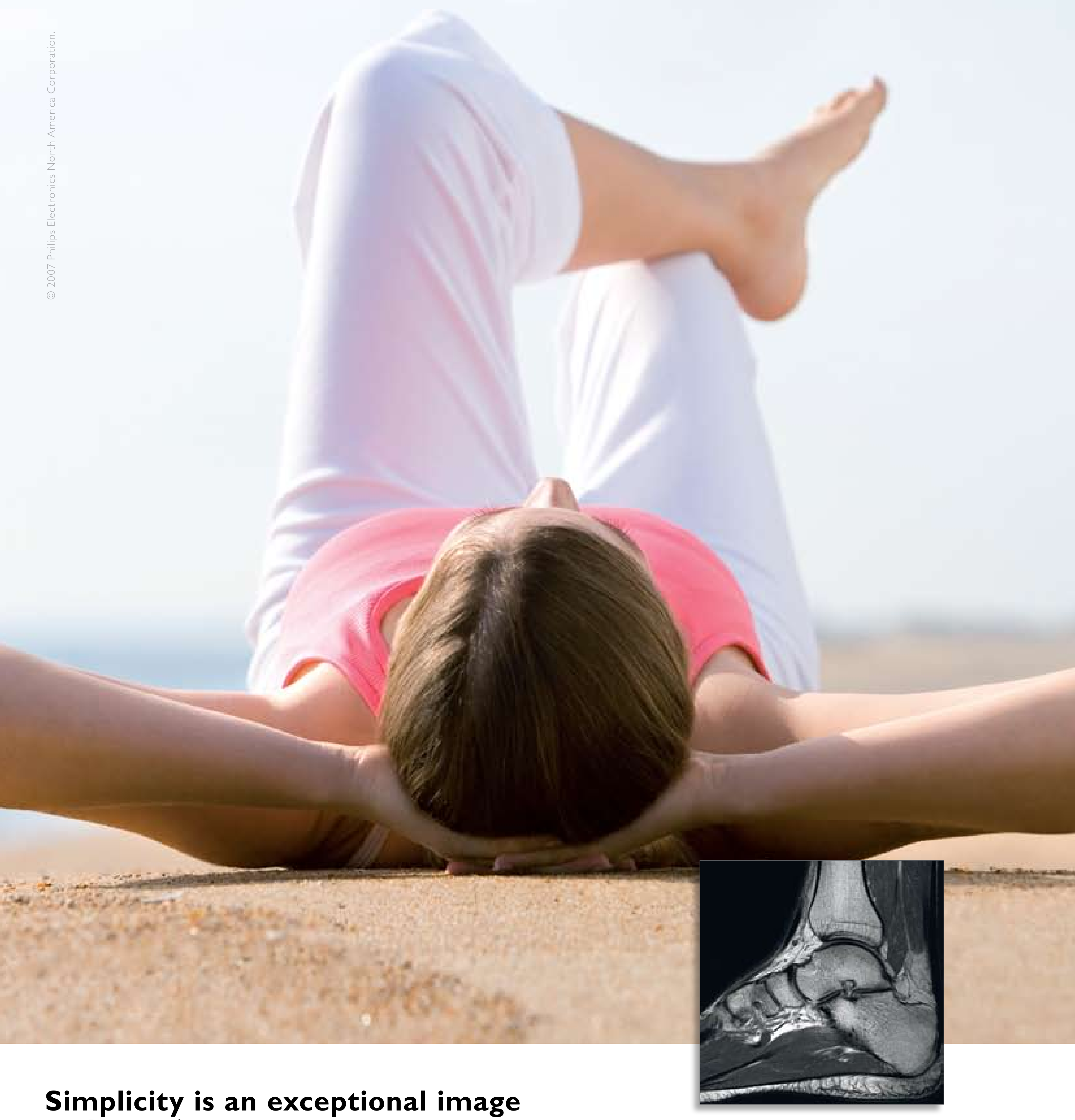

Industry News

Philips Closes Visicu Acquisition

Philips Holding has completed a 427 million dollar acquisition of Baltimore-based Visicu, a healthcare IT and clinical solutions company focused on critical care. The terms of the deal include payment to option holders, pursuant to the previously announced merger agreement by and among Visicu, Philips and Ice Merger Sub. With the close of the acquisition, shares of Visicu common stock are no longer listed on the Nasdaq exchange.

Philips said it intends to capitalise on its extensive sales channel network to accelerate Visicu's adoption by ICUs at hospitals in the United States, while internationalising Visicu's activities and migrating its technologies into other departments within hospitals.

Judge ups Boston Scientific Infringement Payment

US District Judge T. John Ward has added 69.4 million dollars in interest to the 431.9 million dollars a jury ordered Boston Scientific to pay after a jury found that Boston Scientific's Taxus Express and Taxus Liberte drug-eluting stent products infringe Saffran's patent and that the patent is valid. Attorney for the plaintiff, Bruce Saffran, MD, of New Jersey, said this type of interest is "not routinely granted" and is at the discretion of the presiding judge. The interest dates back to when Boston Scientific first infringed on the patent in question.

Boston Scientific said it will seek to overturn the verdict in post-trial motions before the district court. If unsuccessful, the company said it will appeal to the US court of Appeals for the Federal Circuit.

Saffran, a radiologist who obtained a patent for a drug-delivery device in 1997, is not asking to stop sales of the product, but does have a similar case pending against Johnson & Johnson's (J&J) subsidiary Cordis, according to his lawyer Eric Albritton.

The suit against J&J involves its Cypher stent on Raptor over-the-wire delivery system and Cypher stent on Raptorrail rapid exchange delivery system.

McKesson to Incorporate Proventys Risk Prediction Capabilities

McKesson will incorporate Proventys' risk prediction capabilities into the McKesson core clinical decision support solutions, as part of a newly formed strategic relationship. Proventys translates predictive data from traditional and emerging diagnostic tests into clinical decision support solutions. This clinical decision support tool aims to provide information to physicians in the process of making patient care decisions.

Toshiba Partners with MedicSight

Medicsight has entered a preliminary agreement with Toshiba Medical System's System Integration division for the resale of its MedicRead Colon and ColonCAD software solutions throughout Japan. Under the terms of the agreement, Toshiba will work with Medicsight to obtain MHLW approval in Japan, according to both companies.

"This agreement is timely as the recently announced positive outcomes of two major clinical trials are widely expected to accelerate the adoption of CTC (also known as virtual colonoscopy) as routine primary screening for colorectal cancer," said David Sumner, CEO, Medicsight.

Fuji Purchases Pharma Company

Japanese photography giant Fujifilm Holdings has reached an agreement to acquire pharmaceutical firm Toyama Chemical. Fuji, the parent of Fujifilm Medical Systems, plans to acquire a majority stake in Toyama to enable Toyama to develop its existing pharmaceutical pipeline, and will allow Fuji to enter the pharmaceuticals market.

Toyama is working on drugs such as an anti-influenza virus compound and an agent for the treatment of Alzheimer's disease. Under terms of the agreement, Toyama will become a subsidiary of Fuji.

Fuji said the deal is an example of the company's new focus on healthcare as it implements "large-scale structural reforms" to its traditional photography business. The company plans to expand from its base in diagnostic imaging and is increasing its investment in R&D and mergers and acquisitions.

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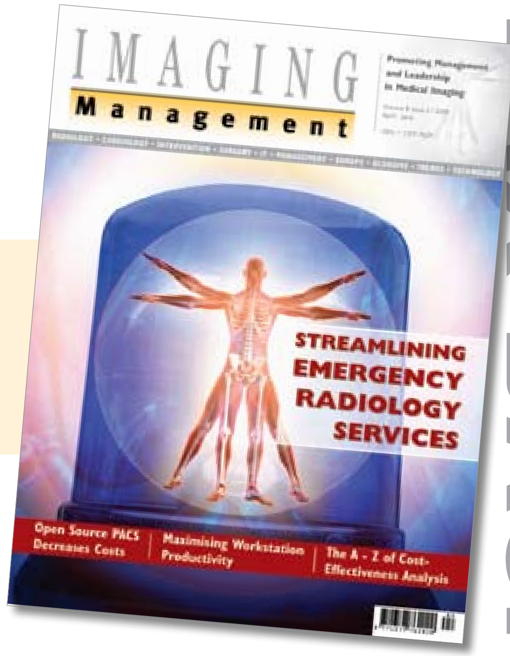

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In order to qualify please fill in the questions below:

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

THE CHANGING BOARD EXAM SCHEDULE IN THE US

General Radiologists to be Re-homed in the ER Department?

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Change, though a constant in radiology, does not always announce its arrival. Though the introduction of a new modality, for example, is readily manifest, in contradistinction, some profound changes are the result of gradual alterations of attitude or slowly developing realignments of opportunities or subliminal redirection of perspectives held by regulators, policy planners, or competitors. Such subtle developments are generally perceptible by those attuned to look for such trends, though most radiologists may be caught unawares.

Just such a metamorphosis will soon occur in the US. Today, advances in imaging are leaving those who profess only general capabilities in radiology in the uncomfortable position of not being that essential after all. Anatomy and gross pathology can now be observed readily in 3D arrays, revealed in multiplanar reformations rendering composite images which are relatively easy to interpret. Our once-exclusive proprietorship of the intellectual manipulation of the 2D to 3D transformation has been challenged.

Such a sea-change threatens to engulf the claims of expertise formerly and until recently held by general radiologists. Because of the vast and accumulating expanse of newly available information engendered by technical advances, they can now no longer lay claim to the possession of recondite knowledge and know-how. Other specialists who care for patients directly can now have at their disposal, detailed static depictions of disease as well as video clips and exciting functional data. Hence, by dint of accessibility to this new diagnostic armamentarium, more and more reliance will be placed on those radiologists who are specialised in the referrer's discipline.

The neurosurgeon will still benefit from the insights of the neuroradiologist and the thoracic surgeon will continue to seek advice from the chest radiologist. But the general radiologist increasingly will have less and less to offer to their traditional referrers. After all, our clinical colleagues' residency education and practice are suffused now with sophisticated image instruction. Many have gained technical facility with image-guided procedures. From now on the radiologist must be a specialist to other specialists or face obsolescence.

Of course, this job category will not disappear overnight. In small and outlying facilities, the general radiologist will stay vital but in a gradually reducing role, servicing primary physicians and other caregivers who have had relatively little training in imaging interpretation. Yet in hospitals of at least medium size, larger radiology groups must become more differentiated along subspecialty lines if they want to keep their "turf".

US Radiology Education Faces Overhaul

Radiology education must adapt to this actuality. US radiologists can no longer be reassured that their four years of residency education, which is now the longest interval between internship and fellowship of any non-surgical specialty, should continue to exist as is. Recent calls to change the timing, content and context of the written and oral boards are motivated by a desire to redirect residency education to emphasise subspecialty options.

And these calls have been heard! Despite objections from those reluctant to change, the American Board of Radiology has taken the step of fundamentally reorienting residency training. The traditional oral board exam with the candidate and reviewer in close communication will be replaced by computer-directed tests. Moreover, the exam schedule will be altered. The present written exam taken in the fourth year will be replaced by an image-rich, comprehensive, qualifying test occurring sometime after 30 months of residency and the aforementioned oral exam will be supplanted by a certifying exam focusing predominantly on areas the candidate wishes to pursue in practice. This latter exam will take place two to three months after the completion of the fellowship year.

The effect of the institution of those changes will stimulate subspecialty training which will likely commence after the initial exam, allowing for much of the last period of residency to focus on the intensive development of expertise in one or two realms of subspecialty knowledge in preparation for the continuance of focused training in a fellowship to follow in the fifth year of radiology training.

General Radiologist to be Re-homed in the ER Department?

But what about the person who does not want to specialise? What would the fifth year entail and what are the opportunities for practice? Regrettably but inevitably, the tasks assigned to the generalist of today will likely diminish as radiology groups become larger and more specialty organised. But the effective "generalist" of tomorrow will have a role to play if his focus is on the urgent and emergently ill and injured.

Just as technology has driven radiology towards subspecialisation as an imperative, so too will clinical demand drive radiologists towards round-the-clock and often on-site coverage. Where is the predominant locus of after-hours practice? The emergency suite of course. Teleradiology may suffice for ER coverage in small hospitals. However, for larger, busier institutions the in-house radiologist will be a necessity if diagnostic imaging is to remain within our specialty and not be apportioned to ER physicians and trauma surgeons. Such an individual will have to demonstrate advanced knowledge of general modalities adapted to all emergently ill and trauma patients, because by definition, emergency radiology cannot be confined to one technology or one organ system or one body region or one patient age group but to one spectrum of conditions defined by urgency of presentation.

Emergency Radiologists the "Odd Man Out"?

Over the years, emergency radiologists in the US have been in many ways the odd man out. They do not have a separate component of the oral board exam through which knowledge and skill are tested even though there is a curriculum entailing emergency radiology's distinctive corpus of knowledge.

Currently, only a few emergency radiology fellowships exist. In various departmental schema, emergency radiology has been an afterthought, despite the fact that in some hospitals up to 50% or even more imaging studies take place in the emergency suite. With the expected transformation of radiology education towards encouragement of specialty training, it is time now for emergency radiology to claim that it too can provide a meaningful experience for those who wish not to be bound by a focus on a modality or part of the body and yet claim special expertise. Guidance and instruction must be provided to enable newly minted radiologists to be regarded as the successors to general radiologist, specialists dedicated to serving the emergently ill and injured and the highly trained physicians and surgeons who care for them.

Conclusion

To me, the path ahead is clear. Emergency radiology is a distinct discipline as evidenced by the creation of a focused curriculum, and a willingness of its practitioners to be available at any time. Emergency radiologists are conversant with new imaging techniques and are comfortable with maintaining a continuing dialogue with emergency physicians and trauma surgeons. If emergency radiologists and general radiologists fail to recognise these inevitable changes they may face obsolescence, and fall victim to the vagaries of technology which, fundamentally, does not owe the practitioners of radiology anything. ❇

RESTRUCTURING EMERGENCY RADIOLOGY SERVICES

Increasing Efficiency and Decreasing Staff Turnover

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Ullevål University Hospital (UUH) is one of the largest hospitals in Scandinavia with about 9,000 employees. The hospital functions on four different levels. As well as acting as the local hospital for the largest part of the Oslo region, it is one of five regional hospitals in Norway, a National Centre of Competence in some fields and the trauma centre for the whole part of southern Norway and the south-west part of Sweden.

The trauma function, which serves approximately half the population of Norway, has been recognised as the most important part in our internal Strategic Plan for the period 2007 – 2010. From January - August 2007, a total of 13,000 patients were admitted to the emergency unit, of which 700 caused chaos for the multidisciplinary trauma team.

When the hospital was reorganised recently, the primary concern was to focus on patient flow in order to optimise both treatment and the use of medical resources.

Radiological Services at the UUH

Our radiological service is organised in four radiological departments as well as the department of nuclear medicine. The radiological departments are the departments of neuro-, cardiac and peripheral vessel intervention, and paediatric radiology, relatively small units with between 15 - 40 employees. The central radiological department numbers approximately 180 people. This department also contains a radiological unit for emergency out-patients in downtown Oslo in addition to a breast diagnostic centre and a unit of diagnostic medical physics serving most other hospitals in the region. In 2007, the radiological departments performed around 371,000 diagnostic and interventional procedures between them.

The central radiological department is responsible for the primary radiological diagnosis on a round-the-clock basis, and of the 25,000 emergency examinations carried out in 2007, 22,000 were done by this department. Each radiological department has a consultant radiologist on call at home 24-hours a day equipped with a PC linked to the hospital RIS/PACS system to decrease diagnostic time and reduce the need for the radiologists on-call to go to the hospital.

Identifying the Problems

Logistics and domestic considerations

The department is geographically situated between the surgical and medical wards. This is very convenient for the in-house patients, but less effective concerning the trauma patients entering the hospital. As part of a strategy to separate the patient flow of the emergency patients and those with a planned admission, it was decided to build an intermediate ward of 50 beds for all emergency patients close to the admission area. The maximum stay in this ward is 48 hours. During this time it has to be decided whether to transfer the patient to another in-house department, to another hospital, to a nursing home or back home.

To meet the needs of the emergency department and of course the needs for accurate diagnosis immediately after admission of critically-ill patients, radiology has established a satellite unit in the admission area. This entity is equipped with MSCT, angiography, DR and ultrasound suites. Other examples of decentralisation is an MSCT scanner in the oncology department and a mobile DR unit for bedside use serving the nursing homes in the Oslo region with online transfer of the examinations to UUH for immediate diagnosis.

Working environment

Working in a radiological department with a high number of emergency examinations of critically-ill patients, combined with in-house and outpatients expecting to be examined at fixed hours are very demanding for the personnel. In the past, major concerns included a high turnover of radiologists, radiographers and other employees and a sick leave percentage of approximately 16. In addition, the building that housed the department was built

quite a number of years ago, in an era when a lot of the radiological exams had to be performed in dim lighting. Thus there was hardly any daylight in the premises; a factor we now know has great importance for fatigue.

What are the Improvements?

The most important change was the separation of emergency and planned examinations with separate core teams for each group. In addition, a focus on making our personnel confident of the huge amount of know-how accumulated in this new organisation has helped, the theory being that acknowledging and increasing this adds to self esteem and better job-satisfaction. Consequently, the organisation was expanded to further develop trade and increase research.

Great emphases are put on the collaboration of all different occupations in the department. Radiologists, radiographers and physicists work together in optimising examinations. This multi-occupational work forms the base for arranging national courses targeting all these professions. Also, the department has lecturing contracts with both the University of Oslo and Oslo College of Radiography, enabling increased participation in international congresses and stays in hospitals abroad to exchange experiences. In addition, more scientific papers are produced and accepted in international publications and investments in ergonomical workstations surrounded with green plants and light-intensive PACS screens allowing for illumination with daylight tubing have helped.

Employees a Core Focus

Management have also focused on encouraging employees as well as giving them the time and means to undertake new challenges both in their daily work and to venture into research and teaching. Praise is essential, as is taking part in their career planning, listening to their suggestions for organising the work schedule and showing consideration for their wellbeing both on and off work. Examples of this are the distribution of free fruit and making a physiotherapist at the disposal of employees two days a week.

In this period, the percentage of sick leave has dropped from 16 to five. With a total of 180 employees, this means 18 more people present each day. This has a great effect on the working environment as well as allowing time for essential activities like research and studying. Staff turnover has decreased dramatically, and the department is now able to serve the hospital with high-quality radiology.

Radiographic Services Now Provided in the New Admission Area

Workflow model for emergency examinations.
All requests for radiology are either received online or scanned into the RIS. One of the key factors for effective imaging services is a three grade alerting system in our RIS. These grades are marked with different icons, and for the most acute grade the icon stays with the examination throughout all stages ensuring first priority until the final report is signed.

State-of-the-art equipment
All emergency patients receive immediate radiology service in the admission area. The emergency radiology unit consists of four rooms staffed with radiologists and radiographers. There is a general radiography room with state-of-the-art computer, radiography equipment, an ultrasound room and a modern angiography suite for diagnostic and interventional purpose will be installed shortly. Finally there is a suite with a 64-row CT scanner which can be accessed from the trauma suite through a sliding door. In addition the trauma suite contains a mobile ultrasound unit and a suspended x-ray tube for conventional radiography with free positioning, enabling it to serve three trauma patients in different locations in the room. An additional mobile radiography unit can be used all through the emergency area.

24h/day radiologist and radiographer service
During the day the emergency radiology section consists of two staff radiologists and one resident in training, two radiographers and one secretary. All cases are immediately interpreted by one of the in-house residents and read out by staff personnel. In case of special CT and MRI image interpretation, sub-specialists from other radiological departments are alerted online via a red-dot system in the RIS, and they are able to make all necessary post-processing and other diagnostic work on their own workstation without having to rush to the emergency unit.

After 4pm, two residents and a general staff radiologist from the central radiological unit are on duty until 11pm, whereas for the rest of the night two radiology residents remain in the hospital. But there are radiologists on call in general, cardiovascular, neuro- and paediatric radiology both for diagnostic and interventional purposes round-the-clock. ❇

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STREAMLINING EMERGENCY RADIOLOGY SERVICES

Collaborative Approach Gets Results

According to the Centre for Disease Control, over 115 million patients per year visit emergency departments in the United States. At our institution, approximately 48% of the admissions originate in the emergency department. However, emergency departments are not just where the critically ill present for acute intervention. The number of patients seeking primary and even preventative care in the emergency department has ballooned as the number of under- or uninsured people has increased.

Emergency medicine relies heavily on medical imaging for triage, treatment and disposition. The percentage of emergency department patients that are imaged approaches 50%. Many of these patients are imaged multiple times. At our institution, we average 1.15 examinations per emergency department visit. By conservative measures over 57 million emergency radiology studies are performed each year; more liberal estimates place the number of emergency radiology examinations at 105 million.

At our institution the number of emergency medicine visits has increased by approximately 5% per year over the past few years. However, emergency radiology imaging services are growing by 7 - 8% per annum. This disparity is not only a reflection of the demand for urgent care but is also a function of emergency radiology's essential role in helping physicians to properly triage patients.

Across the country, busy emergency departments treat patients 24 hours a day/7days a week/365 days a year. The importance of an integrated, fully functioning, streamlined emergency radiology service is imperative and should address a number of key areas.

Quality Management and Workflow Efficiency

Preparedness is a major component of effectively responding to any emergency. It is difficult to predict when and to what extent tragedy will tax the resources of the radiology department. However, creating an elastic system that can expand and contract with the volume of cases, allows emergency radiology to better serve patients. A dedicated emergency radiology manager is helpful in this regard.

The radiology manager can coordinate the various technologists and clerical staff to optimise their efficiency. He or she can also interface with referring physicians to resolve many of the non-medical issues. The manager is also available to help the radiologist trouble-shoot any number of problems, be they administrative, technical or image-related. This division of labour allows the radiologist to concentrate on interpreting images and providing consultations rather than being distracted by administrative, scheduling and clerical issues.

Facilitating communication between the various members of the emergency radiology team can be a challenge under normal circumstances. When the pace is quickened and resources are stretched, open channels of communication are essential to prevent patients from falling between the cracks. In our department, we have designed and implemented a real-time, web-based electronic protocolling and tracking system that allows all members of the radiology team (staff, residents, technologists, clerks and administrators) to monitor and manage workflow within emergency radiology. Such tools orchestrate the movement of patients in and out of emergency radiology quickly and safely.

Automated and streamlined workflow fosters more efficient and improved quality of care. Streamlined internal workflow and improved patient throughput leads to quicker disposition, and higher referring physician satisfaction and ultimately lead to better patient outcomes. Healthcare savings are also realised when effective triage of emergent diagnostic studies can be tailored to the patient in consultation with the ordering physician based on demographics, clinical history, relevant data and physical examination.

Reducing Medical Errors

Medical errors cost the healthcare system billions of dollars every year. Although radiology accounts for a fraction of this number, and while emergency radiology is an even smaller fraction of this number, there is always room for improvement. Obviously, we can reduce our errors by effectively communicating the correct diagnosis the first time. There are, however, other aspects of the quality control rubric that are less well thought of, that should be considered, especially in light of the recent attention to imaging overutilisation and radiation exposure. How do we insure the proper examination is ordered in the appropriate setting?

The utility of the various imaging modalities is well-documented in both the acute and non-acute setting. Based on this experience, we have designed internal authorisation and protocolling procedures for higher order examinations, such as CT and MRI, which have decreased the number of unnecessary, inappropriate and incorrect examinations.

Prior to the patient's departure from emergency radiology, examinations are checked to ensure no additional images or sequences are needed. In highly critical cases that are often encountered in level 1 trauma settings, staff or residents are available to give near real-time preliminary readings at the scanner. Effective triage of imaging modalities, timely provision of appropriate examinations and expedited interpretations are paramount to positive outcomes. Designing imaging algorithms and protocols specifically tailored to answer the clinical questions posed in the ED saves time, saves money and saves lives.

Staff Management

As with any specialty, having a dedicated group of highly trained radiologists with emergency radiology as their primary focus confers an advantage. Exposure, experience and expertise in this medium not only aid in the appreciation of subtle or atypical findings that can significantly impact patient outcome in a positive manner, but also allows for improved efficiency. Emergency radiology is more than simply interpreting images. It also entails image planning, resource triaging and clinical consultation in a fast-paced setting where the resources are limited and the stakes are high.

The approach to emergency radiology requires collaboration with emergency medicine, medicine, surgical and critical care colleagues. Imaging plays a major role in the triaging and the disposition of patients in the emergency department. Radiology staff should be proactive team members rather than passive consultants. Active participation among radiologists facilitates more efficient patient care.

Several staffing models exist, however, emergency radiology needs to support the emergency department and, in many settings, the remainder of the hospital during off-peak hours. Staffing 24/7 allows for contemporaneous interpretations that have an impact on patient care. This reduces the potential for patient recall for further evaluation and delayed diagnosis.

Conclusion

Problems inherent to emergency medicine populations are well documented. One of the largest challenges is to determine which patients need higher order level of care - hospitalisation or intensive clinical intervention versus those that can be managed conservatively or even followed up in an out patient setting. Medical imaging plays a significant role in the decision. The role of emergency radiology is not only to acquire images and to render interpretations, but the goal is to do so in an efficient and safe manner that aids the referring physician and protects the patient. ❇

Principle Components of Conducting and Reporting a Cost-Effectiveness Analysis

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The fundamental principle of economic analysis is that choices have to be made between alternative uses of resources, as there is a finite pool of resources with which to provide all medical care possible to each individual. This principle is not debated. By providing estimates of outcomes and costs, these analyses illustrate the tradeoffs involved in choosing among a variety of clinical interventions to provide the best healthcare. Never before has it been more apparent than in our current healthcare environment that these tradeoffs are inevitable.

The application of economics to clinical practice in healthcare does not necessarily mean that less money should be spent, but rather that the use of resources might be more efficient. Broadly speaking, the tools of clinical economics can be applied to the analysis of medical practice to improve decisions on how to allocate resources for clinical interventions.

Here, we will define each type of economic evaluation, highlight the basic similarities and differences, and then focus on the principle components of conducting and reporting a cost-effectiveness analysis, one of the most commonly used economic evaluations used in clinical medicine.

Cost-Identification or Cost-Minimisation Analysis

Cost-identification analysis is used to describe and quantify the cost of a particular type of medical care or the economic burden of a disease. This type of analysis, also referred to as "cost-minimisation analysis," asks the question, "What is the cost?". An implied assumption is that the health outcomes of different preventive, diagnostic or therapeutic strategies are considered equivalent. E.g., an analysis that assumes the effectiveness of abdominal hysterectomy and laparoscopic-assisted vaginal hysterectomy are equivalent, and that women's preferences for each are equivalent, might simply report the costs associated with each. Although these types of analyses may identify the least costly way of obtaining an appropriate outcome, they cannot specifically predict what the relationship of cost to health outcome will be.

Cost-Effectiveness Analysis (CEA)

Cost-effectiveness analysis incorporates information about both costs and health outcomes to describe the value of a particular healthcare programme. CEA evaluates an intervention through the use of a cost-effectiveness ratio. In the ratio, all health outcomes (compared with a clearly stated alternative intervention) are included in the denominator, and all costs or changes in resource use (compared to a clearly stated alternative intervention) are included in the numerator.

This type of analysis can be used to compare more intensive forms of an intervention with less intensive forms (e.g., screening every year vs. every three years for cervical cancer); a new technology with the standard of care (e.g., laparoscopy vs. laparotomy); prevention of a problem versus treating it (e.g., behavioural school interventions to reduce rates of sexually transmitted diseases in teens vs. a school-based clinic to provide early treatment of these infections). These types of analyses define the "opportunity cost" of each choice, and provide important data to decision-makers in diverse settings for making informed decisions about interventions.

The particular type of cost-effectiveness analysis that uses Quality-Adjusted Life Years (QALYs) as the measure of outcome is sometimes referred to as a cost-utility analysis (CUA), although may alternatively be referred to as one type of cost-effectiveness analysis. Cost-utility analysis is a methodological approach to assessing the value of a given health technology programme, or intervention. As such, it can be considered a process innovation designed to inform decisions about utilisation and coverage of medical interventions.

Cost-Benefit Analysis

Cost-benefit analysis differs from CEA in that it values both health outcomes and costs of medical interventions in dollars. Because clinical benefit is measured in terms of currency, a net benefit or net cost can be calculated by subtracting the cost from the benefit. The criteria that cost-benefit analysis relies on is whether the benefits of a preventive, diagnostic or therapeutic programme outweigh the costs, the premise being that if clinical programmes that fulfil those criteria are adopted, decisions will be made that will result in an "optimal" solution within the economic welfare framework.

The most common methods of assigning dollar value to health outcomes are willingness to pay and human capital. Willingness to pay, a monetary measurement obtained by estimating an individuals willingness to pay for life-saving or health-improving interventions, can be assessed by a survey that relies on an approach called "contingent valuation", or it can be indirectly inferred from decisions that have actually been made that involve tradeoffs between health and money. Human capital values health in terms of the productive value of individuals in the economy.

Despite these difficult measurement issues (i.e., the assignment of a dollar value to outcomes like mortality, functional status and quality of life), cost benefit analyses do appear in the clinical literature. Because it requires valuing all outcomes in monetary terms, it allows for comparison to other sectors of society where benefits are not clinical health outcomes (i.e., environment, education, and defence spending).

Cost-Effectiveness Ratio

Cost-effectiveness ratio is the measure used to express the results of a cost-effectiveness analysis andrepresents the incremental price of obtaining a unit health effect (i.e., dollars per year of life saved or per quality-adjusted life year saved) as a result of a given clinical intervention when compared to the next best alternative. In this ratio, two alternatives are being compared with the difference in their costs being divided by the difference in their effectiveness. Cost-effectiveness ratios should be reported as dollar per unit of effectiveness stating the year of the costs, for example, 25,000 dollars per life year saved (1998 dollars).

Cost-effectiveness analyses are always incremental with the ratios comparing each intervention to the next most effective alternative. This means that the costs and clinical benefits associated with the intervention of interest should be compared to existing practice and to all other reasonable options. When all possible alternatives are not included, there is a risk of coming to an incorrect conclusion that an intervention is cost-effective, but only because it was compared with a cost-ineffective alternative.

Cost-Effectiveness Analysis and Resource Allocation

A systematic consideration of cost-effectiveness in decisions concerning the implementation of healthcare technologies would contribute to the efficiency of the healthcare system. This goes further than the initial decision to finance a new healthcare technology based on a favourable cost-effectiveness ratio. A systematic approach should raise and solve questions of broader resource allocation. The opportunity costs involved with implementing a new technology should not be restricted to the 'old' substituted technology but to all resources available to the healthcare funder.

An imaging test with highest diagnostic accuracy is not necessarily the test of choice in clinical practice. The decision to order a diagnostic imaging test needs to be justified by its impact on downstream health outcomes. Decision analysis is a powerful tool for evaluating a diagnostic imaging test on the basis of long-term patient outcomes when only intermediate outcomes such as test sensitivity and specificity are known. The basic principles of decision analysis and "expected value" decision-making for diagnostic testing are introduced.

The appearance of more CEAs in the radiology literature in the future will create new insights into the reasons for the high cost of medical care and uncover ways to decrease unnecessary expenditures. Readers of this literature must become familiar with the basic vocabulary, rationale, and standard methods of CEA. By improving our knowledge and understanding of this state-of-the-art research tool, the radiology community will have a greater ability to participate in healthcare policy setting and decision-making locally and nationally.

OPEN SOURCE PACS

Does it Really Decrease Costs of Healthcare IT?

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During the last two years the radiology department at the University Hospital in Pisa, Italy, has introduced PACS technology, implementing an open source PACS. Pisa University Hospital is the second largest hospital in Tuscany after Florence University Hospital, with 1,519 beds and 77,725 admissions for inpatients in 2006. The IT team working at the Division of Diagnostic and Interventional Radiology has been involved in many projects in the field of IT applications in radiology, developing new IT solutions for radiology. Particular efforts have been devoted to the implementation of a prototype PACS system, based on an open source solution that also offers teleradiology and e-learning features.

In 2003 the hospital was provided with a commercial RIS (RA2000, Siemens, ASP model). At that time there was no plan for introducing a PACS system, so the IT group moved toward possible low-cost integrated solutions. The O3-DPACS solution, provided with a research agreement with the University of Trieste, has enabled two radiology departments in Pisa to have a digital archive for radiological images that allows radiologists to report exams, checking images on diagnostic monitors.

The purpose of adopting an open source PACS has been to improve radiological workflow, and to evaluate the benefits and drawbacks of open source software, with in-house radiology information system management. We present the proposed model and report the results obtained during a real-world validation.

Currently, hospitals and institutions all over the world are upgrading their systems to reach a completely film- and paperless environment. Radiological modalities have been converted into digital imaging producers following DICOM standards, and PACS is becoming an essential requirement across the hospital environment. Since images are not printed any more, every physician in the hospital must be able to access the PACS database and visualise patients' studies on monitors.

Due to its central role in a paperless environment, the PACS system is one of the most critical and cost-demanding informative system modules in the healthcare scenario. Therefore, providing a hospital with an IT infrastructure for medical images is a big issue: it needs time and resources, starting from the project design, to server and client installations, the introduction of the system into radiological workflow and the management of the running system. In our PACS adoption project, we started by analysing the radiological requirements to evolve toward a paperless environment and we evaluated different solutions available on the market.

We found the possibility to use an open source software very interesting. According to a new report by the California HealthCare Foundation, open source software will decrease the cost of health IT and help physicians share information.

What are the Advantages of Open Source?

The term open source does not actually mean 'free', but pertains to the possibility to modify the code permits personalisation made by the IT in-hospital group. Having access to the source code and to any change in it, would grant the adopter greater control of the system and more possibilities to survive failures in this support. Another advantage of open source software could be in interfacing PACS with other systems, for instance RIS, EPR or HIS: licencing the software to interface systems represents the biggest upfront costs.

Introducing O3-DPACS to Pisa

In 2005 Pisa University Hospital signed a research agreement with the Bioengineering and ICT group of the University of Trieste. They provided O3-DPACS open source software, as well as support to the in-hospital IT team for the implementation in the Pisa environment.

O3-DPACS was implemented to provide PACS functionalities to two radiology departments (S.Chiara and Cisanello) located in buildings about 4km from each other. Through this project, digital images and associated patient data can be transferred electronically among medical staff over a 100 Mbps connection network, through a dedicated fibreoptic channel, and become available throughout the departments.

The IT group started in 2005 by testing the O3-DPACS software in a laboratory, connecting just one modality, a CT, and one client workstation. In this way, with the remote support of the software developers, the IT group became familiar with the O3-DPACS configuration and features. After some weeks of laboratory testing, the analysis of the departmental image productivities guided our choice of the best low-cost hardware.

Installing PACS in the Real Setting

The solution was to realise the archive server with an ordinary PC, using an AMD Athlon XP 3000+, 2 GB RAM and a 2 TB NAS storage. The RAID hard disk configuration provided a security level against hardware failure. Security breaches are handled through encryption and firewalls.

The first production step involved the S.Chiara radiology department. All the DICOM modalities belonging to different vendors (CT, MR, CR and DX) were connected to the archive server and several clients (testing different DICOM software) were configured to query-retrieve images from the PACS server. Some integration issues were solved, sometimes with modality-provider support.

The second step followed the involvement of the Cisanello radiology department. To improve the DICOM server performance, another ordinary PC was used to store images from Cisanello modalities. In this way the workload was divided between the two PC processors, but the clients of both departments were configured to access images on both archives.

All the modalities are now configured to automatically send exams to the archive servers, so that they are immediately available for reporting. Radiologists from any client in both departments are able to access the images and share all relevant current and prior clinical information pertaining to any patients. This PACS-guided workflow, characterised by rapid retrieval and presentation of a

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THE DIGITAL AGE IN MEDICAL IMAGING

How Does it Improve Services?

Digital technology has revolutionised our lives. We are collecting, storing, analysing, and using more and more information at a faster and faster pace. X-ray imaging is no exception. Digital radiology, in which x-ray film is replaced with computer-generated images, is not an entirely new technique; recent technologies, such as computed tomography (CT), have always been digital. However, in recent years, advances have come about that allow all diagnostic studies to exist as electronic files, requiring no film at all.

Digital imaging provides rapid and improved flow of diagnostic information. Electronic images can potentially be viewed immediately after acquisition on a screen, rather than waiting for a film to be processed. In practice, images can be available for viewing less than a minute after they are taken. Rather than being limited to diagnostic information existing on a single piece of film, digital images can be viewed simultaneously at different locations. This enhances clinical care by permitting multiple care providers to view information that previously existed in only one location on a single film. In addition, consultation and discussion from multiple locations may occur, either from within the hospital or at satellite locations.

Accessing Quality Services

Digital technology allows for remote access to radiographic images. The advent of high-speed networks and the internet has expanded the range of remote viewing to be essentially any place with network and/or internet access. Remote access to images relieves radiologists of the requirement of being physically in the hospital at all times. The limitations of teleradiology are generally related to technology such as remote access, network speed and file size. These limitations are generally minimal with the use of newer technologies. Through the use of teleradiology, even small hospitals can have access to high-quality radiology interpretation on a consistent basis.

The ability to manipulate a digital image offers an enormous diagnostic advantage over film. Software on viewing workstations permits the radiologist to utilise zoom for a close-up of specific areas, digital subtraction for improving image definition, stacking of images for serial viewing, contrast enhancement and other benefits. Precise measurement of objects such as aortic aneurysms is possible. In addition, clinically important findings can be annotated for clinical and educational purposes.

Digital Software Allows Faster Processes

Digital radiology software allows for simplified comparison of studies; for instance, side-by-side viewing of radiographs taken days, weeks, or longer apart allows the radiologist to quickly note fine differences in appearance. The number of images that can be stored is limited only by the storage capacity of the archival system. Images stored digitally with proper backup mechanisms, are much less likely to be misplaced, misfiled, or potentially destroyed; they are easily available regardless of time of day or location to anyone who has proper access to them.

With the increasingly widespread use of computers in the display of radiologic images, it is not surprising that this technology is utilised in their interpretation as well. Computer Aided Diagnosis (CAD) of radiology studies has shown promise in pulmonary and breast nodule detection and in evaluating chest radiographs for abnormal asymmetry. A computer cannot replace the perception, intuition, and correlative abilities of a physician, but this technology does have the potential to further increase the diagnostic accuracy of radiograph interpretation, leading to better clinical decision-making.

Enhancing Education

Digital radiology offers several enhancements to institutions involved in education. The ability to manipulate images allows educators to highlight important findings easily; comparisons between normal and abnormal studies, and the illustration of progressive changes in pathology over time, aid in the development of diagnostic competency. Digital images can also be easily transferred into presentations for educational conferences.

The initial implementation of an extensive digital radiology system (including workstations, software, networks,

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Part I: Intelligent Resource and Productivity Monitoring

WORKFLOW MONITORING FOR PACS AND RIS

New Digital Management Tools Inform Radiology Managers

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During 2007, Leiden University Medical Centre (LUMC) implemented RIS/PACS. This technology, supported by advanced production and performance monitoring tools, has enabled access to structured and easily-queried data, facilitating cost savings and streamlining management processes in the department based on real-time facts and figures. In this two-part series, radiology manager Wouter Verduyn speaks about his experience with both intelligent IT solutions for productivity management and the types of ground-floor challenges they are designed to address.

My job is as manager of the radiology department at Leiden University Medical Centre in The Netherlands. I work in a management team of four radiologists as well as myself and the department Chair Prof. Hans Bloem. I am responsible for areas such as investments, personnel management and share responsibility with another management team member for patient care in the department.

Digital Solutions for Better Management

In our institution, we are experiencing the constraints of financial pressure. We aim to address this by both allocating costs better through instigating activity-based costing projects and by increasing revenue through increasing efficiency and new activities. To do this, we needed to implement the latest digital solutions.

We are one of the last hospitals in Holland to implement a PACS system– we purchased our data storage system in 2005 (Dell EMC), but did not implement the RIS/PACS system (Sectra) until 2007. The final impetus was to be able to view images in electronic format across the entire hospital, to store images in the LUMC wide electronic patient records and for the IT department to integrate storage in a holistic solution.

The previous RIS, which was part of the HIS the LUMC still uses, was comparatively inefficient and the technology was at least 30 years old. It stored data but extracting anything other than standard monthly reports was difficult. For any specific query, we had to commission an internal hospital ICT staff technician to write the query, which was time-consuming. The more complex the query, the longer it took to be returned. Therefore planning resource use, budgetary allocations, investments and hiring was neither a modern nor a streamlined process, as the necessary information was not readily available to make informed choices.

Clearly, we needed a more useful tool for accessing the database and decided to reinforce our PACS purchase with Sectra's Control Tower solution. Although prior to purchase we saw a demo and were given a 'tour' of the product, not until we put it into practice did we really see the benefits of the solution. In fact, though the system was only purchased last year, a new upgraded version was installed some weeks ago and we will hold a training workshop to really explore the full functionality of the product, which promises to extract even more complex information, such as patient waiting times.

Typical Radiology Manager's Day…

Let me give you an example of my typical tasks to illustrate the sorts of challenges we face. Last Tuesday morning began at 8am with a management team meeting. We received the approved 2008 imaging budget three weeks ago and are making a plan for its detailed allocation. This was followed up with a project meeting on order management to electronically integrate orders from referring physicians.

Afterwards, a meeting took place about understaffing in the mammography department. After a staff member left, extra duties were passed to a senior radiologist. Instead of hiring a new person, we will share the roles between current staff members over the coming one to two years. However, we would not so accurately deal with these challenges, without the necessary reports and precise data to inform our decisions.

The advantage of the Control Tower solution is having real-time data, e.g. we can see daily MRI levels, per-doctor activity reports, CT waiting queues and get fast feedback on processing levels. Compared to the old system, the department is now far more independent. This enables us to make intelligent decisions for the sorts of daily challenges we face – planning for 2008 will bring new opportunities to implement this data to better operate in an environment of stagnant budgets and increased demands.

Facts & Figures

LUMC comprises Leiden University Hospital and the Faculty of Medicine of Leiden University. The LUMC, which employs approximately 7000 people, is one of several academic medical centres in the Netherlands. The core tasks of the LUMC are:

- Patient care: routine care, high-level clinical care, and in particular, high-level reference care.
- Research: both fundamental and bedside, healthcare-oriented research.
- Education for the faculties of Medicine and Biomedical Sciences.
- Training for residents to become medical specialists
- Training for paramedics, such as nurses and technicians
- Additional training, both post-doctoral and post-vocational.

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SHARING MEDICAL DATA ACROSS ORGANISATIONS AND SYSTEMS

Driving Networked Expertise

The EU e-Health initiative and action plan is a driver for the sharing of patient information and networking of expertise across different institutions and countries. It was launched in 2004 and will be applied in its current form till 2010. Besides organisational eHealth, this initiative stimulates e-Health at national-level. At the same time the focus is being shifted from in-border health to more integrated healthcare provision across the EU.

Modern e-Health emphasises citizen empowerment and citizens' active participation in health and wellness management as well as coordinated resource sharing and problem solving in dynamic, multi-institutional virtual settings with equal participation by health professionals, patients and citizens. The keywords describing modern e-Health include patient/citizen-centric, seamless, shared, secure and trusted, preventive, independent of time and place, networked, cross-organisational, cross-border and interoperable.

It emphasises two aspects: sharing patient information and lining up a network of experts from different organisations or different countries. Changing the working environment so that patient information can be shared and the usage of networked expertise is easy and commonplace, will deliver significant benefits by improving availability of professionals; making specialist capacity available to improve efficiencies in delivery and to standardise working practices and enabling increased knowledge sharing across organisational borders.

Professionals need access to relevant patient data and knowledge in order to identify the issues (diagnose) and plan for a strategy (therapy, care plan, workflow), with expected outcomes (monitoring/follow-up of progress/quality of care).

IT Supports the e-Health Community

IT has a central role to play in the reorganisation of the healthcare service delivery environment by facilitating and enabling new trusted and secure ways of working, collaboration and knowledge sharing. The generic IT services are common and can support any clinical e-Service. Besides generic IT services, e-Service-specific tools supporting a particular clinical e-Service implementation are needed.

Conceptually modern e-Health comprises a number of layers. At the top there are clinical e-Services; professionals deliver these in virtual working environments - making use of various IT services – both generic and e-Service-specific. The IT services themselves are supported by the basic infrastructure services providing also the necessary interoperability for healthcare service providers. Security and trust services are present at every layer. At the bottom there are the local clinical and administrative information systems producing the patient data to be transferred, stored, shared and used on the upper layers.

The workflow of clinicians is patient-centric and also highly nomadic – rarely are they able to accomplish all necessary tasks by remaining at a single location for an extended period of time. However, clinicians have difficulty in moving outside their own environments because of the need to have access to those IT systems that support their work. Similarly, contacts with patients at the bedside can be challenging because disparate sources of patient data need to be assembled for effective communication.

There are emerging generic technologies to support the realisation of the e-Health community: generic patient data repositories and streaming. The generic nature of the future offerings opens the market that was traditionally dominated by application vendors to 'new comers' as well. Hitachi Data Systems is a good example offering both generic repositories to manage all data, but also streaming based viewers to retrieve and view the data.

Generic Patient Data Repositories

The traditional images-only archives are being replaced by new solutions which allow any type of fixed content data including images, laboratory results, video files, electronic patient data summaries, prescriptions, etc. to be stored in one storage system and in a patient-centric way. New generation enterprise archives are configured as network-attached systems and allow a set of standard interfaces and protocols – not just DICOM. The future repositories will form a GRID linked together via nationwide registries; the European Health Insurance Card (EHIC) will be used to access this GRID data in the coming years.

Hitachi Data Systems

HITACHI
Inspire the Next

Storage Solutions optimized for clinical applications

In today's Health Care environment it's all about the data and having data available at the point of care regardless of location. The next evolution in Health Care will see hospitals and national health systems investing in infrastructure so they can leverage the market for storage and applications which comply to open standards, simplify integration but avoid vendor lock-in.

Hitachi Data Systems can help create a solution that's right for your business.

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Hitachi Data Systems can help create a solution that's right for your business.

Sharing of patient data is changing dramatically: from 'point-to-point' to 'many-to-many'. The recent IHE XDS and XDS-I profiles for cross-enterprise document and image sharing are being applied in several e-Health projects in Europe and Canada. In this architecture, IT systems like PACS act as sources and consumers of information. The data are stored in a repository and published in the metadata registry: this is how we separate IT systems from data and data from metadata.

Data Retrieval

The metadata layer enables efficient searching and retrieval of patient data. The retention period for stored information varies country by country and it is different for images and other patient data. The new generation storage solutions allow intelligent information lifecycle management to automate and optimise storing of data taking different national legislations into account. The storage rules can be based on the DICOM metadata or even diagnosis or other data in the metadata layer.

The archives are changing from separate IT system attached silos to common shared architectures, but at the same time to e-Health platforms: the core is still archiving, but there are data privacy and security services, messaging services, patient's informed consent, coding services etc as well. The same platform can also be used for teaching and research.

Streaming Technology for Data Viewing

Streaming is a potential emerging technology to view patient data from the generic repositories. Streaming refers to sending portions of data from a source to a client for processing or viewing, rather than sending all the data first before processing or viewing. Streaming technology is used to overcome various limitations such as limited bandwidth connections, clients that are not powerful enough for the computation tasks required, and the handling of large data sets.

There are two types of streaming relevant in the healthcare field. Intelligent downloading is a form of streaming where only the data required for immediate viewing or processing are downloaded to a client. In general, processing of the data occurs locally on the client. Additional downloading may occur in the background. In adaptive streaming of functionality, data are not downloaded to clients, only frame-buffer views of the data or results of data analyses are streamed. The power of the server is used to render final screen images, which are then compressed and transmitted to client devices.

Advantages of Streaming Technology

There are several advantages with streaming technology. First of all, network bandwidth can be used more effectively than with traditional web-based solutions involving data downloading. Because data can be prevented from being downloaded to local clients, and only streamed for interactive viewing, an additional level of data security can be provided. Additionally, streaming requires only a single copy of data to be stored, which is accessed as needed, rather than maintaining multiple copies in order to meet distribution demands. Streaming also allows access to full processing functionality for all professionals; the clinicians can do 3D reconstructions and other advanced post-processing using their own laptops over low bandwidths. Even handheld mobile/wireless devices can provide clinicians with enterprise-wide access to all patient data and analysis tools on a pervasive basis. ❇

continued from p. 24

and digital archives), requires financial resources and institutional commitment. The major financial benefit of digital systems is due to reduction of film costs and staff. Film costs include processing, handling, storage space, and, of course, the film itself. Information technology and digital radiology system administrators need to be hired, but overall staffing needs are reduced because of the elimination of film library functions and the increased productivity of technologists and radiologists.

Another financial justification for digital radiology has been the recovery of charges that were previously unbillable due to misplaced or lost films. Revenue that is otherwise lost from films without a final interpretation can be a significant source of reimbursement. There is also a financial benefit due to improvements in risk management and the corresponding reduction in liability costs as well as operational advantages resulting in improved productivity and reduced turnaround times, but these issues are dependent on numerous specific organisational changes.

Conclusion

Standing where we are in digital imaging, it is not hard to see that the future is digital. However, there are still unanswered challenges to its implementation, with the need to establish quality electronic viewing, reduction of errors, and protection of patient information. Multiple operational questions need to be evaluated and answered. As we embrace the filmless radiology departments, it is important to uphold evidence-based medicine and at the same time to provide a personalised medicine tailored to the history of an individual patient. ❇

WE ASKED HENRIK TO DESCRIBE HIS DAY

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MAGNETIC RESONANCE IMAGING SYSTEMS

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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SUPPLIER	ECRI INSTITUTE'S RECOMMENDED SPECIFICATIONS[1]
MODEL	**High Field Strength Closed MRI Systems**
WHERE MARKETED	
FDA CLEARANCE	
CE MARK (MDD)	
CLINICAL APPLICATION	
MAGNET	
Configuration	Closed
Strength	1.5 T
Homogeneity, ppm V-RMS	0.45
Dimensions of maximum useful FOV and homogeneity, (x, y, z), cm	50
TABLE	
Detachable	
Dimensions, L x W, cm	
Horizontal speed, cm/s	
Elevating	
Retractable armrest	
Minimum height, cm	
Limited mobility	
Fully mobile	
ACOUSTIC NOISE	
Sound pressure level (SPL) at peak gradient amplitude and slew rate, dB(A)	
Reduction technology	
GRADIENT SYSTEM	
Standard name	
Standard strength, z-axis, mT/m	20, 40
Standard slew rate, z-axis, T/m/s	150
RF SYSTEM	
Power output, kW	
Amplifier type	
Standard number of channels	
Number of channel elements	
Optional channel configurations	
Receiver bandwidth, kHz	
Location of coil connector (plug)	
Standard length of coil cables, m	
Number of coil connectors (plugs)	
Coil tuning technique	
LAST UPDATED	
OTHER SPECIFICATIONS	

Footnotes to the Product Comparison Chart

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

2 The system is equiped with the Atlas coil concept that comprises of anterior and posterior coil segments that can be combined, facilitating organ specific and whole body imaging without the need of coil replacement. Through this concept the workflow has been improved dramatically

Publication of all submitted data is not possible: for further information please contact ECRI Institute or editorial@imagingmanagement.org.

	GE HEALTHCARE	GE HEALTHCARE	GE HEALTHCARE	GE HEALTHCARE	PHILIPS
	Signa HD 1.5T EchoSpeed	**Signa HD 1.5T HiSpeed**	**Signa HDx 1.5T EchoSpeed**	**Signa HDx 1.5T HDx Twin-Speed**	**Achieva 3.0T X-Series**
	Worldwide	Worldwide	Worldwide	Worldwide	Worldwide
	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes
	High performance, whole body	High performance, whole body	High performance, whole body	High performance, whole body	Whole body
	Cylindrical high performance	Cylindrical high performance	Cylindrical high performance	Cylindrical high performance	Short-bore cylindrical
	1.5 T	1.5 T	1.5 T	1.5 T	3 T
	LV-RMS: <0.05 ppm @ 10 cm, <0.25 ppm @ 20 cm, <0.50 ppm @ 30 cm, <1.00 ppm @ 40 cm, <1.25 ppm @ 45 cm, < 2.00 ppm @ 48 cm	LV-RMS: <0.05 ppm @ 10 cm, <0.25 ppm @ 20 cm, <0.50 ppm @ 30 cm, <1.00 ppm @ 40 cm, <1.25 ppm @ 45 cm, < 2.00 ppm @ 48 cm	LV-RMS: <0.05 ppm @ 10 cm, <0.25 ppm @ 20 cm, <0.50 ppm @ 30 cm, <1.00 ppm @ 40 cm, <1.25 ppm @ 45 cm, < 2.00 ppm @ 48 cm	LV-RMS: <0.05 ppm @ 10 cm, <0.25 ppm @ 20 cm, <0.50 ppm @ 30 cm, <1.00 ppm @ 40 cm, <1.25 ppm @ 45 cm, < 2.00 ppm @ 48 cm	0.5 ppm @ 40 cm, 0.12 ppm @ 30 cm, 0.3 ppm @ 20 cm, 0.004 ppm @ 10 cm
	48 x 48 x 48	48 x 48 x 48	48 x 48 x 48	48 x 48 x 48	50 x 50 x 45
	Standard, completely detachable	Standard, completely detachable	Standard, completely detachable	Standard, completely detachable	Trolley
	213.4 (L)	213.4 (L)	213.4 (L)	213.4 (L)	
	10.26	10.26	10.26	10.26	2, 8, 18
	Standard	Standard	Standard	Standard	Yes
	Standard, both sides	Standard, both sides	Standard, both sides	Standard, both sides	Not specified
	68.58 (27 in)	68.58 (27 in)	68.58 (27 in)	68.58 (27 in)	52
	159 (350)	159 (350)	159 (350)	159 (350)	250 (550) horizontal travel
	159 (350)	159 (350)	159 (350)	159 (350)	159 (350) vertical travel
	Not specified	Not specified	Not specified	Not specified	<25 with headset
	Vibroacoustic mat	Vibroacoustic mat	Vibroacoustic mat	Vibroacoustic mat, vacuum sealed gradient coil	SofTone
	EchoSpeed	HiSpeed	EchoSpeed	TwinSpeed	Quasar
	33	33	33	50	40
	120	77	120	150	120
	21 body, 4 head	21 body, 4 head	21 body, 4 head	21 body, 4 head	25
	Solid-state	Solid-state	Solid-state	Solid-state	Solid-state
	4, 8, or 16	4, 8, or 16	8, 16, or 32	8, 16, or 32	8
	Not specified	Not specified	29 (HNS array)	29 (HNS array)	Not Specified
	4, 8, or 16	4 or 8	8, 16, or 32	8, 16, or 32	16, 32
	100	100	100	100	300
	Gantry	Gantry	Gantry	Gantry	Gantry face
	Variable	Variable	Variable	Variable	1.2
	Dual connector port	Dual connector port	Dual connector port	Dual connector port	2
	Auto tuning	Auto tuning	Auto tuning	Auto tuning	Automatic
	Sep-07	Sep-07	Sep-07	Sep-07	Sep-07
	None specified.	None specified.	None specified.	None specified.	Also available in a mobile configuration; optional Ambient Experience; 480 V, 65 kVA, 80 A for the system; 480V, 9 kVA, 30 A for the cryocooler compressor; 480 V, 55 A for the Schreiber chiller.

SUPPLIER	ECRI INSTITUTE'S RECOMMENDED SPECIFICATIONS[1]	PHILIPS	PHILIPS	SIEMENS
MODEL	**High Field Strength Closed MRI Systems**	**INTERA 1.5T**	**Panorama HFO**	**MAGNETOM Espree**
WHERE MARKETED		Worldwide	Worldwide	Africa, Asia, Europe, North America, South America
FDA CLEARANCE		Yes	Yes	Yes
CE MARK (MDD)		Yes	Yes	Yes
CLINICAL APPLICATION		Whole body	Whole body	Whole body
MAGNET				
Configuration	Closed	Short-bore cylindrical	Open, two-post	Superconductive, short bore
Strength	1.5 T	1.5 T	1 T	1.5 T
Homogeneity, ppm V-RMS	0.45	1.4 ppm @ 53 cm, 1.18 ppm @ 50 cm, 0.5 ppm @ 40 cm, 0.07 ppm @ 30 cm, 0.03 ppm @ 20 cm, 0.01 ppm @ 10 cm	2.8 ppm @ 45 cm, 1 ppm @ 40 cm, 0.01 ppm @ 30 cm, 0.03 ppm @ 20 cm	≤5 ppm @ 40 x 40 x 40, 2.8 ppm @ 45 x 45 x 30 (typical 24-plot plane)
Dimensions of maximum useful FOV and homogeneity, (x, y, z), cm	50	53 x 53 x 48	45 x 45 x 45	45 x 45 x 30
TABLE				
Detachable		Trolley	Yes	Optional removable tabletop and trolley
Dimensions, L x W, cm		N/A	80 x 240	243 x 54
Horizontal speed, cm/s		2, 8, 18	2, 8, 18	20
Elevating		Yes	Yes	Standard
Retractable armrest		Not specified	Not specified	Not specified
Minimum height, cm		52	57	48
Limited mobility		250 (550) horizontal travel	250 (550)	250 (550)
Fully mobile		159 (350) vertical travel	250 (550)	250 (550)
ACOUSTIC NOISE				
Sound pressure level (SPL) at peak gradient amplitude and slew rate, dB(A)		<25 with headset	<25 with headset	115.6
Reduction technology		SofTone	SofTone	Gradients incorporate special design features (epoxy resin), torque compensation, stiff suspension, features; magnet encapsulated with optimized composite material; noise-optimized cold head
GRADIENT SYSTEM				
Standard name		Pulsar	Pulsar	Z engine
Standard strength, z-axis, mT/m	20, 40	33	26	33 true each axis value; 52 vector summation
Standard slew rate, z-axis, T/m/s	150	80	80	100 true each axis value; 173 vector summation
RF SYSTEM				
Power output, kW		18	10	22.4 peak; 500 kHz transmitter BW
Amplifier type		Solid-state	Solid-state	Not specified
Standard number of channels		6, 8	8	8
Number of channel elements		Not specified	Not specified	Not specified
Optional channel configurations		Not specified	Not specified	18
Receiver bandwidth, kHz		100	300	500-1,000 receiver BW
Location of coil connector (plug)		Gantry face	Table	Patient table
Standard length of coil cables, m		1.2	1.2	0.15-1.2
Number of coil connectors (plugs)		2	3	10
Coil tuning technique		Automatic	Automatic	Automatic
LAST UPDATED		Sep-07	Sep-07	Nov-07
OTHER SPECIFICATIONS		480 V, 65 kVA, 80 A for the system; 480V, 9 kVA, 30 A for the cryocooler compressor; 480 V, 55 A for the Schreiber chiller.	Optional Ambient Experience; 480 V, 65 kVA, 80 A for the system; 480V, 9 kVA, 30 A for the cryocooler compressor; 480 V, 55 A for the Schreiber chiller.	Head-out scanning for more than 60% of routine scanning.

SIEMENS **MAGNETOM Essenza**	SIEMENS **MAGNETOM Symphony Power**	SIEMENS **MAGNETOM Trio**	SIEMENS **MAGNETOM Verio**	TOSHIBA Leading Innovation **1.5T Excelart Vantage Atlas**
Worldwide	Worldwide	Worldwide	Worldwide	Europe, Japan, US
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Whole body	Whole body	Whole body	Whole body	Whole body
Superconductive, short bore	Superconductive, short bore	Superconductive, short bore	Superconductive, short bore	Ultra-short (149 cm) bore
1.5 T	1.5 T	3 T	3 T	1.5 T
7.5 (typical 6 ppm) ppm @ 45 x 45 x 30 cm DSV, 2.2 (typical 1.9) ppm @ 40 x 40 x 30 cm DSV, V-RMS (based on 24-plane plot)	0.4 ppm, guaranteed 1 ppm based on 24-plane plot	<0.25 at 40 cm DSV, 0.8 at 45 cm DSV, 1.5 at 50 cm DSV	4.0 (typical 3.6) ppm @ 50 x 50 x 45 cm DSV, 1.6 (typical 1.2) ppm @ 40 DSV, V-RMS (based on 24-plane plot)	<1 ppm
45 x 45 x 30	50 x 50 x 50	50 x 50 x 50	50 x 50 x 45	55 x 55 x 50 at ≤2 ppm
Optional	Optional	Optional	Optional removable tabletop and trolley	No
243 x 54	243 x 54	Not specified	238 x 63	242 x 57
20	20	20	20	2 / 15 / 20
Standard free-floating	Standard free-floating	Standard	Standard	Standard
Not specified	Not specified	Not specified	Not specified	Both sides
55	47	Not specified	50	43
200 (440)	200 (440)	250 (550)	250 (550)	
200 (440)	200 (440)	250 (550)	250 (550)	200 (440)
				200 (440)
93 V engine	120 Quantum	102	115	< 90dBA
Antivibration mounting, noise reduction, systems integration, whisper mode, others	Antivibration mounting, noise reduction, systems integration, whisper mode, others	Antivibration mounting, noise reduction, systems integration, whisper mode, others	Antivibration mounting, noise reduction, systems integration, whisper mode, others	Vacuum enclosed gradient coils (Pianissimo)
V engine	Sprint	TQ gradient	VQ gradient	XGV, ZGV
30 true each axis value; 52 vector summation	30 true each axis value; 35 vector summation	45, in x, y, z-axis	45, in x, y, z-axis	30, 33
100 true each axis value; 173 vector summation	75 true each axis value; 130 vector summation	200	200	130, 200 respectively
15	15	35	33	20
Solid-state	Solid-state	Compact air cooled	Compact air cooled	Solid state
8	8	8	8	16 / 32 WIP
Not specified	Not specified	Not specified	Not specified	Max 32 in FOV
N/A	18, and 32 with Tim upgrade	18, 32	18, 32	32 WIP
1,000 per channel	1,000 per channel	1,000 per channel	1,000 per channel	1,000
Patient table	Patient table	Patient table	Patient table	Couch & Gantry
Coil dependent	Coil dependent	Variable	Variable	Coil dependent
4	5	10	10	9 & 1 respectively
Automatic	Automatic	Automatic	Automatic	Automatic
Nov-07	Nov-07	Nov-07	Nov-07	Mar-08
None specified.	None specified.	None specified.	None specified.	Vantage Atlas systems are short (1.49 m), large clinical FOV (55 cm x 55 cm x 50 cm), possesses high homogeneity at <2 ppm over a full 55 x 55 x 50 DSV.[2]

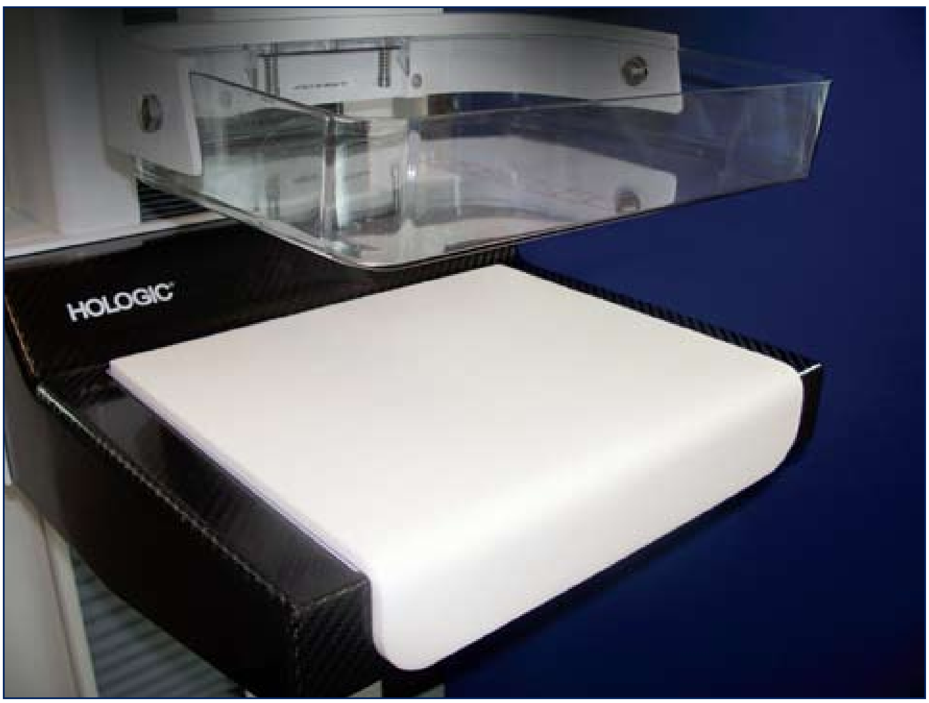
Addressing Mammography-Related Pain

Contributors
Patricia Hall, Hologic, Inc.
R. Edward Hendrick, Ph.D., FACR, Breast Imaging Consultant

Although numerous studies have assessed the magnitude of mammography-associated pain, the variability of test instruments makes it difficult to reliably quantify the severity and incidence of this problem. The most frequently reported source of pain in mammography is compression, followed by discomfort caused by the sharp edges of the image receptor, and contact with the cold surface of the breast support. Until recently, pain control was limited to the use of relaxation techniques and patient controlled compression, with no viable method for addressing pain caused by the physical structure of the mammography system.

In February 2001, the Hologic MammoPad® radiolucent breast cushion received 510(k) marketing clearance from the US Food and Drug Administration (FDA) for use in mammography exams. MammoPad is a soft, compressible, single-use foam cushion with a low-tack adhesive on the underside. The cushion is placed over the image receptor, providing a softer and warmer surface on which the breast can rest during the exam.

To determine whether the use of breast cushions is a viable and effective aid to mammography, it is necessary to establish that the primary objective of the product, reducing pain associated with mammography, can be met and that there are no detrimental effects on the quality of the mammograms, as measured by: (i) image quality and dose; (ii) adequate tissue acquisition; and, (iii) achievement of acceptable levels of compression.



Radiolucent breast cushion applied to image receptor. The low-tack adhesive in the pad does not leave residue on the receptor.

COMFORT ASSESSMENTS

Three large, independent studies[1,2,3] enrolled patients reporting for routine screening to evaluate whether use of radiolucent cushions resulted in increased comfort. In these studies, both the CC and MLO view for one breast was used as a control (uncushioned), while the other breast was cushioned. Following the exam, patients rated the level of pain for each breast using either a visual analogue scale (VAS) or paired numerical rating scale (NRS). Statistically significant levels of pain reduction were seen in all studies, with 66.0% to 73.5% of patients realising at least a 10% reduction of pain (the benefited group). The average reduction of pain ranged from 33.0% to 52.6%.

Studies were performed using cushions on both the image receptor and compression paddle. Today, most practices incorporating the use of breast cushions customarily use a single cushion on the image receptor only and report no discernable reduction in comfort levels. One study[4], has shown that the use of breast cushions may reduce mammography pain by 25% to 50% for women who have previously undergone lumpectomy and radiation therapy.

IMAGE QUALITY AND DOSE

Two methods have been used to evaluate image quality with the use of breast cushions; (i) studies using blinded, side-by-side comparisons of images of cushioned versus uncushioned breasts and (ii) evaluations involving contrast-detail phantoms and ACR phantom images. Both types of evaluations report no degradation of image quality or statistically or clinically significant increase in dose when the breast cushion was used.

COMPRESSION AND COMPRESSION MARKS

Researchers and technologists credit the gripping ability of the MammoPad with enhanced comfort and warmth, which leads to increased relaxation of involved muscles. The body of available published literature supports the fact that the use of breast cushions does not compromise adequate compression; in fact, it has shown that, for many patients, greater compression can be achieved with breast cushions.

Some facilities using breast cushions have experienced random, sporadic occurrences of images showing lighter, circular or oval-shaped areas of contrast within the breast tissue, a phenomenon known as a compression mark. These infrequent occurrences have been limited to large, fatty-replaced breasts. A compression mark may appear with or without breast cushions when uneven compression of the breast occurs.

IMAGE QUALITY AND TISSUE ACQUISITION

Different case studies[5, 6, 7] have shown average increases in tissue acquisition at the chest wall for all screening views ranging from 0.27cm to 0.61cm in side-by-side comparisons with images of exams from the previous year. These three studies looked at the percentage of views showing increased tissue acquisition of 1.24 cm or greater, a measurement felt by clinicians to have greater clinical relevance. The average percentage of views meeting this criteria was 15.4% of all views in the 3 studies, with ranges from 10.7% to 19.7%. In addition to increased tissue acquisition, researchers report increases of 20% or more in the amount of pectoral muscle visualized[7] and openness of the inframammary fold[7].

DISCUSSION

The use of radiolucent breast cushions has been shown to provide a significant reduction in mammography-associated pain for a majority of women. It has also been clearly demonstrated that this increase in comfort can be achieved without a trade-off in reduced image quality or increased dose. In addition, with appropriate training, tissue acquisition can be enhanced when the cushion is used and compression force can be increased without a resultant increase in discomfort.

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OVERVIEW OF THE
AUSTRIAN HEALTH AND HOSPITAL SYSTEM

Austria is a democratic republic and a federal state which is composed nine Länder. The Länder have their legislative competencies and also participate in legislation at a federal in the Bundesrat (upper house of parliament).

The Austrian healthcare system is characterised by the federalist structure of the country, the delegation of competencies to self-governing stakeholders in the social insurance system as well as by cross-stakeholder structures at federal and Länder level which possess competencies in cooperative planning, coordination and financing. According to the Federal Constitution, almost all areas of the healthcare system are primarily the regulatory responsibility of the federal government. The most important exception is the hospital sector. In this area, the federal government is only responsible for enacting basic law; legislation on implementation and enforcement is the responsibility of the nine Länder.

The various sectors of the healthcare system have traditionally been characterised by different stakeholders and regulation- and financing mechanisms. However, in recent years there have been increased eddorts to introduce decision-making and financing flows which are effective across all sectors.

Since 2002, all the Länder, except Vienna, as well as some of the private non-profit owners have privatised their hospitals, mainly in the form of organisational privatisations. The various private operating companies have one thing in common: they are responsible for the management of hospitals, whereas the Länder or local authorities as (majority) owners usually act as a guarantor. The Austrian healthcare system has developed almost completely into a model which is mainly based on decentralised contracts with all service providers.

Healthcare Financing

The financing of the healthcare system is pluralistic in accordance with the constitution and social insurance laws. The social health insurance system, which is the most important source of financing, provided a total of 45,3% of total healthcare expenditure in 2004. Mandatory insurance is based on membership of an occupational group or place of residence; thus there is no competition between health insurance funds.

25% of total healthcare expenditure is financed by the federal government, the Länder and local authorities. 10% of this share was accounted for by tax financed long-term care cash benefits. The latter have been paid out to people in need of long-term care since 1993.

In 2004, around 25% of healthcare expenditure was financed privately. Private households bore 13,5% of healthcare expenditure by means of indirect cost-sharing (services whose costs were fully borne by the insured) and 7,6% by means of direct cost sharing (co-payments). Direct cost sharing was increased in recent years and affects almost every service provided by social health insurance; however, the outpatient clinics fee introduced in 2001 was withdrawn again in 2005 due to the high costs involved in its implementation and the considerable resistance it had encountered.

Delivery System

Those covered by health insurance can freely choose between service providers in the outpatient sector, of whom the majority work in individual practices. In addition, outpatient clinics and hospital outpatient departments.

Compared to 1980, the number of practising physicians and dentists has risen at an over-average rate, with the figures for both professions actually doubling. There is a considerable variation in the density of physicians between the Länder. The number of nursing staff also doubled between 1980 and 2003 to 6 per 1000 inhabitants. However, it was still clearly below the EU average of 7,3 in 2003.

Hospitals which are listed in the hospital plan of a Land are subject to public law ("fund hospitals") and have a statutory requirement to provide care and to admit patients. They are entitled to legally prescribed subsidies from public sources for investments, maintenance and running costs. The ration of beds to inhabitants of 6,1 beds per 1000 persons is clearly above the EU average. The average length of stay, 6 days is shorter than the EU average, the utilisation of bed capacity at 76% marginally below.

With the passing of the 1993 Federal Long-Term Care Act, Austria reacted comparatively early to the approaching demographic challenges. Like acute inpatient care, long-term care too is a sector where federal cooperation instruments are used, specifically to ensure the uniformity of entitlement criteria and quality standards of long-term care institutions.

Health Reforms

Health reforms have primarily dealt with cost containment (by exploiting potential for more efficiency and raising cost sharing) and with structural reforms to improve the planning of capacities, the cooperation of stakeholders and the coordination of financing flows.

In the acute hospital care sector organisational privatisations were performed which was essentially completed by 2002. The reimbursement of services and medicines by social health insurance has been more strongly linked to health technology assessment, but only a small number of benefits have been excluded. At the same time, new benefits have been introduced, such as federal long-term care benefit, psychotherapy, preventive services, and new structures for community-based long-term care.

Contribution revenue has been increased and the contribution rates of some groups of the insured brought into line, but the revenue base has not been fundamentally changed. Quality assurance requirements have been raised and patients' rights have been strengthened by a charter and patients' ombudpersons.

DRG System

The Austrian DRG system o f hospital financing is developing. Its main focuses are the inclusion of the promotion of day care services and the updating of the model through calculations using a revised calculation guide based on updated hospital cost accounting. Furthermore, integrated supply concepts and the reduction of the burden on inpatient care are to be promoted by the development of a points model for medical follow-up care, transfers between departments and hospitals, and readmissions. The coordination of the Austrian DRG model with the services supplied in hospital outpatient departments and private practice is to be achieved through the harmonisation of documentation and the separation of the contents and the scoring of flat rates per case from other areas of care provision. In addition, a performance-orientated financing concept is to be developed for the outpatient sector which is coordinated with the inpatient sector.

The creation of a new instrument of cooperation designed to provide motivation for cooperation between financing bodies is closely linked to the structure of raising funding for hospital financing. Important impulses for cost-containment will result from this cooperation if the stakeholders involved interact in a constructive manner.

Conclusion

In the past 25 years, the stakeholders in the Austrian healthcare system have succeeded, characteristically by means of cooperative agreements and planning, in ensuring almost universal healthcare provision with a comprehensive benefit catalogue, in spite of considerable increases in expenditure and continuing cost containment measures.

Waiting times for medical treatment are rarely discussed in public and can be viewed as short in comparison to other countries, although there has been no precise evaluation of this. However, the supply structure is characterised by inequalities between the Länder and also between urban and rural areas. Altogether, life expectancy and most of the documented health indicators have improved markedly in the past 15 years. The level of satisfaction of the population with the healthcare system continues to be high in an international comparison.

Sectoral fragmentation, which also creates the bias towards hospital care, is a long standing weakness of the Austrian healthcare system. In spite of numerous efforts, it has until now been possible, in the sense of allocative efficiency, to allow funding to follow the services provided across sectoral borders. Nor has it been possible to structure the supply chain in a more needs-orientated way across these administrative and financial barriers at the sectoral borders, especially between outpatient and inpatient care or acute and long-term care.

The planning, structures and funds introduced since 2005 permit for the first time the cross-sectoral steering of capacities and financing flows. They also provide for incentives for improved interface management and integrated forms of care.

Author Guidelines

CONTENT

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Thank you,
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MANAGEMENT CHALLENGES FOR MEDICAL IMAGING IN AUSTRIA

The Chairman's Perspective

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The radiology department at Innsbruck University Medical Centre has two divisions located in two different buildings, staffed by 66 physicians, approximately 200 technicians and 88 scientists. Our centre is a well-known leader in fields such as interventional radiology, particularly in the treatment of aortic aneurysms and intracranial aneurysms. Our team have also developed research in areas such as ultrasound-guided biopsies of the prostate, stereotactic treatment of liver tumours, stereotaxy (http://sip.uki.at), CT-guided biopsies of lung nodules and ultrasound imaging and guided therapies of the musculoskeletal and peripheral nervous system

PACS has been one of the main catalysts for change in the profession of medical imaging, and Austria is no different in this. We first established a government-sponsored teleradiology service in Austria as a pilot project called "Telemedicine Tirol", following what constituted the first hospital-wide PACS at a university hospital in Austria, and one of the largest PACS installations in Europe. Remote consultations are now provided to five local hospitals. On a daily basis, this adds between 2 – 5 % to our overall workload. However, the advent of teleradiology has also given rise to certain operational challenges.

Due to local laws, services are preferentially provided on a local basis and we provide only emergency services and second opinions. Our decision to cut back on our teleradiology operations with outside partners was based on poor reimbursement levels. The remaining services are run more as a courtesy to the smaller institutions whose specialists might not cover the sorts of cases they receive than as a profit-making project.

Productivity Monitoring Key to Good Management

Productivity is becoming increasingly important for good management. We have a fixed annual budget and therefore although there are no penalties in place, if resources are not allocated properly, we may have to cut necessary costs. In parallel, if we perform well, the next year's budget will increase. Therefore, our department operates continuous productivity monitoring and training of staff members. We calculate the output of the department and the numbers of exams performed on an ongoing basis, and relate this to the cost of exams and the income generated by them.

The hospital administration keeps track of the costs per procedure or exam performed. Therefore, if you request new equipment they can calculate not only the cost of the investment but also the running costs such as the staff, materials and accessories that will be required to run it. These running costs are an important factor in estimating whether an investment is realistic or not.

Patient Access a Priority

There are no waiting lists for medical imaging in Austria, and patient access to treatment is very good. Productivity is higher due to greater incentives for doctors. They earn a fixed income, plus extra income from patients with additional private healthcare coverage. Therefore, by doing more, doctors earn more.

Also in Austria, public hospitals operate on a traditional hierarchical structure which, in my opinion, adds to productivity. For example, Chairpersons here are in a position to delegate more responsibility to up-and-coming colleagues, fostering their careers with an and eventually developing their roles to positions of leadership. The general trend is that these individuals, after tens years experience in a bigger hospital can go into private practice or can take a top position in a large radiology department.

Skepticism About Accreditation in Austria

In Austria, there are laws as in other European countries, obliging medical institutions to comply with industrial ISO 9001 standards. Each two years we have to undergo re-accreditation processes to ensure we are up-to-date. However, these are not specifically designed for healthcare institutions, and therefore their true impact on quality management is limited. As a result, accreditation is not viewed in a positive light; as well as being labour and time-intensive, the question remains of who will foot the bill. Also, as the reimbursement levels remain the same whether you undergo accreditation or not, there is a low incentive to get involved.

The results of these procedures are not made public like in the US, which is directed towards patients as consumers with a right to survey the results of institutions, but only used internally. Another negative aspect of accreditation is that it does not measure or regulate the quality of the output of the department. Even if the results of the ISO process are that the reporting process is satisfactory, it makes no comment on the effectiveness of the report for the patient, or whether the referring physician was correct to order that specific exam. Therefore it has limited impact on improving medical quality.

Restructuring the Radiology Department

In early 2007 the hospital administration, the university and myself, initiated a restructuring project for the department of radiology, to cut superfluous processes and related costs and to increase efficiency and medical quality. By eliminating parallel structures, we will offer a more streamlined service, but quality need not suffer. It will take an estimated two years to achieve these goals, and we may have to lose technical and administrative staff along the way. We have a two-man coaching team that are experts in organisational change management to oversee the project and to deal with staff concerns.

Paring down our team may be problematic. We are a public institution, and in Austria, if a public sector worker is on a permanent contract then they have a job for life and it is not possible to make them redundant. Therefore we won't replace staff that leave. In the University, they get around this by only hiring on a contract basis since 2002. But the hospital administration have a different system – they hire doctors for an initial six years, then allow them two following years to be monitored. If they are hired again after this then it is a given that they also have a job for life. It allows those responsible to be sure they are making the right employment decision.

Management Training

Management training is more of a concern in Austria for those interested in developing long-term career goals. If you are going to become a permanent member of staff then taking courses on leadership, people skills and administration is a necessary addition to one's education. Otherwise all hospital staff receive a week-long crash course in the basics of healthcare management including an overview of the administrative and organisational structure of the hospital. If people want to go further than this they have the option of following part-time courses in management with private trainers for up to one year. ❇

PROFILE OF THE AUSTRIAN SOCIETY OF RADIOLOGICAL TECHNOLOGISTS

Interview with Society President, Dr Michaela Rosenblattl

Interviewee
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Please tell us a little bit about the history of your Society and how it has evolved since it was founded.

Founded in 1961, the Austrian Society of Radiological Technologists is now about 48 years old. During this time, the Society was involved in the process of establishing rules and laws for the profession of radiological technology. At the beginning, we were quite a small organisation with only about 70 members while presently, we have nearly 800.

We are now also a registered state organisation in Austria. The Society is governed by the ministry of health, the national medical association, and the governing body of paramedical professionals (Medical Technological Society of Austria).

Please tell us a little about its main activities.

One of our main activities is to develop and promote the professional qualifications and occupational characteristics of radiologic technologists.

We also organise an annual congress and offer a platform for the posting of jobs for radiologic technologists. These services are much appreciated by our members and help us to network. We also issue a number of different publications and newsletters during the year.

What are the main challenges facing radiologic technicians in Austria and how does your Society help to address them?

Education of radiologic technologists is housed in the University of Applied Science where trainees may attain a bachelor degree of science in health studies. The study programmes include diagnostic imaging and interventional radiology, radio-oncology and nuclear medicine.

Is your Society active in the field of educating its members? How is this achieved?

Yes - in 2005 the Society adopted the Continuing Medical Education (CME) point system. We offer our members the possibility to take part and thus generate 150 points within three years. We also have partnership programmes for continuing education with medical societies and companies.

Does your Society host any kinds of events or congresses for its members?

Each year during Spring, we organise a big congress that includes a variety of themes in diagnostic imaging and interventional radiology, radio-oncology and nuclear medicine which are consolidated under a single theme.

The role of radiologic technicians is growing and changing in Austria - the profession has expanded and now includes roles in application of contrast media, as freelance worker, agent of radioprotection, network agent in radiology and teleradiology, though it does not yet include reporting.

We are also focusing on future changes we would like to see happen to improve the working lives of our members. With this in mind, we have taken the decision to establish a paramedic council to register professionals and to have more power of veto before nascent rules pass through the legislative process, as well as to negotiate for increased salaries.

RADIOLOGY MANAGEMENT IN AUSTRIA

Profile of the AKH Imaging Department

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The history of the Vienna General Hospital goes back more than three hundred years. It came about as the result of the reconstruction of the "Home for the Poor and Invalid", which was founded by Emperor Leopold I in 1693 and was located from 1694 on the site between Alserstrasse, Spitalgasse and Garnisongasse. The home was partly opened in 1695, and in 1696 it housed more than 1,000 poor people. The Vienna General Hospital was officially opened on 7 June, 1994. This is commemorated by a roll of honour at the entrance to the hospital with the names of the decision makers: Franz Vranitzky, Erhard Busek, Helmut Zilk, Ferdinand Lacina, Hans Mayr and Sepp Rieder.

Vienna University Hospital (AKH) has now developed into one of the largest hospitals in Austria. It is a university hospital with 2,189 beds. There are two imaging departments - radiology and nuclear medicine. We perform about 10,600 diagnostic procedures per annum. We provide a thyroid outpatient clinic, a treatment ward and a nuclear medicine imaging centre, including PET. Ours is a public institution. Reimbursement is provided for by both the city of Vienna and the federal budget.

Education in Radiology

In Austria, the residency course for radiology takes six years to complete, of which 5 years are spent training in radiology, 1 year of which can then be spent in either the nuclear medicine or radio-oncology departments. The 6th year must be split into 6 months between internal medicine, 3 months of which in surgery and 3 months where residents are free to choose from other specialties. At the end of the training there is a board examination.

In my own case, after finishing medical school 1993, I began my residency in internal medicine at the University Hospital of Vienna. After training in internal medicine I started specialisation in nuclear medicine, finishing in 2002. Since 2003, I am an attending physician at the department of nuclear medicine.

In my function as assistant medical director I have been organising the thyroid outpatients clinic from 2003 to 2004, then the treatment ward until 2006. Since 2007, I am organising and working in the diagnostic imaging centre. My areas of interest are paediatric nuclear medicine and the evaluation and optimisation of processes as well as standardisation and SPECT-CT. I do a lot in radiation safety and clinical investigations, as well as basic science in medical physics.

Our imaging department offer patients conventional NM, SPECT-CT, PET and in the near future PET-CT (as well as PET-MRI, albeit for science and not as a matter of routine). We are also involved in thyroid management and therapy.

Management Challenges

In our department, there are waiting lists in the thyroid outpatient clinic and partly in the PET facility where these waiting lists sometimes pose a significant problem. In the diagnostic imaging part of our department, which I am responsible for, our scheduling centre has been set up to provide ways to avoid the formation of significant waiting lists.

We are proactive in avoiding turf battles and other conflicts in the nuclear medicine department by encouraging open communication as often as possible with the referring physicians. We also try to optimise and adapt our services to the demand of the clinicians and to anticipate there needs. This sort of approach ensures that problems are less likely to develop. If you know what they want and they know what you are able to deliver then it should work without major conflicts.

In terms of career development, the higher you rise in the hierarchy, the more you have to do troubleshooting and management tasks. If you want to be good at your job, you have to take classes in management. While common sense might help you, in a today's world it is more important to learn the tricks from experts who are specifically trained in economics.

While I definitely enjoy the management part of my job, the problem is that I have to manage without optimal financial resources and the obligation to report to the head of the department can present obstacles, and while I am committed to the scientific part of my job, I can only fulfil all these functions by eating into my spare time. ❇

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current study and comparison studies, resulted in a speeding up of the production of an imaging report from an image study and related exams.

Good performances for PACS mean from the user perspective that a query against current exams should last less then five seconds, regardless of the acquisition date, and the time for retrieving an exam should remain in the order of the network transfer time. In Pisa radiology departments, radiologists have to wait a very short time: for example to retrieve a CT of more then 500 images they need about 25 seconds. Obviously, this performance time should remain stable in the long term and not degrade in a significant way.

The department's IT group developed sufficient competencies in hardware, systems and applications: all the available internal knowledge was used to plan and implement the system. Once the system was in production, fast failure response times were controlled by the department's IT group itself. They can promptly react to malfunctioning, solve more than 95% of the problems and provide the best information for the most effective intervention by the developer team.

The IT departmental group acts also as an interface to users, physicians and other personnel, teaching them how to use the system and helping in solving personal issues with it. High level support is the key to a good implementation of any technology in the real world scenario.

In two years, both radiology departments collected 7TB of images and O3-DPACS was appreciated for its stability, robustness, interoperability and reliability. In the project development, we evaluate the scalability feature of the adopted PACS. An healthcare informatics system should implement solutions that could be applied to low load environments up to multicenter systems reaching also regional integration environments. This should foster vertical integration and reduce costs. We observe also the economicity of using an open source PACS: an healthcare informative system should not require high investments if not necessary and should try to guarantee the greater reliability at the lowest cost.

UKRC

UK RADIOLOGICAL CONGRESS 2008

AN INVITATION FROM THE PRESIDENT

I extend an invitation to attend the UK Radiological Congress 2008 which is to be held in Birmingham, UK between 2-4th June 2008. There is a strong management theme running through the Congress which reflects current trends in the UK. Justifiably, the UK is proud of its progress with improvements in service delivery and the UK Radiological Congress represents the major UK forum for service delivery and management.

Major themes in 2008 are workforce, delivery targets and service standards. There is a fascinating session on “surviving as a future workforce”. It will feature a UK perspective with Professor Adrian Dixon from Cambridge delivering a presentation with the challenging title “Radiologists: Will we need more or less?” A US perspective will be delivered by Dr Giles Boland from Massachusetts. The UK workforce has done much to look at skill mix and Mr Richard Evans from the Society of Radiographers asks the intriguing question “workforce planning: Whose problem?”

UKRC is pleased to announce that the Department of Health will be holding an Imaging Forum at UKRC. This will look at sustainability of current success of service delivery improvements and discuss future developments.

The UK Royal College of Radiologists and College of Radiographers are developing a patient focused accreditation programme for the accreditation of radiology services. This innovative project will be presented in detail at UKRC.

At UKRC 2008 there is a strong satellite programme delivered by industry partners. There will be a wide variety of topics including “ambient experience a new experience for patients” and “trauma imaging in the future using hybrid imaging systems”.

There will also be a strong digital, technology and clinical programme which can be viewed with the rest of the programme at www.ukrc.org.uk

I look forward to meeting you at the UK Radiological Congress 2008

Stephen Davies

Stephen G Davies
UK Radiological Congress President
president@ukrc.org.uk

INTERVIEW WITH DR. MARCO ROSSELLI DEL TURCO

Interviewee
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Why did you decide to focus your career on breast cancer imaging?

My participation in the student's political movements at the time of my degree in medicine, inspired me to seek a new approach to medicine. Thus, I decided to dedicate my professional activity to prevention and I decided to apply for a job at a new centre for prevention of social diseases, just built in Florence. At that time the preliminary results of the Health Insurance Plan conducted by Dr. Philip Strax in New York, who had a very nice office on 5th Avenue, were very promising and our group decided to start the first European population-based screening programme in 25 municipalities in the outskirts of Florence.

How did you come to be elected to President of the European Society of Breast Cancer Specialists (EUSOMA)?

Since 2003, I have been member of the Executive Committee and following last year's election I had the honour to be appointed President. I've been collaborating within European groups for breast cancer screening and with EUSOMA for a long time; as experts in radiology, our main task is to improve quality in mammography. I have been invited to participate in different EUSOMA workshops for the preparation of European Guidelines. This is an opportunity to collaborate with other European experts and increase my commitment to contributing to improvements in breast cancer care, developing projects on training for young health professionals, preparing guidelines on urgent issues such as the definition of quality indicators for breast cancer care, the use of MRI in breast cancer clinical diagnosis and the optimal organisation of a breast unit, etc.

How is EUSOMA active in the definition and dissemination of quality standards for audit and accreditation of breast units?

The primary aim of EUSOMA is to harmonise at a high level, the quality of breast cancer care in Europe, drawing up guidelines on the different aspects of its care. One of the essential requirements for providing the best care to women is to guarantee they are treated in dedicated breast units. Therefore EUSOMA has written guidelines on the requirements of a specialist breast unit and based on this has defined a voluntary certification process, in order to foster their implementation and development. This is an increasing activity for the society; the number of units requesting to be certified is growing, as not only health professionals are eager to demonstrate they are working according to European standards in a multidisciplinary way, but also patients are aware about the importance of this and look for centres responding to well-defined criteria.

What are the remaining challenges for a European standardised breast unit accreditation system?

The big challenge is to prove that quality can only improve if you employ dedicated personnel, if doctors, nurses, radiographers and clerical staff are able to share their experience with the other colleagues involved in the same professional field, independently from their original specialty.

What is the 'gold standard' that a breast unit must achieve?

The mandatory requirements for a breast unit are a core team of specialised health professionals, who offer a high standard care with a multidisciplinary approach; a sufficient number of cases to allow effective working and expertise; data collection and

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HOW TO...
INCREASE WORKSTATION PRODUCTIVITY

In my work, my general area of interest is in medical image perception and decision making, how well radiologists interpret images and what factors contribute to better decision-making strategies. A key component in the imaging chain is the display, or the point at which the image meets the eye-brain system of the radiologist. In the early days of digital radiology, the question was quite basic: can radiologists attain the same level of accuracy with digital softcopy displays compared to traditional film? Once it was clear that the answer was yes, the question became how can we optimise softcopy display. This, and other factors for good workstation use, are the focus of this article.

For a number of years we worked on the topic of optimising softcopy display, analysing the influence of display properties such as luminance, calibration method, noise compensation etc., on the diagnostic performance of radiologists. We still carry out those types of studies now, but the focus has shifted slightly to include measures of efficiency and diagnostic accuracy.

For example, we examine the types of display parameters already noted, but include measures of timing such as total viewing time per image. We also record eye position in many studies to determine how efficiently the radiologist scans the image or collects and processes the information in the image in order to render a diagnostic decision. We have found in a number of studies that optimised displays not only tend to yield higher diagnostic accuracy but they also tend to improve interpretation efficiency. Radiologists tend to fixate the lesions earlier in the search and tend to need less time to distinguish them from the background and render the correct decision.

What Factors Improve Productivity?

As already noted, optimising the display is one major factor influencing productivity. Additionally, the layout of the images and the user tools within the display(s) is quite important. In one study recording eye position, we found that readers were spending about 20% of their search time focusing on the menu and tools rather than the image itself. The image "hanging protocol" and the tool/menu layout does influence productivity. For many people that means customisation, and many workstation developers incorporate customisability into their products.

Another key factor that has not been well studied to date is the nature of the input device. Most radiologists are using the mouse (buttons and/or scroll wheel), hot keys, a joystick or common modifications of these devices. Some, like the basic mouse, are rather inflexible and awkward to use. They can and do slow down the image interpretation process, especially when scrolling through stacks of hundreds to thousands of images. They can also lead to repetitive use injuries. More research in general needs to be on finding innovative ways to interact with image data.

Increasing Image Volume Impacts Workers' Health

It is not just radiology that is feeling the impact of the increasing volume of data from studies. Pathology is starting their own digital revolution with virtual slides (digitised glass specimen slides) and these images are as large and even larger than radiology images. Many departments are utilising more image data of all sorts in routine patient care and more and more clinicians are using workstations for various interpretation tasks. Studies that I am carrying out now with Kevin Berbaum, PhD at the University of Iowa, are looking at one aspect of the increasing image volume on radiologists' health and satisfaction.

Specifically, we are examining the effects of visual strain and fatigue on observer performance. Initial surveys found that radiologists were experiencing more and more visual strain, blurred vision, double vision, headaches, and shoulder/back pain compared to viewing images in the traditional film environment. Using a device to measure visual accommodation or how well the radiologist can focus their gaze on a point in space (e.g., a fracture on a bone image) we are trying to quantify the effects of long hours of reading on a digital display on diagnostic accuracy. So far we have found that the ability to accommodate does indeed decrease at the end of the day (after long reading hours) compared to the beginning of the workday.

Does IT Offer a Solution?

More computer-aided detection tools are being developed for a wide variety of lesions and modalities. The next big step will be getting FDA approval for computer tools that also provide an estimate or probability of malignancy for such things as mammographic, colon and lung lesions. The key in both cases is to maximise sensitivity and specificity so the radiologist has sufficient confidence in the computer's decisions. Another aid is the development of 3D images either by tomography or through production of stereo images and displays. David Getty, PhD from BBN Technologies has shown amazing improvements in the detection and classification of mammographic lesions with stereo images. Further investigation with these types of techniques with careful attention to both diagnostic accuracy and interpretation times will be needed to really determine their true worth.

Ensuring Worker Health is Protected

Repetitive stress injuries are common from use of improper input devices (mouse, no pad etc.) and shoulder, neck and back problems are quite common too from poor selection of chairs, monitors at the wrong height, etc. As already noted, eye strain and visual fatigue seem to be more common than one would think. The only way to avoid these problems is to become familiar with ergonomic guidelines for reading room design as outlined in the ACR digital radiology guidelines, read OSHA recommendations for computer use in general, and to just use common sense. If you are uncomfortable or feeling pain, then there is clearly a problem and unfortunately it is probably almost always up to the individual to do something about it and change their working environment as best they can.

Additionally it is useful to be aware of the signs of fatigue - if your eyesight starts to get blurry or your eyes feel dry, then stop for a few minutes, look away at a distant target from the computer monitor and just rest your eyes for a few minutes. It is probably also a good idea for radiologists to get their eyes checked on a regular basis. Reading at such a close distance for hours on end can actually induce myopia. Corrective lenses (special computer glasses) may be required for more people and at younger ages than with traditional film reading.

Factors for Success

Good workstation design and attention to ergonomic details when designing the digital reading environment will reduce distractions, improve reader comfort and reduce the amount of time it takes to efficiently gather and cognitively process the information in the displayed images. If all of this is accounted for, then there is the potential to reduce reading errors.

User group meetings, inter-departmental committees, planning groups for reading room design, etc. are all useful in the good deployment of in-house workstations. The more input someone gets from the eventual users, the more likely it is that the adopted solution will work and be acceptable. It simply may not be possible to please everyone with a single choice.

Interoperability, flexible licensing, add-ons, service agreements, etc., are fairly standard and obviously should be requested from vendors when choosing workstations. Another important thing to ask for may be how willing the vendor is to customise the display for your institution or even an individual user. In the past this has not even been a real consideration, but as software becomes more powerful and flexible, we may see workstations that actually adapt to the user. The longer an individual uses a workstation, the workstation can learn the user preferences, style and so on and adapt to that particular user. When someone else logs in, the computer recognises the new user and brings up the configuration it has learned for that user instead of the one for the previous user. This possibility is not that far in the future. ❇

⏭ *continued from p. 44*

audit; providing all services from genetics and prevention to treatment of primary tumours and care of advanced disease and finally, patient support.

What do we know today that has made the biggest impact on survival rates?

We now know that the detectable preclinical phase of breast cancer is even longer than originally thought, and that new technologies can further advance time of diagnosis, although we risk some over-diagnosis. The challenge of research in this field is to better understand which cancers progress rapidly and need to be treated at a very early stage.

What is your best advice for other managers in breast units?

To employ dedicated personnel, to maintain recall rates within 3 - 5%, and to implement digital mammography whenever possible. Multidisciplinary teams in breast units are essential, and triple assessment is already the standard for specialist breast cancer centres. A multidisciplinary meeting should be regularly organised once a week with the attendance of specialists in the different disciplines. Also, to avoid errors, they should measure the interval cancer rate, the rate of advanced cancer and the proportion of cancers under 1cm of diameter. If these measures are not at an acceptable level, an accurate training programme should be implemented and external advice should be considered. ❇

AGENDA
Key Seminars & Conferences

April 2008

4 – 6 67th International Meeting of the Japan Radiological Society
Yokohama, Japan
www.secretariat.ne.jp/jrs67/english/invitation_eng.html

7 – 11 IHE Connectathon
Oxford, UK
www.ihe-europe.org

7 – 8 Annual Meeting of the National Council on Radiation Protection & Measurements
Arlington, US
www.ncrp.com

9 – 10 European Conference on Embolotherapy
Florence, Italy
www.et2008.org

10 – 12 ESGAR Hands-on Workshop on CT-Colonography
Vigo, Spain
www.esgar.org

11 – 13 Internationaler Fortbildungskurs Moderne Mammodiagnostik und Therapie
Erlangen, Germany
www.comed-kongresse.de

12 – 15 30th Charing Cross International Symposium
London, UK
www.cxsymposium.com

13 – 18 108th Annual Meeting of the American Roentgen Ray Society
Washington, DC, US
www.arrs.org

23 – 26 International Society for Radiographers and Radiological Technologists (ISRRT) 15th World Congress
Durban, South Africa
www.isrrt.org

30 – 03 89th German Radiology Congress
Berlin, Germany
www.roentgenkongress.de

June 2008

4 – 7 31st Postgraduate Course & 45th Meeting of the ESPR
Edinburgh, UK
www.espr.org

5 – 8 25th International Congress of Radiology (ICR)
Marrakesh, Morocco
www.icr2008.org

5 – 9 8th Asia Pacific Congress of Cardiovascular & Interventional Radiology
Kuala Lumpur, Malaysia
www.apccvir.org

10 – 13 European Society of Gastrointestinal and Abdominal Radiology (ESGAR) 2008 Annual Meeting and Postgraduate Course
Istanbul, Turkey
www.esgar.org

14 – 18 Society of Nuclear Medicine, 25th Annual Meeting
Honolulu, US
www.snm.org

25 – 28 CAD – 10th International Workshop on CAD
Barcelona, Spain
www.cars-international.org

25 – 28 EuroPACS Annual Congress
Barcelona, Spain
www.europacs.org

25 – 28 CARS Annual Congress
Barcelona, Spain
www.cars-international.org

July 2008

20 – 23 9th International Workshop on Digital Mammography
Tucson, Arizona
http://iwdm2008.org/

September 2008

5 – 9 MRI Update in Neurological & Orthopaedic Imaging
Oostende, Belgium
www.oostende-mri-congress.be

11 – 13 9th ESGAR Hands-on Workshop on CT-Colonography
Berlin, Germany
www.esgar.org

11 – 14 ESUR 2008
Munich, Germany
www.esur.org

13 – 17 CIRSE Annual Congress
Copenhagen, Denmark
www.cirse.org

18 – 21 European Society of Neuroradiology Congress
Krakow, Poland
www.esnr.org

In the next issue...

- *The Future of Imaging Education*
- *DICOM Toolkits for Cost-Effectiveness*
- *Clinical Leadership in Imaging*
- *Procedure Coding*
- *Medical Imaging in Belgium*

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