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CHANGE MANAGEMENT

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www.imagingmanagement.org


Where's Parker's lab report?
Where's Parker's X ray?
Where's Parker, anyway?
CITY HOSPITAL

Editorial

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Change Management

Dear readers,

Much has been written on the management of change across a variety of industries and services. Change is an integral feature of radiology, which has evolved and integrated a number of different imaging modalities of increasing sophistication, complexity and clinical effectiveness. Every time a new piece of equipment is installed in a department it requires re-evaluation of working practices, clinical applications and workflow, costs and income.

It is also important to ensure that changes that result from new equipment implementation or work practices are patient-focused. The emphasis should be primarily on clinical effectiveness with cost and staff considerations being important but nevertheless secondary. There are many recent examples of changes that require careful management including the introduction of MR, the replacement of old single-slice CT scanners with multi-slice CT systems that have massively increased throughput but have brought time-consuming data analysis and huge storage capacity requirements. However, the development that has affected the imaging department and indeed the whole hospital has been digital archiving and data transmission. These PACS systems have required re-engineering of clerical, radiographic, radiologic staff and pan-hospital information delivery and usage and storage of imaging data.

Many papers have been written about the management of the implementation of these systems - the key seems to be very careful planning and inclusion of all staff from inception to implementation. Discussion of the implications, well-organised re-training and a transparent and orderly plan as well as the removal from an early stage of all uncertainty are also factors in the success of projects. It is also desired that both staff and patients are persuaded of the benefit to them of the proposed changes.

This edition's cover story includes three articles on different scenarios in change management. One article emphasises the steps required for successful change management in any healthcare setting. A second paper discusses the natural resistance of staff to change which they perceive, rightly or wrongly, to be threatening to their way of working. The third paper discusses the implications of mergers & consolidation, and emphasises the need for all parties to have an understanding of the goals of the merger, an agreement on the governance structure and the creation of a new culture. It is to be hoped that these papers will provide useful messages. The journal would also welcome contributions from those of you who have managed departmental reengineering whether they were stress-free or whether they generated lessons from any confrontations that may have occurred during the transition period.

Please send your responses to myself or to Managing Editor Dervla Gleeson at *editorial@imagingmanagement.org.*

Prof. Iain McCall

HAVE YOUR SAY!

Letters to the Editor at editorial@imagingmanagement.org

Content

IMAGING Management
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IMAGING Management

MIR 2007 Congress Review

Reinforcing the Message of Management in Medical Imaging

Dr Nicola Strickland
Chairman

Organised and chaired by Dr Nicola Strickland, consultant radiologist at London's Imperial College Healthcare NHS Trust, this year's annual Management in Radiology (MIR) congress, a professional meeting aimed at leaders, managers and administrators of imaging departments worldwide, was held from 10 - 13 October in Oxford, UK. The congress attracted 137 professionals from 29 countries. With 64 invited lectures and proffered papers, and 52 international lecturers, the event, held for the 10th year, was welcomed by participants and this year had a particularly innovative programme.

Sessions Shed Light on Management in the UK

The congress addressed critical managerial challenges encountered in the daily work of running the medical imaging department, with a particular focus on issues facing the congress host country, the United Kingdom. The opening session was dedicated to highlighting imaging management issues in the UK as a direct result of feedback received from MIR's congress last year held in Budapest, Hungary, where requests were made for delegates to be informed about the MIR host country's imaging issues.

Dr Nicola Strickland, with Prof. Georg Bongartz

During this first session on Wednesday afternoon, Dr. John Somers spoke amusingly but sincerely about the difficulties in managing "difficult" Trusts in the UK government's national "Connecting for Health" (CfH) PACS programme, such as resistance to change. He provided a true recent example of mismanagement and overspend experienced during one particular PACS implementation across two hospitals, which he described as a 'bloody' merger. Many joking references were made in particular to the orthopaedic surgeons involved in the transition, who resisted the change most strongly through complaints and indefatigable requests for unnecessarily expensive additions. His advice, on how to manage these sorts of expectations, was clearly based on personal experience and was well received.

This was followed by a presentation by Dr Nicholas Hollings on managing the problems created when implementing PACS in a geographically dispersed and economically challenged region (Cornwall in South West England), including maintaining connectivity, and how solutions such as voice recognition technology and digital dictation can overcome this.

ESR Request Coding Session

At the specific request of the ESR Professional Organisations Committee (POC), Dr. Strickland included in this year's MIR programme, a special session dedicated to imaging study coding issues and how greater standardisation can be achieved through a set of national codes. It explored the management process necessary to update those codes and guidelines for implementation. "A new system is an enabler for change", explained speaker Dr Rhidian Bramley, who discussed the benefits of common code sets such as simplified deployment of systems and the improved interoperability of systems with more consistent data collection. The ensuing post-session discussion provoked much comment and debate. "Payment by results will bring

MIR Congress Review

Prof. Guy Frija speaking during the congress

accountability", said Dr. Strickland, "We need to ensure that all work performed will draw funds from the National Health System in the UK, and in order to achieve this we need to identify how much each item of work is actually costing, and to use radiological procedure coding to make sure that the same imaging procedures are identified and paid for uniformly across the UK, and hopefully across Europe". It was also noted that in the US, there are highly trained coding specialists who are dedicated to the task of coding, but the question of who in European hospitals will be responsible for this, remains.

10 Commandments for Managing an Imaging Department

One of the most compelling and entertaining sessions held during the course of the congress, the ten commandments for managing an imaging department, kicked off with sound advice from Prof. Philip Gishen who at one point, broke into song to express his disdain of the eternal refrain of radiologists everywhere 'we're short of staff', before proceeding to debate whether or not the field of medical imaging actually suffers a shortage of trained staff. Having worked hard to achieve no waiting lists and no delays in reporting in his department, Prof. Gishen was ideally placed to provide some key pointers for participants, such as the need to work smarter, so that the government does not continue to farm out routine radiological work, thus risking the future of radiology as a specialty.

Prof. Guy Frija also contributed to this session with advice on leadership, defining key strategic goals and targets and dealing with problems in radiology reporting. Another leading speaker, Prof. Henrik Thomsen, urged "visibility, openness and engagement" as the keys to leading a successful department. All speakers were in agreement that people management was one of the top factors in contributing to this success. The results of this session will be summarised in a future edition of IMAGING Management.

Prof. Michael J. Pentecost

Future Congresses and Workshops

MIR organises a congress each year and a winter course at a variety of European locations. The next winter course on "Applying Industry Leadership Concepts to Healthcare" will be held from 10 - 12 January, 2008 in Bad Gastein, Austria, and the next congress will take place in Athens, Greece, in October 2008.

The workshop programme in particular, will explore key concepts required to enhance a manager's ability to work effectively within an organisation. It will further explore concepts such as emotional intelligence, why high performance teams are critical for success and the top keys to successful communication.

The MIR Congress presentations and pictures are available at: www.imagingmanagement.org.

To register for the upcoming workshop please visit: www.mir-online.org.

The following edition of IMAGING Management includes a cover story highlighting in more detail the leading presentations from the congress.


Outsourcing Is Fashion's Latest Trend
Afiul profit halves on surge in credit costs
Netmont set to flex its new-found financial clout
Crude prices extend decline for second day

Dates Announced for 2008 EuroPACS Meeting

Next year's EuroPACS meeting is to be held June 25 - 28, 2008, Barcelona, Spain, in conjunction with CARS. 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 Beyond Radiology (Cardiology, Endoscopy, Opthalmology, etc.)
- Image Distribution, Storage and Archiving Strategies
- Workflow and Data Flow in Radiology
- PACS/RIS/HIS Integration Issues
- Regional PACS and Teleradiology
- Security and Privacy, Quality Assurance, Legal Aspects
- Standardisation (DICOM, HL7, IHE)
- PACS and E-Learning in Radiology and Medical Sciences

www.europacs.org

Registration Open for 2008 IHE Europe Connectathon

Registration for the next IHE Europe Connectathon, to be held at St Catherine's College in Oxford, UK will close December 7, 2007. The Connectathon itself will take place Monday, April 7 to Friday, April 11, 2008, while the traditional participants' workshop will be held on both February 6 and 7, 2008.

Participants will benefit from the success of previous events, to ensure that interoperability remains a hot topic and to ensure the future success of their systems in regards to interoperability.

The IHE Connectathon

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.

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.

www.ihe-europe.org

Abstract Submission Open for 2008 CARS Congress and Exhibition

Abstract submissions for presenters at the forthcoming CARS 2008 22nd International Congress and Exhibition will be accepted until January 10, 2008. Chaired by Prof. Stanley Baum and Co-chaired by Prof. Luis Donoso Bach, this year's edition takes places in Barcelona, Spain from June 25 – 28, 2008. Programme topics will include:

- Medical Imaging, e.g., CT, MR, US, SPECT, etc.
- Computer Assisted Cardiovascular Imaging
- Image Processing and Display
- Medical Workstations
- Interventional Radiology
- Minimally Invasive Spinal Therapy
- Image Guided Diagnosis and Therapy of the Prostate
- Tumour Ablation Therapies
- Image Guided Radiation Therapy
- Telemedicine, e-Health and Multimedia EPR

The CARS meeting will also host the annual conference of the International Society for Computer Aided Surgery, the International Workshop on Computer-Aided Diagnosis, the annual EuroPACS meeting and the Computed Maxillofacial Imaging Congress.

And finally, the 7th CARS/SPIE Joint Workshop on Surgical PACS and the Digital Operating Room, chaired by Professor Heinz Lemke (University of Southern California) and Dr. Osman Ratib (University of Geneva) was successfully held on the closing day of CARS 2007.

www.cars-int.org

WHO Redesignates ECRI Institute as a PAHO/WHO Collaborating Centre

ECRI Institute, an independent nonprofit body that researches the best approaches to improving patient care, announced that the World Health Organization (WHO) has redesignated ECRI Institute as a PAHO/WHO Collaborating Centre for Patient Safety, Risk Management, and Healthcare Technology.

WHO Collaborating Centres are part of an inter-institutional network designed to strengthen resources in terms of information, services, research, and training in support of national health development. As a PAHO/WHO Collaborating Centre, ECRI Institute's activities include coordinating a medical device safety programme, providing training in technology assessment, identifying healthcare standards and guidelines, and supporting global patient safety efforts.

"We are gratified to again earn designation as a PAHO/WHO Collaborating Centre," says Ronni P. Solomon, J.D., ECRI Institute's Executive Vice President. "As a nonprofit organisation, we are committed to finding the most effective ways to improve patient care and to sharing that information with the international healthcare community."

Since its first PAHO/WHO Collaborating Centre designation in 1987, ECRI Institute has worked on a range of health technology issues around the world.

www.ecri.org.uk

Update from CIRSE 2007

With over 4,700 participants and a record level of abstract submissions, this year's annual congress of the Cardiovascular and Interventional Radiological Society of Europe (CIRSE) proved a great success. Abstract submission for CIRSE 2007 reached an all time high surpassing the 1,000 benchmark for the first time in CIRSE history. The strong increase in submissions to the CIRSE meeting as well as the increasing number of late-breaking abstract submissions shows once again that CIRSE is not only an important educational congress, but also an outstanding meeting for the presentation of new scientific findings.

Scientific Programme

The programme put together by Prof. Michael Lee and his scientific programme committee comprised more than 100 hours of lectures and hands-on workshops. CIRSE's new format streamlined around five major topics (Vascular Interventions, Non-Vascular Interventions, Transcatheter Embolisation, Interventional Oncology and Clinical Practice) facilitated itinerary planning and enabled participants to follow a specific area of interest without overlap. The new format will be continued for CIRSE 2008.

The CIRSE Foundation Courses, designed for young doctors to illustrate the basic principles of a specific procedure, focused on embolisation and peripheral vascular disease. These sessions were complemented by a self-assessment test based on the ESR tool which had been adapted for CIRSE by José Ignacio Bilbao. The test could be carried out individually by the participants or in a special session which allowed for Q and A.

The 'CIRSE meets…' session was dedicated to the European Society for Cardiovascular Surgery (ESVS) and China, a country of almost unlimited potential for IR. Professor Ke Xu and other distinguished members of the Chinese Society of Interventional Radiology (CSIR) gave a very interesting insight into the current status of IR in China as well as into the state of specific procedures and conditions in their home country.

The CIRSE 2007 exhibition comprised 3,000m^2 of exhibition space, where more companies than ever chose to present their latest developments and many launched their latest products. Numerous companies also offered Learning Centres to the participants. The industry satellite symposia, comprising a newly introduced breakfast slot, also enjoyed great popularity.

Apart from the usual highlights of the CIRSE social programme, such as the highly popular CIRSE Foundation Party, this year's meeting also featured two new events; the CIRSE Fun Run and the first CIRSE Soccer Cup. Both events met with a very positive response, and will become regular features of future CIRSE meetings.

Abstract Submissions CIRSE 2008!

Upon their arrival from Athens, the members of the CIRSE Scientific Programme Committee have already started putting together the topics and sessions for CIRSE 2008 to take place in Copenhagen September 13 - 17. Abstract submission for CIRSE 2008 will be possible from December 4, 2007 until February 12, 2008. Please refer to www.cirse.org or contact CIRSE Central Office at info@cirse.org to stay updated on CIRSE 2008 and all other CIRSE initiatives.

www.cirse.org

SEVENTH FRAMEWORK PROGRAMME FOR RESEARCH AND TECHNOLOGICAL DEVELOPMENT

Dervla Gleeson
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The Seventh Framework Programme for Research and Technological Development (FP7) is the European Union's main instrument for funding research in Europe. Running from 2007 to 2013, it will execute a budget during that period of €50.5 billion and an additional Euratom budget for the next five years of €2.7 billion. FP7 is designed to support research in selected priority areas.

How is FP7 made up?

FP7 is made up of four main specific programmes under the headings Cooperation, Ideas, People and Capacities, plus a fifth specific programme on nuclear research. Here we assess the most relevant ones.

Cooperation

With a budget of €32 billion, the "Cooperation" programme will provide research support to international cooperation projects across the European Union and beyond. Its ten thematic areas, corresponding to major fields in science and research will promote the progress of knowledge and technology. Research will be supported and strengthened to address European social, economic, environmental, public health and industrial challenges, serve the public good and support developing countries.

Health Research Programme

With a budget of €6 billion, the health research programme aims to improve the health of European citizens, and increase and strengthen the competitiveness and innovative capacity of European health-related industries and businesses. Global health issues, like emerging epidemics, will also be addressed. European collaboration with developing countries will allow those countries to develop research capacities. Its emphasis will be put on translational research (i.e. the translation of basic discoveries in clinical applications), the development and validation of new therapies, methods for health promotion and prevention including the promotion of healthy ageing, diagnostic tools and medical technologies, and sustainable and efficient healthcare systems.

Clinical research will tackle a number of diseases such as cancer, cardiovascular, infectious, mental and neurological diseases, and in particular those linked with ageing, such as Alzheimers and Parkinsons diseases. Through international multi-centre trials involving the required number of patients, new drugs and treatments would be developed in a shorter time frame. European-funded health research will focus on:

- Biotechnology, generic tools and medical technologies for human health
- High-throughput research
- Detection, diagnosis and monitoring
- Prediction of suitability, safety and efficacy of therapies
- Innovative therapeutic approaches and intervention
- Translating research for human health - Integration of biological data and processes
- Research on the brain and related diseases, human development and ageing
- Translational research in infectious diseases (HIV/AIDS, malaria, tuberculosis, SARS, avian influenza)
- Translational research in major diseases: cancer, cardiovascular disease, diabetes/-obesity, rare diseases, other chronic diseases including rheumatoid diseases, arthritis and muscoskeletal diseases
- Optimising the delivery of healthcare to European citizens
- Translation of clinical outcome into clinical practice
- Quality, efficiency and solidarity of health care systems including transitional health care systems and home care strategies
- Enhanced disease prevention and better use of medicines
- Appropriate use of new health therapies and technologies

"People" Programme Supports Careers in Research

With a budget of €4.7 billion, the "People" programme offers individuals training and career development in research. It aims to encourage European researchers to stay in Europe and attract the best researchers in the world to European research excellence and infrastructures. The "People" programme should encourage individuals to enter the profession of researcher; structure their research training by offering options; and, encourage mobility within the same sector. The mobility of researchers is not only key to the career development of researchers but also vital to the sharing and transfer of knowledge between countries and sectors.

During FP7, a series of EU research funded actions will support the on-going training, research and mobility of highly qualified scientists and encourage the proliferation of centres of excellence in the EU and their contribution in new areas of research and technology. This will be carried out through initiatives such as lifelong training and career development through individual fellowships and co-financing programmes at international, national and regional level and international outgoing and incoming fellowships aiming to increase research talent outside Europe and fostering mutually beneficial research collaboration with researchers from outside Europe. The activity will also include measures to counterbalance "brain drain" and create networks of European researchers working abroad.

Capacities

With a budget of €4.2 billion, the "Capacities" programme will optimise the use and development of research infrastructures, while enhancing the innovative capacities of SMEs to benefit from research. The programme is designed to support regional research-driven clusters and at the same time unlock the research potential in the EU's convergence and outermost regions.

Four Countries Sign Agreement to Join FP7

Croatia, Serbia, the former Yugoslav Republic of Macedonia and Turkey all recently signed agreements that enable their eligibility to compete on an equal footing with EU Member States in the Seventh Framework Programme (FP7), following the signature of Memoranda of Understanding with the European Commission.

These countries will now be able to participate in all the FP7 calls for proposals and enjoy the same rights for participation as EU Member States in all the research cooperation and supported actions funded under FP7.

Science and Research Commissioner Janez Potocnik has noted the importance of the agreement in view of these countries' application to join the EU. 'Research cooperation with Europe's scientific community is a tool which can smooth the way for the integration process of candidate and potential candidate countries into the European Union,' he said.

Montenegro has also requested to become associated with FP7 and it is expected that a decision will be taken once Stabilisation and Association Agreement (SAA) negotiations have come to a head. Albania, Bosnia-Herzegovina, Israel and Switzerland are also expected to join soon.

Further Reading

http://cordis.europa.eu/fp7
http://www.dti.gov.uk/science/uk-intl-engagement/euro-programmes/fp7/page38886.html
http://europa.eu/scadplus/leg/en/lvb/i23022.htm

Industry News

Siemens

Siemens Expand Vascular Analysis Offering

New functions for vascular analysis are available for Siemens Medical Solution's client-server solution for computed tomography (CT), the syngo WebSpace. syngo WebSpace allows users to access and manipulate CT images via an internet or other network connection. Improved algorithms and additional tools in the new software version aid physicians to more quickly analyse small vessels as well as document reports. For example, computer-supported measurements for stenoses and comparisons of vessel cross-sections are now part of the package.

Matrox

Matrox Releases Smart Camera/Software Package

Matrox Imaging has launched its Iris E-Series with new Design Assistant, a smart camera/software package. It enables users to instruct the Matrox Iris E-Series camera to intuitively grab, process and display, perform measurements, analyse image data and read machine codes. This potentially eliminates the need for programming and scripting and users benefit from simplified application development. The development environment is fully self-contained for both application development and deployment, and the integrated HTML editor and layout tool gives users more flexibility to create a custom web-based operator view for monitoring the application.

AGFA

Agfa HealthCare Announces Live Operation of HYDMedia Solution

Agfa HealthCare has announced the installation of its HYDMedia Archiving and Document Management System (DMS) at the Marienhospital in Osnabrück, part of the Management Katholischer Krankenhäuser der Region Osnabrück (MKO) holding, in northern Germany. The HYDMedia solution was installed at the hospital over a period of four months and is connected to ORBIS via the patient interface. The roll-out of the DMS to two more hospitals of the MKO-holding, the St. Franziskus-Hospital Harderberg and the Krankenhaus St. Raphael Ostercappeln, is planned to be completed by the end of 2008.

Hologic

Study Rates Performance of Direct Digital Over Film Mammography

The Vestfold County Study, comparing the results of a particular digital mammography technology to women screened with film was published in European Radiology in August 2007. Researchers compared cancer detection and recall rates of 18,239 women screened with a Hologic Selenia digital mammography system to the results of 324,763 women screened with film over a two year period. Researchers reported that the detection rate for ductal carcinoma in situ (DCIS) and the positive predictive value for cancer (PPV) were statistically significantly higher and the technical recall rate was statistically lower for Selenia over film.

Carestream

Carestream Adds to Molecular Imaging Product Line

Carestream Molecular Imaging is introducing new large Stokes shift dyes for fluorescent in-vivo imaging applications. The dyes are designed to enable researchers and scientists to maximise fluorescent signal and minimise autofluorescence issues during in-vivo imaging. Kodak X-Sight dyes will be available in 2008 for preclinical use.

Philips

Philips Seeks to Reduce Time from Heart Attack to Treatment

Royal Philips Electronics recently demonstrated its HeartStart MRx Monitor/-Defibrillator, which enables paramedics to transmit patient data from the ambulance to the hospital's emergency department to help clinicians use ECG data to begin organising its resources before the patient arrives. The HeartStart MRx also integrates with the hospital's ECG management system TraceMasterVue, enabling critical patient information to be seen where it's needed.

E–Z–EM

E-Z-EM Announces Financial Results 2007

E-Z-EM, Inc. has announced financial results for its fiscal 2007 fourth quarter and fiscal year. Highlights for the quarter included:

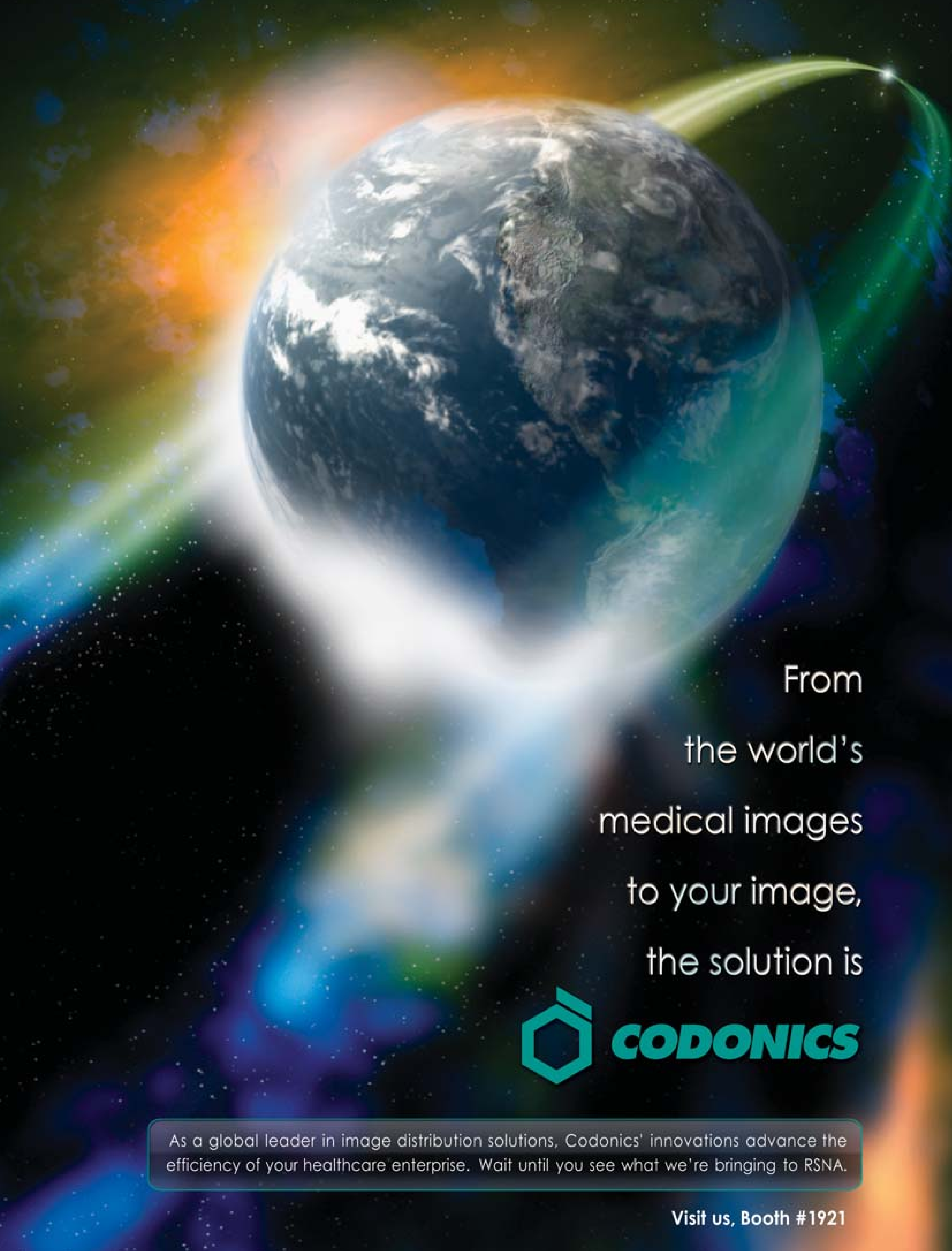
- Net sales from continuing operations of $36.7 million
- Earnings from continuing operations of $2.8 million
- Receipt of 510(k) regulatory approval for EmpowerMRTM
- Receipt of $8 million follow-on order for RSDL from the DoD

Sales were led by CT imaging products, which increased 8% over the prior-year quarter. Injector system sales were up 20%, while CT contrast sales were flat compared to the prior-year period. Sales of virtual colonoscopy and X-ray fluoroscopy products grew 22% and 7%, respectively. Gross profit for the current quarter increased 10% to $17.1 million from $15.6 million in the prior-year quarter.

Confirma

Confirma Expands Extensive Education Programme

Confirma has announced that it has awarded an educational grant to the International Centre for Postgraduate Medical Education (ICPME) to develop a new curriculum of continuing medical education for breast MRI. The breast MRI curriculum includes two separate programmes supported by the educational grant from Confirma. The first is "Decisions in Medical Imaging – Breast MRI Analysis and Interpretation with CAD," a series of online case reviews using CAD to aid the radiologist in the analysis and interpretation of breast MRI studies. The second is a full-day course of instruction and training for radiologists and interventional radiologists, "Breast MR Imaging, Interpretation and Intervention."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SIX STEPS FOR SUCCESSFUL CHANGE MANAGEMENT

What Works and What Doesn't

The way hospitals address and manage change can substantially influence employees' willingness to commit to the process. Today, the question is not whether to change, but how we manage the transformation in a way that also motivates employees and unifies the healthcare organisation. On the one hand, change is demanding and stressful. On the other hand it provides an exciting and challenging area that is responsible not only for the existence of but also for the enjoyment of our jobs.

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How should we implement change? It is a simple enough question; surely there is a simple answer - especially since we do it so often. Every time we implement a new system or install a new process, we are implementing change. Therefore, surely there are some things that work, and some things that fail?

The Only Person That Likes Change is a Wet Baby

When change is considered or promoted, there will always be a conflict between those supporting the status quo and those supporting change. Among the supporters of change there may be conflict as to the extent and the nature of change that is desired. There is an assumption that there is a clear solution and the process is only a matter of finding that solution. The progression follows a linear process, namely deciding if change is necessary, and if so, what change will be made. Healthcare is an area in which change is characteristically slow. In addition, healthcare organisations often look at issues in a very narrow, short term way. However, in healthcare there may not be a clear, single solution or best choice. There may be as large a group that supports the status quo as there is promoting change.

Views on Change Management

Change management can be viewed from two perspectives – from those implementing the change and from the recipients of change. Your view of change management varies dramatically if you are the executive demanding the change versus the front-line employee who may be unsure why a change is even needed.

In many cases at the onset of a new change, neither the executive nor the front-line employee is knowledgeable about managing change. Executives want the change to happen now; employees are simply doing their job. It is the project managers, consultants or members of the project team that first learn about the necessity for change management. They are the first to realise the two dimensions of change management: the top-down managers' perspective and the bottom-up perspective.

The result is a potentially dangerous mix of different priorities, different knowledge sets and different driving forces. If the change is not managed properly, these different values and driving forces clash, resulting in unfortunate outcomes for the business. Many healthcare organisations learn the hard way through failed projects. They learn that change management is not something addressed after the fact. Change management must start at the beginning of the project and be integrated into all steps. Both perspectives of change management must be addressed: the managers' and the employees'.

The Managers' Perspective

The managers' perspective on change is results-oriented. Managers are very aware of the issues facing the department or institution and are accountable for its financial performance. When a change is deemed necessary, quick action is required. Primary concerns include:

- When can the change be completed?
- How much will this improve the processes of the hospital?
- How will this change impact financial performance?
- What is the required investment?
- How will it impact participants within the process (e.g. patients, referring physicians, etc.)

The Employees' Perspective

Now consider the perspective of front-line employees in hospitals. They are the ones who must ultimately implement the change. In general, they do not have an overview of the department's or institution's strategic goals. Serving patients and getting the job done on a day-to-day basis are their primary areas of interest. When changes are made, many employees lack the broader context or knowledge base of why the change is being made. They also do not share the same accountabilities as managers. They question, therefore, how the change will impact them personally.

Six Steps for Implementing Change

Given the above-described model or framework for change management, you can break down the required elements to effectively manage change.

I - Understand status quo

Creating something new is always an act of destruction. When implementing change you replace the old status quo known to everyone, with a mere vision of a goal in the future. Having respect for the existing status quo builds respect for you. Some status quos have been around for only a few months, others for years. The older the status quo, the more likely it will be difficult to remove. The older a status quo, the more it has been proven as being valid. Let us respect the status quo, but not be afraid of change.

II - Understand the need for change

Before you implement change, it is crucial that you understand all the reasons for it. You must become an expert in the change being proposed or reacted to, because people will look to you for answers. They might even look to you for guidance. At the very least, "Is the change necessary?" will be asked by everyone impacted by it. It would be nice to have an answer.

III - Create desire to change

This phase draws on all your management and leadership abilities. The more people who come to believe that the change is necessary, the easier the change process. Imposing on them what to believe is not the answer. Describing the problem, creating a vision of the future, and allowing them to contribute to the details of what the solution might be, creates a common ground for support and commitment to the change.

IV - Get operational

The move takes place, the layoffs happen, the new system is made live. Getting the operational details to go as smoothly as possible, through good management practices, adds to the ease with which the change is assimilated.

V - Reinforce new behaviour

Most attempts that are prepared well and implemented properly will result in sustained success. Not all attempts will result in failure. Each one of those successes should be rewarded. Employees initially hesitant to the respective change need special attention to guide them to appreciation.

VI - Celebrate

Celebration is both personal and peer recognition that you are of value to the progress of our department or institution. People like to be appreciated, and a celebration is a powerful way to communicate that message. Celebrating does not require a huge financial budget. It does require an attitude, however, that people work better when their efforts are appreciated.

Implementing a support structure to assist people through a significant change is not just a matter of overcoming your reluctance to leave the comfort of the old status quo; it is an attempt to support and promote the determination and courage necessary to move towards the next one. Especially in healthcare organisations, change management approaches are often rather random instead of strategically driven. However, a strategic management of change for healthcare organisations is needed to face the challenges of the future.

Vestfold Hospital in Norway:

One of the 1st Breast Cancer Units in the World To Go All Digital

Dr. Einar Vigeland

It was a bold decision for Vestfold Hospital in Norway to establish an all-digital breast care unit in 2002. Digital breast imaging was in its infancy, and few breast centers in Scandinavia, indeed few in the world, were completely digital.

The center had originally planned to purchase one digital mammography system and a computed radiography system. However, a financial analysis found the site could more than break even with two digital mammography systems and a prone breast biopsy system. One digital mammography unit would be dedicated to breast screening; the second would be reserved for diagnostic cases.

The addition of a prone biopsy table would ensure that optimal patient care could be achieved. Criteria and motivations were diverse. Hospital radiologists wanted to acquire the best image quality and give optimal patient comfort.

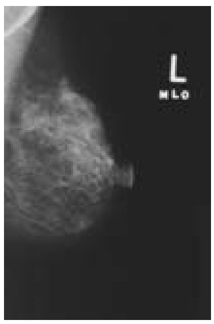
The hospital administrators wanted a system that would evolve as the Center's patient population grew while putting up with very heavy usage for the Norwegian Breast Cancer Screening Program. After a thorough review of the available technologies, Vestfold chose the Hologic Selenia digital mammography system. The decision to go with Hologic technology was based on the quality of their selenium detector images and the size of their detector (the system's field of view is one of the largest available).

"We believe strongly in the [Hologic Selenia] detector," said Dr. Einar Vigeland, the leading consultant radiologist at the breast care unit in Vestfold. ***"We have a strong belief that we have chosen the right system and that this is the solution for the future."***

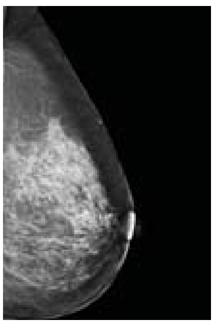
Also important was the integration of mammography into the radiology department's existing PACS. At Vestfold mammograms are both archived and presented on soft copy workstations using the PACS. They are made available electronically throughout the radiology department. Dr. Vigeland is particularly impressed with the Selenia system's ability to visualize microcalcifications. ***"For microcalcifications, digital is clearly superior to analog."*** The center receives analog images from many referrers, enabling an easy comparison with digitally captured pictures. ***"We cannot see anything on film better than we can with digital,"*** he said.

In August 2007, European Radiology published the results of a study by Dr. Vigeland and his colleagues. The study looked at cancer detection and recall rates for 18,239 women screened with the Selenia systems at Vestfold Hospital compared to the results of 324,763 women screened with film in other hospitals involved with the Norwegian breast screening program.

While prior studies have compared the performance of digital mammography to screen-film in high volume screening, until this study, no researchers had looked at the performance of this specific digital mammography technology exclusively. The detector characteristics and way the various digital mammography systems operate is considerably different. The pixel size of the system studied, the Hologic Selenia system, is smaller, the system uses direct capture (selenium) technology, and the image-processing algorithms are unique, resulting in a sharp, high contrast image.



Film Image of patient



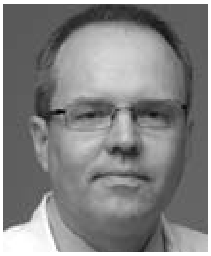
Digital Image of same patient

Dr. Vigeland says the site gets better images than analog with the Selenia direct capture system while keeping radiation dosage within Norway's recommended conservative values.

The researchers found that the detection rate for ductal carcinoma in situ (DCIS) and the positive predictive value for cancer (PPV) were statistically significantly higher and the technical recall rate was statistically lower for Selenia over film.

Image quality and dose aside, image archival and presentation are less labor intensive with the digital systems. The one or two medical professionals who used to hang images on light boxes can now concentrate their efforts on other crucial duties. In fact, the entire system runs more smoothly when the light box shortage inherent to analog systems in busy departments is circumvented.

"Overall," Dr. Vigeland said, ***"the digital systems enable radiologists to make a more flexible use of their time."***



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IT & CHANGE MANAGEMENT

Dealing with Staff Resistance to PACS Integration

In 2006, the Orthopaedic University Hospital Balgrist in Zurich treated more than 4,000 inpatients, saw approximately 40,000 clinical outpatients and performed approximately 42,000 radiological exams. The hospital is part of the university healthcare system. Orthopaedic surgery is the dominant clinical discipline. In addition, there are departments for paraplegiology, rheumatology and rehabilitation medicine, anaesthesiology and internal medicine. In 2000, a decision was made to install a PACS. This article deals with the varying degrees of resistance met with from internal staff, and how we overcame these management concerns.

The project team was aware that introducing a PACS was not only an informatics project but that it would change a number of processes both within radiology and in the clinics. After planning, tendering, decision-making and securing of financing the PACS went online in May 2002. An extensive training programme was initiated, and there was extensive internal promotion of the new PACS.

Post-installation Review

A review of the PACS project was performed three months after installation. The result was generally positive on the technical side, in terms of system reliability and functionality, as well as interfaces with the HIS and network capacity. However, the DVD jukebox installed for long-term storage was already slow during heavy outpatient clinics, though most exams were still available via hard disk-based short-term storage. The special equipment required for the operation theatre had long delivery times and was not yet installed.

On the human side, the new PACS was quickly accepted as an additional tool, for instance as a back-up solution when hardcopies were not available or for slide production. However, total integration was proving difficult, as the cost of film was decreasing more slowly than anticipated, in part due to an increasing number of MR exams performed after installation of a second scanner, but also due to the unwillingness of many clinicians to reduce hardcopies. Workflow changes were felt to be extensive, even for the department of radiology, which had been most closely involved in the project.

Tough Measures to Ensure PACS Uptake

The following guidelines were implemented to increase the uptake of PACS and to discourage dependency on hardcopies:

Goal	Expected contribution of PACS
Improve quality of care	• Improvement of image availability • Faster radiology service • New opportunities for quality control
Marketing	• Positioning of the hospital as early adopter of new technology • Faster service than competitors
Cost savings	• Reduction of printing and mailing cost • No replacement of auto-alternators
Productivity	• Reduction of workload for printing and handling of hardcopies • Improved workflow
Scientific documentation	• Electronic administration of studies • 100% availability of documents
Teaching	• Electronic organisation and retrieval of teaching files

Table 1: Goals of the PACS process

- No hardcopy printing for non-orthopaedic clinics.
- Pushing for individual commitments to use PACS in orthopaedic surgery.
- For reluctant surgeons, printing of hardcopy was performed only on individual request.
- Publication of statistics regarding percentage of exams documented on hardcopies.
- Absolutely no reprinting of lost hardcopies.
- Continuous PACS training, including thorough induction of new employees.
- Continuous internal promotion of PACS during morning conferences, with flyers, posters and electronic mailing.
- Refusal to handle any hardcopies by the department of radiology, such as mailing and storage, in contrast to the support provided for electronic data handling.

As expected, resistence against the PACS increased, following these activities. We encountered many of the well-known problems occurring in change management situations (Lewin 1951, Beckhard 1969).

Change Management

Change management "manages the people side of change and realises it effectively" (Hiatt and Creasey, 2003). According to Strebel (1998), there are four typical reactions to major change, as outlined in table 2 (see below).

Another approach to innovation is provided by the Everett Rogers' "diffusion of innovations" theory (1962), which differentiates five categories of product adopters, as outlined in table 3 (see below).

During our PACS project, a mixture of these personality types was found. Early adopters included radiologists, technicians and the informatics team. These persons were treated preferentially with regards to hardware and software upgrades, training and support. The majority of the employees adapted to PACS sooner or later, including most physicians, secretaries, nurses and the administration. This group had standard equipment, training and support.

Finally, there was a small group of traditionalists and resistors who complained about details such as spelling errors in the web viewer entry page. A negligible number of persons spread unfounded rumours about the lack of legal basis for running a PACS or regarding the reliability and technical quality of the PACS manufacturer. The comments of traditionalists and resistors were disregarded.

PACS Review: Four Years Later

Approximately four years after the installation of PACS, our hospital was filmless. Retrieval times were within requirements after the replacement of the DVD jukebox by a hard disk RAID. A number of teleradiology projects had been started. On the other hand, hardware costs increased more than anticipated, due to increasing requirements for processor and RAM for the web viewer used by clinicians. On the human side, PACS was widely accepted within the hospital. The majority of external referring physicians, however, still required film, preventing complete replacement of hardcopies.

Conclusion

A PACS project is a change management project with an important people side. There are many obstacles which can be overcome with persistence, good project management, fast and competent support as well as permanent communication. Major problems must be solved. Details, however, often have to wait, especially when only important to traditionalists and resistors.

Change Agents	Respond actively to change, see it as an opportunity for development of their personality rather than a time-consuming problem.
Bystanders	In principal agree with the necessity of change, but demonstrate a lack of initiative
Traditionalists	See no need to change, are comfortable with the present, focus on security and react passively
Resistors	Fear high losses, use power politics, focus on their position

Table 2. Four typical reactions to major change

Innovators	Venturesome, educated, multiple info sources, greater propensity to take risk
Early adopters	Social leaders, popular, educated
Early majority	Deliberate, many informal social contacts
Late majority	Skeptical, traditional, lower socio-economic status
Laggards	Neighbours and friends are main info sources, fear of debt

Table 3. Five Categories of Product Adopters

CHANGING THE WORLD OF X-RAY IMAGING

Outstanding Qualities of the World's First Direct-Conversion R/F-FPD SHIMADZU FPD safire

safire: **S**himadzu **A**dvanced **F**lat **I**maging **RE**ceptor

The Effective Use of Tomosynthesis in Orthopaedic Surgery: Follow-up after Procedures using Metal

Author: Dr. Hiroyasu Yano, Hachiya Orthopaedic Hospital

Introduction

Opened in 1959, Hachiya Orthopaedic Hospital is committed to providing superior medical care. In keeping with this commitment, we digitalised our ordering system in 1996, completed image digitalisation in 1998, and added a urology department in 2004 to maintain a continuously high level of medical service. Our hospital is a 52-bed acute care hospital that conducts over 550 operations per year, including leading-edge treatments such as minimally invasive artificial joint surgery and endoscopic surgery.

Metal implants, plates and screws are commonly employed during orthopaedic surgery. These frequently cause problems with metal artifacts during CT or MRI examinations of bone union and in post-surgical follow-up observations. This is a report on the use of tomosynthesis to restrict metal artifacts in images.

Current Tomosynthesis Status

Since introducing a flat-panel detector (FPD) in August 2005, we have conducted tomosynthesis examinations on 35 artificial joint cases (20 hip, 10 knee, 5 elbow), 8 spondylodesis cases, 3 arthrodesis cases, and 4 osteosynthesis cases.

Evaluation of Clinical Images

Tomosynthesis images created by the shift-and-add and filtered back projection (FBP) method were compared to CT images using the Shimadzu Sonialvision Safire R/F system with Tomosynthesis Workstation option and the Company A 6-slice CT.

a) X-P b) CT image c) Shift-add method image d) FBP image

Fig. 1

Clinical Images

Clinical Image 1: Post-surgical images of bilateral total hip replacement

The left joint was replaced in a 73-year-old female patient 11 years after bilateral total hip replacement surgery, due to looseness of the stem.

The bilateral hip replacement post-surgical CT image in Fig.1 b) includes significant artifacts due to the implant between the acetabulum and trochanter.

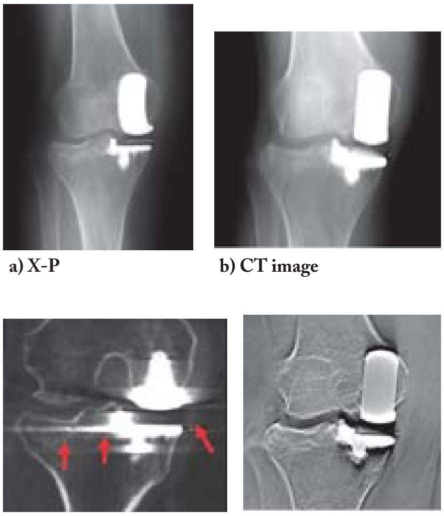
The shift-and-add method image in Fig.1 c) exhibits no effects of artifacts, whereas the FBP image in Fig.1 d) exhibits artifacts in the tube-shift direction and at the boundary of the implant.

Clinical Image 2: Fracture after knee replacement

A 59-year-old female who had undergone knee replacement surgery due to osteoarthritis of the knee suffered a fracture of the lateral tibial plateau due to a fall. The CT image in Fig.2 b) exhibits effects of the implant artifacts to the lateral side of the tibia. However, these effects do not extend to the lateral side in the shift and add method image or the FBP image (Fig.2 c, 2 d).

Clinical Image 3: Follow-up of anterior fusion of cervical vertebrae

After surgery for a cervical hernia on a 39-year-old male, anterior fusion was conducted from the 3rd to the 6th cervical vertebrae, as shown in Fig.3. Periodic follow-up observations were required because of delays in bone union at the bone graft periphery on the 5th and 6th cervical vertebrae. Tomosynthesis was used, due to its lower X-ray dose than CT examinations.



a) X-P b) CT image

c) Shift-add method image d) FBP image

Fig. 2

Evaluation of the bone union of the grafted bone is based on the continuity between the grafted bone and the original bone and on the reduction in radiolucent lines.

As doctors found evaluation difficult due to the strong enhancement of the FBP image in Fig.3 d), the shift-and-add method image in Fig.3 c1) was subsequently used. The shift-and-add method image in Fig.3 c2) taken 1 year and 2 months after surgery shows that bone union is almost complete.

		Radiography	Artifact effects	Artifact generated and 3D images	Flexble image reconstruction	Exposure (thorax)	No. of Images
CT		360 deg. around body axis	Large	Metal artifact Beam hardening	Possible	10 to 20 mGy	200 to 300 average
TomoSynthesis	Shift & add	Linear path, max. 40 deg. With respect radiography position	small	Blurring	Change tomographic plane and slice thickness 3D images not possible	4 to 5 mGy	67 images in 1 direction
	FBP		less than CT	Metal artifact			

Conclusion

Fig.4 compares CT and tomosynthesis images. For CT exams where radiography is conducted while rotating the body axis, the significant metal artifacts centered on the metal and the beam hardening occurring between metals affect the raw images. Blurring occurs along the path of the X-ray tube during tomography.

However, as the images are two dimensional, the effects of the artifacts are less than with CT. Low-artifact images can be achieved by selecting shift-and-add method images or FBP images according to the aim of the examination.

CT is superior in some aspects, as it allows flexible image reconstruction and produces 3D images. However, due to concerns about X-ray exposure from radiodiagnosis, CT examinations have been ranked in the highest exposure class of all radiodiagnostic techniques, with a tissue- absorbed dose between 10 and 100 mGy. As tomosynthesis requires fewer images than CT, the exposure dose should be lower.

Examining these topics and efficiently applying digital image technologies to take even better images in the future should make tomosynthesis an effective means of post-operative follow-up. ❍

a) X-P b) CT image c1) Shift-add method image c2) Shift-add method image d) FBP image

Fig. 3

ACADEMIC MEDICAL CENTRES & MERGERS

Consolidation Leads to Increased Competitiveness

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Concerns over rising healthcare costs have motivated hospitals to seek ways to increase efficiency, decrease costs and improve quality. Hospitals have recognised that consolidation might accomplish these goals. Academic medical centres are especially vulnerable to a changing economic environment, as their teaching and research responsibilities increase the cost of their services and many found that re-organisation and consolidation put them in a more competitive position. This article examines the background, causes, benefits, and pitfalls of hospital mergers. We also analyse related managerial and organisational challenges.

In the US in the 1970s, both federal and state governments enacted various regulations and laws resulting in a shift from expansion to cost control. This altered the incentive for lengthy inpatient admissions and created a decline in demand for inpatient services. Also, the changing environment in healthcare delivery and reimbursement in the late 1980s and '90s sparked a major overhaul in the organisational structure of healthcare institutions, emphasising primary care physicians over specialists and introducing price competition into the marketplace. Factors that influenced this change were:

- Medicare moved from a cost-based to prospective, fixed-price payment system;
- Technological advances enabled more treatment to be provided in a lower-cost outpatient setting;
- Increases in managed care and selective contracting restrained reimbursement rates, enabling close monitoring of service necessity.

Academic Medical Centres Adapt to Market Demands

Academic medical centres faced enormous challenges in this new economic environment. Due to the high cost of the service delivered by them, referrals to academic medical centres from community physicians and hospitals began to decline. As volumes dropped, so did clinical revenues. As the clinical subsidies that supported teaching and research missions declined, the financial structure that supported the whole academic medical system was threatened. Moreover, academic medical centres also faced reductions in Medicare spending in the mid-to-late 1990s.

The academic medical community investigated a number of strategies to overcome the challenges it faced. In this regard, Harrison et al reported three alternatives:

1. "Do it alone" by creating a self-contained integrated delivery system;
2. Consolidate by forming networks or mergers;
3. Separate the college of medicine from the teaching hospital by selling the hospital to a for-profit company.

Perhaps the most hyped merger strategy was consolidation of highly specialised, high-cost programmes and equipment to result in significant savings, enhanced bargaining power to further reduce costs and the pooling of the patient base and increased referrals or market share to support operations.

Three Elements for Success

Three key elements play a critical role in achieving successful merger of health institutions: the consensus of fundamental goals and direction of merger by key leaders, agreement of governance structure and cultural resolution.

The first element crystallises the need for senior administrators from both institutions to reach consensus on the goals and pathways needed to achieve a viable merger. Both strategic direction and day-to-day operations of large organisations like hospitals depend on the skills, visions and team abilities of senior executives. Thus, once corporate-level issues are resolved, departmental leaders can act as liaisons in these discussions to facilitate communication between institutional leaders and clinical departments.

A second element is governance structure. The parties involved need to agree on the level of involvement or autonomy between them. The purpose of a central governance body of a nonprofit organisation is to provide strategic guidance and support but requires constant and proactive communication. In mergers where communication is a priority, more thorough and timely consolidation between departments is achieved.

A third key element to mergers is cultural resolution. Institutional leaders need to reach a consensus regarding cultural merger between two entities. Will they facilitate merger between two institutions by creating a new culture, where the perceptions of "us" versus "them" are minimised or will they retain former cultural practices? When entities retain an "us" versus "them" mentality, a destructive tendency against successful merger between the two departments emerges.

Radiology Departments and Mergers

There are several advantages for radiology departments to merge early during the process. Firstly, radiology is a procedure-based specialty and largely patient independent and therefore may have less departmental idiosyncrasies. Secondly, there are a sizeable number of radiological exams that are location independent, due to ease of electronic imaging relay systems. In addition, there is considerable investment in the property and equipment of radiology, making it extremely capital and space intensive, enabling departments to enjoy the benefits of economic scale. Finally, the level of advanced technology also has a significant impact on the clinical and educational components of academic medical centres.

Partners HealthCare System, Inc.

Brigham and Women's Hospital and Massachussett's General Hospital were among the first academic medical centres to merge in the US. Both are teaching hospitals of Harvard Medical School and were interested in establishing a holding company while preserving their names and identities. A neutral name was selected for the new organisation: Partners HealthCare System, Inc., (PHS). The ultimate power to decide policy for the corporation was given to Partners' Board of Trustees. Accomplishments of the new corporation include:

- The formation of Partners Community Healthcare Inc., (PCHI), a subsidiary corporation that established a network of over 1,000 primary care physicians to serve practices and conduct negotiations with insurers;
- Partners and Dana Farber Cancer Institute to form Partners/Dana Farber Cancer Care for joint clinical, research, and educational programmes in oncology;

> **“Consolidation of services in another location may result in loss of a significant percentage of patients needed to support the operation”**

- Partners’ joint continuing medical education programmes and research projects;
- Merging of half of the residency programmes and one-third of the fellowship programmes into single training programmes across both institutions. Executives of Partners are housed in Boston, MA, midway between both hospitals, and manage a consolidated administrative structure that includes finance, budgeting, information systems, investments, legal issues, marketing, etc.

Avoiding Staff & Patient Loss

Elements that typically lead to the failure of a merger include:

- Allowing anxiety of downsizing or demotion to permeate throughout both hospitals and departments leading to staff departures;
- Retaining separate financial records, information systems, billing systems, and marketing services;
- Merging with an entity geographically far from your institution.

An overwhelming number of mergers do result in layoffs of both managers and rank-and-file staff, so many employees have good cause to feel uneasy in times of change. To many employees, an impending merger spells an uncertain situation with implicit risks. Even if the merger does not eliminate their positions, it will change the way they perform their jobs. A simple memo indicating the will of the leadership to accomplish the merger with as little impact on employment as possible can be helpful.

Particularly for patient referral, the location of an institution is often a critical factor. Consequently, the consolidation of services in another location may result in loss of a significant percentage of patients than were anticipated, to support the operation.

ARE TECHNICAL AND LEGAL STANDARDS FOR PACS TOO HIGH?

Results from Mainz Meeting Indicate a Need for Change

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PACS systems offer many proven benefits compared to film-based services in clinical environments. However, have we set the benchmarks for its implementation and regulation too high? This question was discussed with PACS experts at the HIS/RIS/PACS/DICOM meeting June 6 – 7, 2007 in Mainz, Germany (http://www.unimainz.de/FB/Medizin/Radiologie/agit/Welcome.html). This article follows up by presenting the case for a relaxation of certain significant rules for PACS usage.

Here are some examples of the regulations for PACS usage that were challenged at the Mainz meeting:

- PACS is the most critical application of an enterprise. The up-time must be more than 99.9% with a 24h/365d service.
- All aspects of storage, data security and availability of PACS images must be increased 100 times, if possible 1,000 times above film-based radiology.
- All images must be archived even if they are only for temporary use without clinical relevance.
- A PACS system is mandatory to store all thin slices if a Multi Detector CT (MDCT) is operated.
- Film-based use of MDCT is not allowed.
- No image may be lossy compressed, even if the difference between original and compressed image is less than the difference in quantum noise between two sequential exposures.
- Storage has to be done locally, with high security Storage Area Network systems (SAN) and Network Attached Storage (NAS). External archiving by Application Service Providers (ASP) is not an option.

Is PACS a Critical Application?

At the Mainz meeting, radiologists were asked “Do you classify PACS as a critical application?” Two answered with “yes”, eight with “no”. PACS vendors were asked “Do you provide a 24h/365d service in Germany?” One vendor provides this service in 5% of cases, all others in 0% of the installed base.

In our 2,500 bed hospital, the consensus of the Chairmen of thirty clinical departments was that PACS is not the most critical application. All agreed that the availability of HIS, network and laboratory data are critical, requiring a 24h/365d service. For PACS, we provide several fallback and security mechanisms. Most new radiological modalities are prepared to store image data from three to fourteen days. This time should be sufficient to fix any PACS problems. Paper or film-based printing is available in most hospitals. A quick film reading of emergency cases can be performed at the primary or secondary modality console. In our PACS system the web-server for all clinical departments can be accessed directly by all modalities. During the last six years, these methods have been more than sufficient.

On a typical 8 AM to 6 PM day with high PACS workload, any problems can be fixed within hours by the PACS vendor or IT department. Saturday, Sunday, on holidays and at night-time, the PACS workload is low and radiologists on duty can use prescribed fallback mechanisms. Critical applications in terms of patient safety are CT, radiography, ultrasound and in some environments, angiography. No service contract guarantees the 100% uptime of a CT scanner, hence these critical modalities must be doubly available.

Are Safety Requirements too High?

It is often argued that PACS downtime may not exceed 0.1%. Solutions are often high-level expensive SAN systems with fast image access. Long-term archiving is performed with tape or optical robot systems or hierarchical storage management systems (HSM). Retrieval of these older images often takes up to a half hour depending on the daily workload, speed of the archive system and the quality of the prefetching and autorouting implementation.

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Medical Doctors (respond below)

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

1a. 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)

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

Non-physician professionals (respond below)

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

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

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

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

All respondents reply to the questions below

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

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

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The future is clearly fast online storage and access preferably for four to six years. This reduces access to images in the long-term archive far below 1%. At the Hospital Nuremberg we provide fast online storage with a less expensive solution over six years based on standard IDE and SATA RAID systems. This storage is installed in two independent server rooms with an automatic switchover of the IP address if one system fails. All images over six years are accessible in 1 - 2 seconds. The need for retrieval of images older than six years is nearly zero.

Should we Archive all Images?

The answer is clearly no. The preferable system is as follows:

- Thick slices are sent to PACS by the modality; multiple thin slices go to a workstation. Here they are used for post-processing in a first-in, first-out (FIFO) buffer and are deleted after several days or weeks. If archiving of thin slices is necessary, storage in the PACS has to be done manually. This solution involves time-consuming interaction between technicians and physicians.
- New MDCT scanners provide scan protocols that include the reconstruction of angulated images without displaying the thin slices. Hence, thick slices go to PACS or workstations only if flagged by the scan protocol.
- These algorithms could be included in PACS rules, for example "if thin slice datasets (e.g. >200 slices, <1 mm slice thickness) were used for reconstruction of diagnostic datasets that are also stored in the same study, there was no access to this study for >6 month and no "don't delete" flag exists, images can be deleted automatically". This procedure keeps the online archive fast and small but does not exclude archiving of all images in the long-term archive that is normally done close to the exam date.

When asked "Do you want thin CT-slices to be archived if they are only used for reconstruction of diagnostic thick slices?", only one radiologist at the Mainz meeting answered yes, eight answered no, and there was one abstention.

Why are we Afraid of Lossy Image Compression?

Lossless compression which reduces the amount of data by a factor of about 2.5 is not generally used and lossy compression is not used at all. There are various legal reasons for this. In Germany the "Röntgenverordnung" allows a compression (lossless or lossy) "as long as there is no loss of diagnostic quality". The responsible radiologist has to decide what is diagnostic or not. Hence PACS vendors provide lossy DICOM JPEG2000/Wavelet compressions but PACS users need a common consensus which lossy compression rates are safe and acceptable.

At the Hospital Nuremberg we compress all images after "no touch" for six months with intelligent PACS rules depending on modality and type of study with compression rates between 1:2.5 and 1:10. With this delay all film readings and clinical conferences are performed with original images as well as external long-term archiving close to exam time. This compression reduces online storage volume by a factor of eight, compared to uncompressed data, or 3.2 compared to lossless compression.

At the Mainz meeting radiologists were asked "If there is a consensus of radiologists on safe lossy compression factors, would you use lossy compression?" Ten answered yes, one said no and I was the only one actually using lossy compression.

External Archiving by Application Service Providers

At our hospital, the concept to store everything online (EOL) between five to six years had a strong influence on the decision for long-term archiving. This reduces the slow offline archive from a "working archive" to a "depository under legal aspects" where images must be retrievable in "appropriate time" (legal regulation in Germany "Röntgenverordnung" < 24 hours). Hence, we decided to cooperate with an external ASP. The upload is not time-critical and the download of < 1% requires no high speed WAN connections. Of course the decision for ASP models depends on legal regulations which vary from country to country.

At the Mainz meeting radiologists were asked "Would you use ASP for long-term storage?" Ten answered yes. I was again the only individual present using ASP storage. Clearly the results of the Mainz meeting indicate that is time to think and act differently in future when planning or expanding a PACS system.

THE ROLE OF DICOM IN THERAPY

Coping with Rise in Demand for Surgical Services

A recent report predicted the rise in demand for surgical services to be up to 47% by 2020. Difficulties that are already apparent in the Operating Room (OR), such as the lack of seamless integration of Surgical Assist Systems (SAS) into workflow, will be amplified in the near future. There are many SAS in development or employed in the OR, though their routine use is impeded by the absence of appropriate integration technology and standards. This article explores efforts to develop strategies for improving surgical and interventional workflow assisted by surgical systems and technologies.

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Appropriate integration technologies require correlative IT infrastructure as well as communication and interface standards, such as DICOM, to allow data interchange between surgical system components in the OR. Such an infrastructure system, called a "Therapy Imaging and Model Management System" (TIMMS) supports the essential functions that enable and advance images. A TIMMS provides the infrastructure necessary for surgical/interventional workflow management in the Digital Operating Room (DOR). The design of a TIMMS should be based on a suitable DICOM extension for data, image, information, model and tool communication in order to clarify the position of interfaces and relevant standards for SAS and their specific components.

Therapy Imaging and Model Management System and its Interfaces

The DICOM standard comes closest to providing the basis for the design of TIMMS interfaces. DICOM standardisation aims at providing support to fulfil design criteria derived from software engineering principles when realising ICT systems for medical activities.

Engineering of ICT systems for the assistance of surgical interventional activities implies the specification, design, implementation and testing of Computer Assisted Surgery (CAS) or IGT systems. A number of components for such systems have been developed in academic and industrial settings and are applied in various surgical disciplines. In most cases, however, they are standalone systems with specific ad hoc propriety or vendor interfaces. They can be considered as islands of IT engines and repositories with varying degrees of modularisation and interconnection.

Such a system needs to be designed to provide a highly modular structure. Modules may be defined on different granulation levels. A first list of components (e.g. high and low level modules) comprising engines and repositories of an SAS, which should be integrated by a TIMMS, is currently being compiled within the DICOM WG 24 "DICOM in Surgery".

Fig. 1 (page 32), demonstrates a high-level generic modular structure for an SAS. High-level modules are abstracted from many specific CAS/IGT systems that have been developed in recent years. In general, a combination of these can be found in most R&D and commercial SAS systems. The "Kernel for workflow, knowledge and decision management" in Fig. 1 provides the strategic intelligence for preoperative planning and intraoperative execution. Often this module or parts thereof is integrated into other engines, as required.

Steps Towards DICOM in Surgery

Medical imaging and communication standards are well defined by DICOM and are an integral part of TIMMS. Most of the Image and Presentation States (IOD), defined in DICOM, etc. are also relevant to surgery.

However, models and associated management have not been considered in DICOM intensively, except through some work done in DICOM WG 07, WG 17 and WG 22. Modelling and simulation in surgery however, are key functions for SAS pre- and intra-operatively. The interfacing of tools supporting these functions represents a new scope for DICOM.

It will be a significant extension of current DICOM efforts to complement an image-centric view with a model-centric view for developing DICOM objects and services. Some IODs that make use of the concept of a model are listed in DICOM PS 3.3 as part of annex C 8.8., "radiotherapy modules". Currently, approximately 40 modules have been specified for radiation therapy. They imply a limited spectrum of data types and data structures with different degrees of complexity, e.g. simple lists or tree structures. In the context of a TIMMS, a more comprehensive view on modelling than for example in RT, will be necessary. Not only as regards the modelling tools for generating different types of data structures, but also with respect to the modelling engine that carries out the modelling task. This engine will occupy a central position in the design of a SAS and the TIMMS infrastructure.

By default, the broader the spectrum of different types of interventional/surgical workflows that must be considered for standard interfacing support, the more effort has to be given for designing appropriate IOD modules and services. The following list contains examples of modelling tools and aspects that may have to be considered in DICOM WG 24:

- Geometric modelling incl. volume and surface representations
- Properties of cells and tissue
- Segmentation and reconstruction
- Biomechanics and damage
- Tissue growth
- Tissue shift
- Prosthesis modelling
- Fabrication model for custom prosthesis
- Properties of biomaterials
- Atlas-based anatomic modelling
- Template modelling
- FEM of medical devices and anatomic tissue
- Collision response strategies for constraint deformable objects

One of the first tasks of DICOM WG 24 "DICOM in Surgery" is to agree on a list of relevant models to be considered for DICOM IODs etc.

Following the inauguration of WG24 on June 25, 2005 during CARS 2005 in Berlin, the following roadmap has been agreed on by the members of WG24:

1. Identify and build up a user community of IGS disciplines in WG24. Initially five surgical disciplines (Neuro, ENT, cardiac, orthopaedics, thoracoabdominal and interventional radiology) have been selected. Anaesthesia is included as long as surgery is affected.

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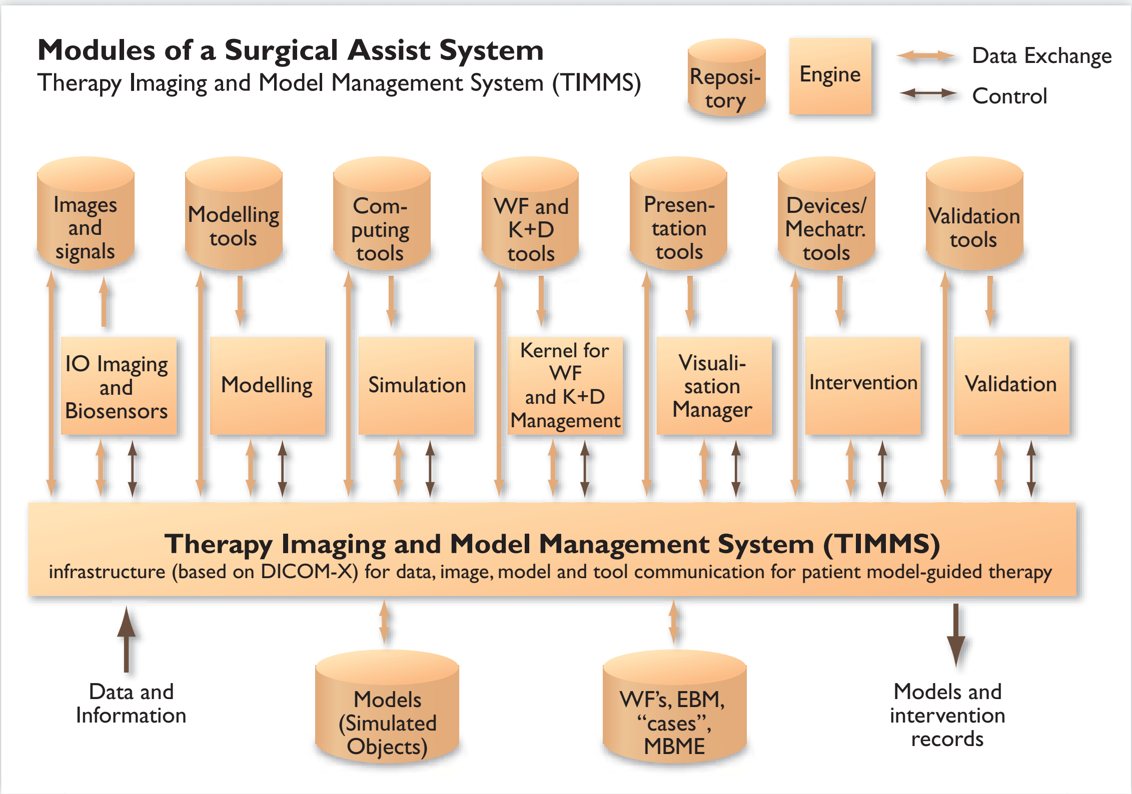

Fig. 1: Therapy Imaging and Model Management System (TIMMS)

FOCUS ON INTERVENTIONAL RADIOLOGY EQUIPMENT

Technology Drives Clinical Practice

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Interventional radiology (IR) refers to a wide range of minimally invasive procedures in which radiology equipment is used to guide interventions, such as stenting, biopsy, embolisation, and ablation. While guidance can be achieved with various radiologic modalities, including fluoroscopy, ultrasound, computed tomography, and magnetic resonance, the term interventional radiology usually refers to the use of x-ray fluoroscopy-based equipment. In recent years a number of technological developments have increased the usefulness of IR. This article will review the improvements in IR equipment and the possibilities for the future.

Flat Panel Technology

For many years, image intensifiers mounted on a C-arm have provided useful service and this technology can be considered mature. However, image intensifiers are not only bulky but are also susceptible to image distortion and have limited dynamic range. Flat panel detectors offer a number of advantages.

Electronic flat panel detectors were first developed to provide digital radiography without the need to transport image cassettes between the patient and the image plate reader, as is necessary with computed radiography. Cutting out the transport step means that images are available within about ten seconds of an exposure, so efficiency is greatly improved. The next development was to modify the radiographic detectors for fluoroscopic use. To achieve this modification two significant differences needed to be addressed: fluoroscopy uses much lower x-ray dose rates and image read times of up to 60 frames per second are necessary.

Adoption of Flat Panel Technology

The first commercial flat panel detector was introduced in the late 1990's by Marconi (previously known as Picker, now part of Philips) as an add-on to the Mx8000 CT system. The FACTS (Fluoro-Assist Computed Tomography) was designed to help CT-guided interventional procedures by allowing greater access to the patient than is possible with CT. However, the concept never gained wide clinical acceptance. In 2000, GE Healthcare introduced a cardiology interventional system, the Innova 2000. This was truly the first fluoroscopy flat panel to gain widespread acceptance for an interventional application. Cardiology was chosen first since a relatively small detector is sufficient. Cardiologists quickly recognised the advantages of the flat panel, for example, the lack of distortion and even image quality. What is more, the flat panels are physically smaller, so they are less obtrusive. So, despite the higher cost (about $200,000 or more), flat panel-based cardiology systems quickly replaced image intensifier based systems. Technical issues, in particular the detector size issue and the higher cost, meant that general radiology interventional systems were not yet available. However, as the detectors improved it was inevitable that image intensifier based interventional radiology would become obsolete.

Reduced Radiation Dose

At the same time the greater computer power becoming widely available enabled manufacturers to improve capabilities. Some developments were made that significantly reduced radiation exposure. For example, last image hold, virtual collimators, and fluoroscopy storage all help reduce the amount of fluoroscopy time and, therefore, the radiation dose.

Image Processing Presents More Information

All fluoroscopy images are two-dimensional. Anatomy, however, is three-dimensional. In applications in which more 3D information is essential, the traditional approach was to use a biplane system. The resulting two orthogonal views help neuroradiologists and paediatric cardiologists gain an accurate understanding of vasculature. The other solution is to use CT. CT fluoroscopy is widely used, particularly for biopsies. However, the limited coverage (present day CT systems have a maximum of 4 cm), the high doses to the operator, and the limited access to the patient, mean that CT fluoroscopy is limited. Also, judging by the very limited adoption of the FACTS system mentioned above, neither is a combined CT and fluoroscopy system a practical solution.

3D Angiography

However, this increased computer power enabled the development of rotational angiography. The idea is

continued on p.45

HEALTHCARE PRODUCT COMPARISON CHART

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For more information, visit *www.ecri.org*

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Footnotes to the Product Comparison Chart

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

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

SUPPLIER	ECRI[1]
MODEL	**General Angiography**
PA GANTRY	
Configuration	
Depth, cm (in)	107 (42.1)
RAO projection	120
LAO projection	120
Cranial-to-caudal angulation, deg	±50
SID range, cm (in)	90-105 (35.4-41.3)
Motorized/manual	Motorized
Counterbalanced	
Support	
Park capability	
TABLETOP	
Motion	4-way
L x W, cm (in)	320 x 43 (126 x 16.9)
Vertical	90-116 (35.4-45.7)
Lateral	±20 (7.9)
Longitudinal	170 (66.9)
Maximum patient weight, kg (lb)	200 (440)
X-ray density	
ROTATIONAL ANGIOGRAPHY	
X-RAY GENERATOR	
Model	
Type	
Power rating, kW @ 100 kVp	100
Radiographic mA	1000
Radiographic kV	60-150 kVp
Radiographic timer	Up to 1.5 seconds
Fluoroscopic mA	10
Fluoroscopic kV	60-110 kVp
X-ray tubes, maximum number	2
Pulsed fluoroscopy	Yes
Cine range, fps	7.5
X-RAY TUBE	
Power rating, kW	15, 45, 100
Heat storage capacity, HU	1,500,000
Heat dissipation rate, HU/min	300,000
Focal spot size, mm	0.2-0.3, 0.6, 1.0-1.2
Grid pulsed	Yes
Cooling system	Yes
IMAGE INTENSIFIER	
Phosphor diameter	
Input, cm (in)	38 (15), quad
VIDEO INPUT/OUTPUT	
TV camera type	
SNR, dB	60
Scan lines	
NUMBER OF MONITORS	
Monitor sizes	21"
DATA COMPRESSION	DICOM
IMAGE STORAGE	
512 x 512, images	48,000
1024 x 1024, images	12,000
Additional storage	User preference
DIGITAL IMAGING SYSTEM	
DICOM 3.0 COMPLIANT	Yes
MINIMUM ROOM SIZE, m (ft)	
MINIMUM ROOM H, m (ft)	
OTHER SPECIFICATIONS	
LAST UPDATED	

SHIMADZU **BRANSIST safire Bi-plane (MH-300/400)**	SHIMADZU **BRANSIST safire HC/VC (MH-200S)**	SHIMADZU **BRANSIST safire HF/VF (MH-300)**	PHILIPS **INTEGRIS H5000 Ceiling or Floor**	PHILIPS **MultiDiagnost Eleva**
C	C	C	Floor or ceiling G	Floor C
90 (35.4)	90 (35.4)	90 (35.4)	105 (41.3)	90 (35.4)
120	120	120	120 motorized	90
120	120	120	120 motorized	90
50/45	50/45	50/45	45/45	45/45
90-115 (35.4-45.3)	90-115 (35.4-45.3)	90-115 (35.4-45.3)	86.5-123 (34-48.4)	95-120 (37.4-47.2)
Motorized	Motorized	Motorized	Motorized	Motorized
Yes	Yes	Yes	Not required	BodyGuard
Floor	Ceiling support	Floor	Floor and ceiling	Floor
Yes	Yes	Yes	Yes	Yes
All-way floating, 270° rotation	All-way floating, 270° rotation	All-way floating, 270° rotation	4-way floating, AD-5	Stationary
288 x 70 (113 x 27.5)	288 x 70 (113 x 27.5)	288 x 70 (113 x 27.5)	293 x 50 (115 x 20)	220 x 56 (87 x 22)
36(14)	36(14)	36(14)	76-104 (30-41)	70-140 (27.6-55.1)
±15 (5.9)	±15 (5.9)	±15 (5.9)	±18 (7)	+28 to -12.2 (+11 to -4.8)
135 (53)	135 (53)	135 (53)	100 (39.4)	160 (63) C-arm, 198 (77) patient
227kgs (504) + 100kg(CPR)	227kgs (504) + 100kg(CPR)	227kgs (504) + 100kg(CPR)	200 (441); 300 (661) for CPR	185 (407.9)
0.8 mm Al	0.8 mm Al	0.8 mm Al	<1 mm Al	<1 mm Al
Up to 60°/second, Option	Up to 60°/second, Option	Up to 60°/second, Option	Not specified	No
UD150G-40	UD150G-40	UD150G-40	OMCP power pack	VelaraOptimus TC
High-frequency	High-frequency	High-frequency	High-frequency	High-frequency
100	100	100	100	80, 100
10-1,250	10-1,250	10-1,250	10-1,000	10-1,000
40-150 (1 kV steps)	40-150 (1 kV steps)	40-150 (1 kV steps)	40-150	40-150
0.001-25 seconds	0.001-25 seconds	0.001-25 seconds	0.001-1.6 seconds	0.001-4 seconds
0.3 - 30	0.3 - 30	0.3 - 30	0.1-7.5	0.1-6
50-125(1 kV steps)	50-125(1 kV steps)	50-125(1 kV steps)	40-110	40-110
2 (3 by option)	2 (3 by option)	2 (3 by option)	3	2
Yes	Yes	Yes	Grid switched	Grid switched/pulsed
30	30	30	15-60	Optional 1-30
100	100	100	44/80 (MRM); optional 45/85 (MRC)	Not specified
3,000,000	3,000,000	3,000,000	1,400,000 (MRM); optional 2,400,000 (MRC)	800,000
462,000	462,000	462,000	Optional 900,000 (MRC)	245,000
0.5, 0.8	0.5, 0.8	0.5, 0.8	0.5, 0.8	0.6, 0.8
Yes	Yes	Yes	Yes	Optional
Water circulation	Water circulation	Water circulation	Recirculating oil	Water
Direct Conversion Flat Panel Detector	Direct Conversion Flat Panel Detector	Direct Conversion Flat Panel Detector		
22.1cm x 22.1cm, 19.2 x 19.2, 15.3 x 15.3, 11.5 x 11.5	For Cardiac "HC9": 9x9/7.5x7.5/6x6/4.5x4.5 (inch) For Angiography "VC17": 17x17/15x15/12x12/9x9 (inch)	For Cardiac "HF9": 9x9/7.5x7.5/6x6/4.5x4.5 (inch) For Angiography "VF17": 17x17/15x15/12x12/9x9 (inch)	23, 18, 13 (9, 7, 5)	38, 20, 25, 20, 17 (15, 12, 10, 8, 6.7)
Direct Conversion Flat Panel Detector	Direct Conversion Flat Panel Detector	Direct Conversion Flat Panel Detector	CCD	CCD
			67	51 @ 300 nA
1472 x 1472 pixels	1472 x 1472 pixels	1472 x 1472 pixels	Not specified	1,024/512
8	4	4	2	1, 2, 3
18"	18"	18"	21"	17", 18", or 21"
DICOM	DICOM	DICOM	2:1 cardiac; 1:1 vascular	Not specified
			36,000 (8-bit), 14,400 (10-bit)	240,000
100,000	100,000	100,000	9,000 (8-bit), 3,600 (10-bit); 25% of 512 x 512 matrix	60,000
HD, DVD-R	HD, DVD-R	HD, DVD-R	Not specified	Not specified
DAR-9400f	DAR-9400f	DAR-9400f	Integrated	Extended digital imaging
Yes	Yes	Yes	Yes	Yes
7m x 6m	7m x 6m	7m x 6m	5.9 x 4 (19.3 x 13.2); ceiling version is 6.2 (20.5) in length	3 x 2.6 (9.8 x 8.4)
2.85m	2.85m	2.85m	2.9 (9.5)	Not specified
Direct Conversion Superfine Detector; Lateral-moving C-arm; CyberChase; One-hand C-arm Control Grip; IVR-NEO for tableside image processing and management; Movie MAP; Maskless Realtime DSA option; Speedy Parallel Processing Digital Station; Safety sensors; Meets requirements of DEKRA, EN 29001 and 46001, ETL, IEC 601-1, ISO 9001, JIS-T-1001, Z-9901.	Direct Conversion Superfine Detector; Lateral-moving C-arm; One-hand C-arm Control Grip; IVR-NEO for tableside image processing and management; Movie MAP; Maskless Realtime DSA option; Speedy Parallel Processing Digital Station; Safety sensors; Meets requirements of DEKRA, EN 29001 and 46001, ETL, IEC 601-1, ISO 9001, JIS-T-1001, Z-9901.	Direct Conversion Superfine Detector; TriplePivot Lateral-moving C-arm; One-hand C-arm Control Grip; IVR-NEO for tableside image processing and management; Movie MAP; Maskless Realtime DSA option; Speedy Parallel Processing Digital Station; Safety sensors; Meets requirements of DEKRA, EN 29001 and 46001, ETL, IEC 601-1, ISO 9001, JIS-T-1001, Z-9901.	PA gantry uses collision avoidance patient protection; optional motorized park.	90/90° table tilt; 20/20° table roll; optional grid-controlled fluoroscopy.
1/09/2007	1/09/2007	1/09/2007	1/03/2006	1/03/2006

SUPPLIER	ECRI[1]	ITALRAY	NEUSOFT	NEUSOFT
MODEL	**General Angiography**	**Clinodigit Compact**	**NAX-500/800/1000 R/F**	**NSX-RF3900**
PA GANTRY				
Configuration		Tilting table	NA	NA
Depth, cm (in)	107 (42.1)	NA	NA	NA
RAO projection	120	NA	NA	NA
LAO projection	120	NA	NA	NA
Cranial-to-caudal angulation, deg	±50	±40 (with independent ±180 tube angulation)	NA	NA
SID range, cm (in)	90-105 (35.4-41.3)	115-150 (45.3-59.1)	NA	NA
Motorized/manual	Motorized	Motorized	NA	NA
Counterbalanced		NA	NA	NA
Support		Floor	NA	NA
Park capability		NA	NA	NA
TABLETOP				
Motion	4-way	4-way elevating	Lateral	Lateral/longitudinal
L x W, cm (in)	320 x 43 (126 x 16.9)	210 x 74 (82.7 x 29.1)	21.1 x 13.6 (8.3 x 5.4)	222 x 77.8
Vertical	90-116 (35.4-45.7)	76-100 (29.9-39.4)	Not specified	Not specified
Lateral	±20 (7.9)	34 (13.4)	±11 (4.3)	±11
Longitudinal	170 (66.9)	95 (37.4)	Not specified	±35
Maximum patient weight, kg (lb)	200 (440)	150 (330)	135 (298)	160(353)
X-ray density		<0.5 mm Al	<1 mm Al	0.8 mm AL
ROTATIONAL ANGIOGRAPHY		No	No	No
X-RAY GENERATOR				
Model		Pixel HF 1050	CPI	Not specified
Type		100 kHz	Indico 100	Not specified
Power rating, kW @ 100 kVp	100	80	50, 65, 80	50
Radiographic mA	1,000	25-1,000	10-1,000	10-630
Radiographic kV	60-150 kVp	40-150	40-150	40-150
Radiographic timer	Up to 1.5 seconds	Controlled by AEC	0.002-63 seconds	0.005-63 seconds
Fluoroscopic mA	10	0.5-6, automatic	0.5-6	0.5-6
Fluoroscopic kV	60-110 kVp	40-125, automatic	40-125	40-125
X-ray tubes, maximum number	2	2	1	1
Pulsed fluoroscopy	Yes	Yes	Yes	Yes
Cine range, fps	7.5	Up to 60	Up to 30	Up to 30
X-RAY TUBE				
Power rating, kW	15, 45, 100	40/100 (small/large focal spot)	Not specified	Not specified
Heat storage capacity, HU	1,500,000	2,000,000	300,000	300,000
Heat dissipation rate, HU/min	300,000	1,000 W	Not specified	Not specified
Focal spot size, mm	0.2-0.3, 0.6, 1.0-1.2	0.6, 1.3	0.6, 1.2	0.6, 1.2
Grid pulsed	Yes	Yes	No	No
Cooling system	Yes	Oil/forced air	Air	Air
IMAGE INTENSIFIER				
Phosphor diameter		Not specified		
Input, cm (in)	38 (15), quad	40, 35.5, 32, 23 (16, 14, 12, 9)	32, 24, 16 (12, 9, 6)	23, 16, 14 (9, 6.7, 5.5); 32, 24, 16 (12, 9, 6.7)
VIDEO INPUT/OUTPUT				
TV camera type		CCD progressive interline scan	CCD	CCD
SNR, dB	60	?66	66	60
Scan lines		1024 x 1024	1024 x 1024	1024 x 1024
NUMBER OF MONITORS		2 exam, 2 central	2	3
Monitor sizes	21"	18" LCD	17"	15", 19", 18"
DATA COMPRESSION	DICOM	Available	Lossless	Lossless
IMAGE STORAGE				
512 x 512, images	48,000	NA	NA	NA
1024 x 1024, images	12,000	75,000	40,000	10,000
Additional storage	User preference	150,000 (1024 x 512)	Optical disk, 640 MB	CD-RW 700 MB
DIGITAL IMAGING SYSTEM		X FRAME CCD	Yes	Yes
DICOM 3.0 COMPLIANT	Yes	Yes	Yes	Yes
MINIMUM ROOM SIZE, m (ft)		4 x 4.5 (13.2 x 14.8)	5 x 4.5 (16.4 x 14.8)	Not specified
MINIMUM ROOM H, m (ft)		2.9 (9.2)	Not specified	Not specified
OTHER SPECIFICATIONS		None specified	Meets requirements of IEC 60601-1.	None specified
LAST UPDATED		1/03/2006	1/03/2006	1/03/2006

Author Guidelines

for Imaging Management

CONTENT

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Thank you,

The IMAGING Management Editorial Team

HEALTHCARE AND THE MEDICAL PROFESSION IN FINLAND

Overview of National Healthcare Services

The aim of Finnish health policy is to lengthen the active and healthy lifespan of citizens, to improve quality of life, and to diminish differences in health between population groups. In 2002 there were more than 19,000 doctors in Finland. Almost 1,000 Finnish doctors of working age live abroad and some 200 foreign doctors practice in Finland under temporary licences. About half of the Finnish medical profession is female.

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The child mortality rate in Finland is one of the lowest in the world; the infant mortality rate is below 4%. The life expectancy for women is 81 years, for a man, 73 years. The life expectancy of Finnish men is impaired by cardiovascular disease, excessive consumption of alcohol and accidents. Cardiovascular mortality has declined in response to effective health and nutritional education in recent decades but excessive blood cholesterol levels and obesity remain common in Finland. Smoking and drug abuse are significantly less frequent in Finland than in Europe on average. Prevention receives particular emphasis in primary healthcare.

Primary Healthcare in Finland

Finland is divided into some 450 municipalities. Each municipality is responsible for arranging healthcare for its inhabitants. Primary healthcare is provided by health centres established by a single municipality or jointly by neighbouring municipalities.Municipalities have the right to buy services from other municipalities or from the private sector. Health centre services include medical consultations and provision of dental care, preventive care and environmental healthcare. Health centres run maternity and child health clinics, and arrange school and occupational health services.

Finnish municipalities have switched from a primary healthcare system to a family doctor system. Each family doctor is responsible for about 2,000 patients. The aim is for a patient to be able to contact her or his doctor and have needs for treatment assessed within three working days. This system has proved very successful.

Benefits of long-term treatment relationships include a reduced need for hospital exams and reduced healthcare costs. Outpatient care is also provided by occupational and private healthcare units. Employers are under an obligation to arrange occupational healthcare for employees which can be arranged through municipal health centres or private practitioners. About 4% of Finnish doctors work in occupational healthcare, offering both preventive services and primary healthcare.

Specialist Care

Finland is divided into 20 hospital districts, each providing specialist consultation and care for its population. Local municipal authorities are responsible for funding specialist treatment for inhabitants of their areas. Each hospital district has a central hospital with departments for main specialties. Finland has five university hospitals. These provide the most advanced medical care, including highly specialised surgery and treatment for rare diseases. The university hospitals are also mainly responsible for the clinical training of medical students, and for medical research. In comparison with the situation in other countries, the number of hospital beds in Finland is fairly high.

There has been a trend towards reducing the number of hospital beds by grading of care, which means that milder cases are treated in outpatient care and health centres and more severe cases in hospitals. Other ways

> **"Adequate supply of doctors should be ensured by improving working conditions rather than increasing student numbers"**

of reducing the number of hospital beds include introducing short-term postoperative treatment and transferring patients, for example those receiving psychiatric treatment, to receive outpatient care. The number of emergency units has also been reduced in an effort to save costs and reduce the workloads of doctors.

Costs of Public Healthcare

Health services are available to all in Finland, regardless of their financial situation. Public health services are mainly financed from tax revenues; partly municipal, partly state tax. Central government's contribution to municipal healthcare is determined by population numbers, age structures and morbidity statistics. A number of other factors also affect its computation. Finland spends less than 7% of its gross national product on healthcare, one of the lowest among EU member states. The public sector finances 76% of total healthcare expenditure, users of services 20% and others 4%. Other contributors include employers, private insurance and benefit societies.

Private Healthcare

Private medical treatment is provided by municipalities and the state. Particularly in cities, many doctors, dentists, and physiotherapists offer private care. There are also a few small private hospitals. Only about 8% of Finnish doctors earn their living solely as private practitioners. However, about one third of doctors run a private practice in addition to working in a hospital or health centre. Most private practitioners now work in group practices.

Everyone in Finland is covered by obligatory sickness insurance, funded through taxes by the state, municipalities, employers and the insured population. The sickness insurance scheme reimburses fees paid by patients to private doctors, costs of medicines prescribed, and transportation costs arising from treatment of illness. By far the greatest expenditure in relation to health insurance is compensation for sick leave and parental leave. All licensed Finnish doctors are covered by the reimbursement system, which is administered by the social insurance institution

Medical Education in Finland

In Finland, basic medical education is given in five universities (Helsinki, Tampere, Turku, Oulu, and Kuopio). There is substantial competition for places in medical schools. The number of applicants is four or five times higher than the number admitted. The FMA has tried to persuade the authorities to bring numbers of students into correspondence with numbers of doctors needed. The view of the FMA is that adequate supply of doctors should be ensured by improving remuneration and working conditions of doctors rather than by increasing numbers of students. Studies have traditionally involved an initial two-year preclinical period of mainly theoretical courses in anatomy, biochemistry, pharmacology, etc. However, students now have contact with patients from the beginning of their studies.

A problem-based learning method has been introduced. All medical schools have research programmes for students who wish to undertake scientific work. Inclusion of clinical cases in various courses and preclinical subjects is becoming common. During the clinical period of their courses, students participate in the work of various hospital and health centre departments, learning necessary medical skills. After each clinical course, students have to pass a final examination in the specialty. Basic medical education lasts for some six and a half years and leads to the degree of Licentiate of Medicine.

Facts about Finland (2002)	
Area	338,145 km^2
Population	5.2 million
Population density	17/km^2
Capital	Helsinki
Inhabitants	560,000
Official languages	Finnish 92%, Swedish 6%
Major religions	Lutheran 85%, Orthodox 1%
GDP per head	26,000 Euros
Number of doctors	19,336
Inhabitants/doctor	269

Table 1: Facts about Finland (2002)

MANAGEMENT CHALLENGES FOR RADIOLOGY IN FINLAND

Reorganising Departmental Activities for Greater Effectiveness

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Municipalities in Finland are responsible for arranging healthcare services for the people living in their area. The hospital district of Helsinki and Uusimaa, owned by thirty-one member municipalities, is a publicly-funded specialised medical care organisation. Helsinki city is the biggest municipality owner of the group, providing services to over 1.5 million people. The University of Helsinki is also an owner of this organisation, and includes fifteen hospitals, of which eleven have university hospital status.

Since 2004, the HUS Helsinki Medical Imaging Centre (HMIC) is responsible for the provision of radiological services for the hospital district of Helsinki and Uusimaa. HMIC offers radiological services to fourteen hospitals.

Municipality owners also have their own primary healthcare organisations, which have been equipped with conventional radiographic and ultrasonographic tools since the 1970's. When the Hospital District of Helsinki and Uusimaa was established, Helsinki City handed over its primary healthcare radiological services to HMIC. After that, many other municipalities took the same decision, and today HMIC offers primary radiological services in sixteen of its thirty-one owner municipalities. The integration of specialty and primary radiological services reduces overlapping activities, increases the use of radiological equipment and decreases the number of radiological exams, generating cost savings for the municipalities.

Financial Facts about HMIC

The 2007 budget of HMIC is 68.7 million Euros. Pre- and post-tax profits are forecasted to be 1 million Euros. The number of employees is 790, of which 171 are radiologists, 466 radiographers, and 153 other staff. The number of radiological exams is 800,000 per year. Conventional radiography accounts for 69% of all exams, CT 10%, ultrasound 13%, and MRI 5%.

The annual investment level is under 10 million Euros. There are nine MRI scanners, of which one is a 3T unit, as well as thirty ultrasound scanners and fifteen CT scanners, of which two are 64-slice scanners. The organisation also has fourteen DR and twenty CR systems for conventional radiography.

Protocols that Serve Patients and Doctors

HMIC operates on the principal of the patient's right to be examined with the right radiological equipment based on careful clinical tests done for the patient and patient's disease history. The right imaging protocol is also provided. Exam results must be available when the referring doctor needs them for treatment decision-making. In big organisations like HMIC, there are very varied pools of radiological knowledge. Networking this knowledge results in more accurate radiological diagnoses and enables quicker consultations. The patients can choose the department where the exam is done, except for MRI and CT exams.

Uniform Processes

In order to efficiently manage a big organisation, processes must work fluidly. With fourteen radiological departments and studies carried out in 30 different buildings, core and supportive processes cross all HMIC departments in order to achieve uniformity. The two core processes are diagnostics and research/teaching. HMIC has four diagnostic processes: conventional radiography; ultrasonography; CT and MRI; fluoroscopy, angiography and radiological interventions. The purpose is to do the radiological exam in a uniform way across the whole organisation. With this in mind, each of the fourteen radiological sites are networked. The integration of radiological services between these buildings is supported by the HUSPacs IT solution and a domestic RIS. HUSPacs is one the biggest regional PACS in Europe.

The owner of each diagnostic process is responsible for developing, planning, and coordinating their process and for planning investments in radiological equipment. The target is to allocate scarce resources in an efficient way between the different departments. When planning radiological investments, attention is paid to the utilisation capacity of the investment. Process owners also participate in allocating the use of human resources.

Economic Background

HMIC is a non-profit or low-profit public organisation, which finances its activities from money coming from services given to patients and paid for by the responsible municipalities. The economic situation of the municipalities determines the targets and frames for HMIC. HMIC uses so much capital for its huge running costs that global business models are followed to ensure smooth management. Much attention is paid to cost-control. HMIC's size gives it synergies and excellent opportunities to utilise scale of economies, for example in investments.

> **"Adequate supply of doctors should be ensured by improving working conditions rather than increasing student numbers"**

Human Resources

In Finland, there is a shortage of radiologists. Public hospitals have difficulties in hiring radiologists, and the workload for those in employment is high. In HMIC, the additional challenge is to balance the workload of radiologists and radiographers between different departments. HMIC has hired private sector radiologists to read and report exams to assist in this. In public hospitals, the incentives for personnel are fewer than in private practices. However, the trend is to increase incentives in public hospitals also. As a hospital with university status, HMIC pays attention to educating personnel. The interesting nature of radiological work at the university hospital appeals to many radiologists and radiographers.

Management

HMIC is an organisation of many kinds of professionals. This presents a challenge in leading and managing the enterprise. Having university hospital status does not make it easier. The essential role of the managing director is to be visionary. Changes in radiological business are rapid and must be noted in the development and planning of activities. At the same time, increasing healthcare costs cause additional challenges for management. The main task of the managing director is to ensure that economic and functional targets, assessed by the HMIC board and the Council of the Hospital District of Helsinki and Uusimaa, are achieved.

Radiological departments are run by chief radiologists and chief radiographers responsible for arranging daily work in their departments. Department chiefs must negotiate with process owners for daily investment and human resource needs. The role of the headquarters of HMIC is planning, development and coordination of radiological activities within the whole HMIC organisation.

Achievements

Every year we see positive results from our tight managerial procedures. The ordered exams have been carried out at the right time, within time limits set by Finnish standards. Costs have been within target budgets. An annual decrease in indexed costs has been at the level of 3%. This has resulted in a good price stability, and for the three last years, the nominal prices have remained unchanged.

Future Challenges

Until the present time, HMIC has concentrated on expanding and taking over integrated radiological services in the Hospital District of Helsinki and Uusimaa. In the near future, the target is to reorganise radiological activities to achieve additional synergies, economies of scale and cost savings and to secure regional radiological services for patients. When reorganising HMIC's activities, identifying and balancing the interests of the stakeholders is crucial. In the near future, further development of processes is required.

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FINNISH NATIONAL EHR PROJECT

An Interoperable Infrastructure for eHealth

Launched in 2001, the Finnish EHR project defines the basic level of semantic interoperability of EHRs and the national communication infrastructure for eHealth. The main building blocks of this architecture are eArchiving services and a national communication platform. This platform integrates all local EHR systems and the eArchive. The eArchive preserves not only narrative EHRs but also images and also supports gross organisational seamless care by disclosing health records. First national eHealth services are e-prescribing and the preservation and distribution of EHRs and digitalised images. A new law allows all EHR systems storing digitalised EHRs to use national services after 2011.

The national communication platform is financed both by the Ministry of Social Affairs and Health and public and private service providers. The platform will start its service in Spring 2008 and should be fully operational by the end of 2011. The platform offers both promises and challenges. Using the national eArchive it is possible to create one virtual lifelong personal health record for every citizen which can be used for profiling, prevention and prediction of the future health status and risks.

Typical eHealth services available via the internet are booking and information services, disease and lifestyle management and home care. The eArchive also offers citizens access to his or her own EHR and audit logs generated by the eArchive. Because all official eHealth services will use the national web service platform, it is also a natural platform for future consumer-oriented eHealth services.

Background – Digitisation in Finland

The first eHealth strategy established by the Ministry of Social Affairs and Health was published in May 1996 built around the principle of secure information sharing and ICT support for seamless citizen-centred care. This strategy was updated in 1998 with the following targets: adoption of EHRs in all levels of care, nationwide interoperability, high-level security and privacy protection and citizens' access to their records via the internet. This strategy was realised by the implementation of regional cooperative EHR systems (RHIS) with common middleware services. RHIS supported the transmission of eReferrals, eConsultation messages and digitalised images.

Structure of the Finnish EHR

In Finland every health organisation has the responsibility to manage and archive health records. Inside the service organisation the health record is personal and lifelong. Based on national regulations health records must be archived up to 100 years and images should be archived for 20 years.

In Finland the collection of care information is based on documents. Those documents represent snap-shots of the dynamic care process. For security and confidentiality, after every care episode, the responsible physician must sign the EHR. The internal organisation of the Finnish health record is very close to the structure defined in the open EHR standard. The EHR has folders for every specialty and inside a folder there is a set of cumulative episodes. Episodes are organised under headings. Each headed section is lifelong and cumulative.

Securing the Future of Healthcare

In 2001, the Finnish government launched the national programme for securing the future of healthcare. One of the eighteen projects of the programme concerns the implementation of national, interoperable EHRs. Messaging methods are based on HL7 CDA and DICOM messages for communication. A national core data set was created for semantic interoperability.

The long term tradition in Finland has been to develop both strategy and supporting legislation in parallel. A new act regulating the management and use of electronic health information has been developed. This act regulates the collection and disclosure of EHRs and sets minimum security and privacy protection rules. The updated eHealth strategy and new legislation form the road-map for the implementation of future eHealth services in Finland.

The national communication architecture is targeted to support both the technical and semantic interoperability of EHRs and to solve the problem of the long-term availability and usability of EHRs. Security services are also one of the key functions of the platform. In the architecture, the web-service platform acts as an integration machine. Information between legacy systems and common services are transferred in the form of documents. Citizens and patient are connected to the eArchive via web services.

Technical interoperability is achieved using standardised messages. Messages accepted at the present time are HL7CDA R2 and DICOM. ePrescriptions are transferred in the form of HL7 v.3 messages. All messages have a header with harmonised meta-data and a structured body section supporting the previously-mentioned EHR structure.

Semantic interoperability is archived by making the use of national core data sets, selected classifications and EHR headings mandatory. All terms and classifications can be downloaded from the term code server. Long-term availability of records is achieved by the development of a centralised EHR archive. For security, all documents are signed electronically and transferred in a Simple Object Access Protocol (SOAP) envelope. Healthcare persons and entities are identified and authorised using the common PKI-service. All health professionals have a health professional smart card.

Common Services

Key common services are registration of EHRs, eArchive, consent management, certification service and code and term service. The registering service is the key tool to locate and manage EHRs.

The role of the eArchive is to preserve, disclose and destroy records. The disclosure of EHRs is based on policy rules. In Finland, preconditions for any EHR disclosure are the presence of doctor-patient relationship, patient's consent or explicit legislation. It is the responsibility of legacy systems to create the relationship credential and consent document. A policy engine has been included to the SOA service layer to control the disclosure of EHRs. The eArchive has to prove the availability and security of records during preservation.

The main task of the eArchive is to preserve narrative EHRs, pictures, images and bio-signals. Existing PACS/RIS systems send pictures selected for long term preservation or disclosure in DICOM document format to the eArchive. The national consent service stores all consent documents. Patients maintain the right to check and change their active consent profile. The eArchive must check consent before any data disclosure. National certification services are intended both for healthcare entities and health persons. There is also a national certification service for citizens.

Requirements for the Users of National Services

The main users of common services are legacy systems and patients. Present legacy systems are not ready to be connected to common services. They should be updated and new services should also be developed for citizens. All computer systems connected to the national platform should be certified against functionality, interoperability and security.

Legacy systems should implement the following new services before the use of national services:

1. A data entering application to support common headings, terms, classifications and the core data set;
2. Creation of consent document and relationship credentials;
3. Capturing data from the local database;
4. Creation of HL7CDA and DICOM messages;
5. Creation, preservation and access requests which are sent to the eArchive;
6. Viewing received EHR-messages; and,
7. Generating audit logs.

A secure web service will be developed for citizens accessing the eArchive via the inter-net. A smart citizen card and certification services should be used for security.

HOW TO...
ASSESS STAFF PERFORMANCE IN THE IMAGING DEPARTMENT

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Implementing good staff assessments in the medical imaging department begins at recruitment level. Making sound hiring decisions in the first place ensures as few later difficulties as possible. Don't hire anyone who isn't well qualified or who has questionable career history, is the first piece of advice; it makes assessing staff afterwards much more straightforward.

One of the main challenges in recruiting medical imaging staff in Europe is posed by the national variations in standards throughout Europe and beyond, on what constitutes an adequately qualified radiologist. For example, in Russia it takes a mere three years to become a practicing radiologist, with not even a fixed curriculum for residents by which to assess what areas an applicant has covered. This is in complete contrast to countries such as the United Kingdom and Germany, where curricula are highly regulated. Personality is also important – making sure an applicant has the right personality and can engage effectively in cooperation and teamwork will make their place in your department much smoother.

Keeping Abreast of Evolving Procedures

A candidate's initial education, while important, must be backed up by continuing medical education to ascertain whether or not they are up-to-date with current practice. The US is further evolved in this respect, due in part to the rise in malpractice suits and a more litigious culture. US board examinations, while not mandatory, are generally taken by all, as no decent hospital will hire a radiologist who has not taken and passed these exams. There, radiologists view board exams as a desirable addition to their resumé, an attitude similar to the one in the UK.

The US has also developed e-Learning as a tool to offer continuing specialty-based exams that are again not mandatory, but demonstrate that a medical professional is actively ensuring their education is relevant. It is inevitable that Europe must follow the US in these practices and formalise continuing education with a homogenised set of standards.

For example, in Europe, many medical staff attend such courses, but due to a lack of regulation, it is possible for them to obtain the relevant CME credits without actually attending the course. Big meetings such as the ECR have taken steps to regulate this absenteeism, but smaller courses don't have a formal structure in place to ensure that absent participants are not credited for courses they have not in fact attended.

Evaluating Underachieving Staff

Document, document, document! It is essential to maintain a comprehensive dossier on complaints about all employees to back up any formal procedures that may eventually take place when a member of staff underperforms or is involved in a negative situation with patients or other staff members.

An annual review is a great forum for thrashing out any workplace issues – with a positive 'how can we help you' attitude, where one can give a warning that an incident or behaviour/attitude in the department was inappropriate. This is the generally accepted formal setting for dealing with underachieving staff. The informal way is to evaluate performance amongst peers within the department. In our department, colleagues send each other their cases for second opinion so that at the end of the year we are then able to say how many judgement calls are valid, and how many if at all, adversely affected patients. We hope to formalise this process and I believe it will be a valuable tool in assessing staff.

Other Evaluation Tools

Job descriptions are broken down into secondary task lists for each individual team member. At the annual review, this allows us to compare results to the original standard document. We also maintain a coordinating member of staff for each modality, for example, MR, and their role in this task is also up for annual evaluation to talk about the changes they have experienced over the past year, if they are satisfied with the way they are going and if there are any future changes they wish to implement. It allows us to develop a realistic and fulfilling career path for all members of staff.

Using Staff Information Responsibly

Confidentiality is key in staff assessment. We can use information about staff to inform our decisions in hiring, extending contracts or reviewing performance. We can let it be known to other members of staff if we have a general feeling of reservation about a certain individual, but sharing negative information is clearly discriminatory and must be avoided. All records from staff reviews are held in a central repository only accessible by the record keeper, the board of directors and the Chairman to ensure complete confidentiality.

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that the C-arm can rotate 180∞ around the patient while capturing multiple images. The images can then be back-projected, in much the same way as in CT, to produce a 3D depiction of the anatomy. Angiography was the first application of this, since it is inherently high contrast, on account of the contrast media, allowing the use of low x-ray doses. The earliest implementations were limited due to the five minutes needed for reconstruction. As more computing power was added and the algorithms improved, this delay has been significantly reduced, so that a few seconds is all that is required.

The 3D angiography technique has now been extended to produce more CT-like image performance: in other words, better soft tissue contrast. The idea is that CT-like images can be acquired during an interventional procedure without having to take the patient to a CT scanner mid-procedure. The images, while of insufficient quality for diagnosis, are good enough to guide therapeutic applications.

In fact, while interventional CT images don't have the same contrast resolution found in diagnostic CT, the spatial resolution is better.

Flat Panels Become Necessary for IR

While these applications are theoretically possible with image intensifier-based equipment, the wider dynamic range, high uniformity, and distortion-free image quality mean that flat panel systems are necessary. So, flat panel detectors can now be found on interventional radiology systems from all major manufacturers. More recently, healthcare facilities have a greater variety of biplane flat panel systems to choose from. So, the use of image intensifiers is shrinking. It is mainly due to cost considerations that the radiographic/fluoroscopic systems used in diagnostic applications are still equipped with image intensifiers.

What About the future?

Minimally invasive procedures are becoming increasingly important. Flat panel technology will improve, allowing further dose savings and higher resolution imaging. The present limitations on frame rate will be improved. But the area with the most benefit to patients will be the addition of more robotic technology and other automated guidance techniques. For example, one technique that already exists is magnetic guidance of catheters in cardiology. Such a technique would be impossible with an image intensifier on account of the magnetic fields. But with 3D data sets it is possible to guide a catheter through the tortuous vasculature with far greater precision and, therefore, safety.

Another example is the addition of an x-ray imager on an MR system. MR cannot provide real-time images and makes it extremely difficult to access the patient. But MR does provide soft tissue contrast that is simply unobtainable with x-ray-based imaging. So, combining the two modalities promises significant advantages.

INTERVIEW WITH PROF. JEAN-PIERRE PELAGE

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INTERVIEWEE
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Please tell us about your background in the area of UFE.

I was trained as a resident and performed my first UFE procedure in the Hôpital Lariboisière, a University Hospital of Paris under the supervision of Dr. Le Dref, one of the pioneers in this field, in December 1993. This is also where the first case of UFE was performed by Prof. Jean-Jacques Merland. I then performed a four-year clinical fellowship in interventional radiology in the same hospital.

The Hôpital Lariboisière has a long tradition of interventional radiology both for neuroradiology and peripheral radiology. It was then the reference hospital for the management of gynaecological and obstetric emergencies such as postpartum haemorrhage. I got involved in women's interventions and set up a specialised consultation for candidates for UFE, ovarian vein embolisation or tubal procedures. I then moved to another university hospital, Paris Ouest, where I was promoted to Associate Professor of Radiology in 2003 and then full Professor of Radiology in 2006. We have adopted the same way of working closely with the gynaecologists with pluridisciplinary discussions of all cases of patients with uterine fibroids.

How are you involved with CIRSE and the UFE taskforce?

I am a member of CIRSE since my fellowship and have been progressively involved in different committees. First, the standards of practice committee that published joint recommendations with the American Society of Interventional Radiology on UFE. I also got involved in the set up and monitoring of the UFE registry, promoted by the CIRSE Foundation. Finally, CIRSE created a UFE taskforce of which I am Chairman.

We have gathered a group of radiologists and gynaecologists from different European countries with the goal of promoting UFE. The first objective has been recently achieved with the launch of the UFE website, which will be progressively available in different languages to help patients to better understand about uterine fibroids, available treatments and their principles, advantages and side-effects. A section entitled "Find a doctor near you" will provide the list of centres per country where embolisation is available. We have also just started a UFE advisory group dedicated to promotion, training and research in the field.

How does UFE compare with the already "established" treatments?

From scientific publications including large prospective studies and randomised controlled studies versus surgery, we know that UFE is a valuable alternative to hysterectomy and multiple myomectomy. UFE is usually not a first line treatment as an alternative to a single myomectomy, particularly by laparoscopy or hysteroscopy. All studies show that embolisation is very effective to control heavy menstrual bleeding and bulk-related symptoms. Volume reductions both for the uterus and the fibroids range between 30 and 60% after treatment. Hospital stays are minimal, one or two nights in most cases. Some well-organised centres even offer UFE as an outpatient procedure. Recovery is short and most women will stay out of work for a week. Complications are rare in experienced hands. Different cost analysis, performed both in North America and in Europe, show that UFE compares favourably with hysterectomy and myomectomy despite the cost of the pre- and post-procedural MRI and the need for single use devices such as catheters.

Is UFE one of the main procedures performed by interventional radiologists?

Due to the high percentage of women presenting with fibroid-related symptoms, we may expect UFE to be a commonly performed procedure. However, it is still mainly available in big hospitals and universities where trained radiologists and specialised fibroid centres are present. In some centres like ours, UFE is one of the many embolisations for gynaecological and obstetric disorders. We treat pelvic arteriovenous malformations, cancer-related bleeding, adenomyosis, and post-operative or post-partum haemorrhage. In fact, UFE is very helpful to train young radiologists to perform all kind of emergency pelvic embolisations.

How can we ensure that gynaecologists be informed about UFE so that they can present this procedure as a treatment option?

Most gynaecologists are now well aware about UFE even if they aren't as familiar with its indications. Scientific meetings and publications will help. Family doctors have so many clinical conditions to manage that it is difficult for them to know about new treatments. We try to inform them through local meetings and publications. The CIRSE UFE website has a section for doctors presenting the various aspects of the technique, indications, results and follow-up. An updated list of publications is also available. For patients, the website seems very promising since it is available in different languages. For patients who don't speak English it is sometimes difficult to get information on the internet.

What trials are available comparing surgical and non-surgical options, and what do they tell us about the safety and effectiveness of UFE as an alternative?

There are different high-quality studies in the literature. In particular, the results of two multi-centre randomised controlled studies conducted in the UK (REST study) and the Netherlands (EMMY trial) have been recently published. Both studies compared outcomes from therapies in patients randomly assigned to UFE or surgery and confirm that UFE is equivalent to hysterectomy in terms of quality of life after treatment. Minor complications are slightly higher after embolisation and major complications after surgery. Hospital stay, length of recovery and cost are in favour of embolisation. Not surprisingly, when comparing a conservative treatment to hysterectomy, the rate of re-intervention is higher after UFE, particularly in case of clinical failure.

How can one manage pain in the best possible way?

The best way to avoid complications is good patient selection, best done as a team with radiologists and gynaecologists involved. Some types of fibroids may not respond well to embolisation or may be associated with an increased risk of complications. Patients' expectations should be evaluated before embolisation to avoid problems: very large uteri will never become normal despite satisfactory devascularisation of all fibroids and patients should be informed.

Different protocols are used to reduce patients' discomfort during and after embolisation. Administration of NSAIDs, analgesics, use of PCA pumps or spinal analgesia are commonly performed to manage pain which may be intense during 6 - 12 hours post-embolisation. We are currently investigating the value of embolisation microspheres loaded with pain killers progressively released in the blood circulation at the site of embolisation.

What does the future hold for UFE and how is the treatment being developed to grow safer and more effective?

I think that UFE may become a first-line treatment in young patients trying to conceive, particularly if the only treatment on offer is hysterectomy and multiple myomectomy. More studies addressing the issue of fertility should be conducted to verify this statement. The best proof that UFE is a global and effective treatment is that surgeons try to mimic its mechanism of action. Laparoscopic clipping of the uterine artery and transvaginal uterine artery clamping are being investigated as an alternative to UFE.

Erratum:
In the last edition of IMAGING Management, we incorrectly published a picture of the "Gaiffe" machine of 1907, instead of the referred-to CT machine of 1974 in the My Opinion interview. The picture is available upon request.

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2. Encourage experts from vendor and academic institutions to join WG24. Vendors of endoscopic and microscopic devices as well as implants (templates) should be included in addition to the classic vendors of medical imaging and PACS.
3. Compile a representative set of surgical workflows (with a suitable high level of granularity and appropriate workflow modelling standards and surgical ontologies) as a work reference for the scope of WG24. Initially, three to five workflows, characteristic for each discipline, should be recorded with sufficient level of detail.
4. Derive potential DICOM services from these surgical workflows.
5. Design an information/knowledge model based on electronic medical record (EMR) related work and identify IOD extensions to DICOM.
6. Take account of the special image communication (1D - 5D) requirements for surgery and mechatronic devices.
7. Work in close cooperation with DICOM experts from radiology, cardiology, radiotherapy and related fields represented in WG1 - WG23.
8. Encourage close cooperation with working groups in international societies with an interest in this area.
9. Disseminate knowledge gained following the roadmap through workshops, conferences and special seminars.
10. Connect to integration profiles specified for surgery by IHE activities.

Conclusion

In the process of realising a standard for therapy imaging and model management in surgery, it can be expected that surgeons, interventional radiologists, hospital managers as well as buyers and vendors of OR equipment, will become aware of the new business potential made possible by a suitable DICOM standard. By using the standard, their business situation will improve not least by more streamlined workflows, but also by a safer and higher quality patient care.

Key Seminars & Conferences

DECEMBER 2007

13 - 16 — 30TH ANNUAL SAN ANTONIO BREAST CANCER SYMPOSIUM
San Antonio, TX, USA
www.sabcs.org

14 — COURSE ON 'LIFE AFTER PACS'
London, UK
www.hhnt.org/hcc/conferences/life_after_pacs/index.htm

JANUARY 2008

10 - 12 — "APPLYING INDUSTRY LEADERSHIP CONCEPTS TO HEALTHCARE" MIR WORKSHOP
Bad Gastein, Austria
www.mir-online.org

FEBRUARY 2008

1 - 4 — MRI IN PRACTICE
Sydney, Australia
www.aaedpro.org

17 - 21 — 14TH INTERNATIONAL POSTGRADUATE COURSE ON ADVANCES IN CARDIAC ULTRASOUND
Davos, Switzerland
www.echodavos.info/info.htm

MARCH 2008

7 - 11 — EUROPEAN SOCIETY OF RADIOLOGY (ESR) ANNUAL CONGRESS
Vienna, Austria
www.myesr.org

15 - 20 — SOCIETY OF INTERVENTIONAL RADIOLOGY (SIR) 2008 ANNUAL SCIENTIFIC MEETING
Washington, DC, USA
www.sirmeeting.org

APRIL 2008

7 - 11 — IHE CONNECTATHON
Oxford, UK
www.ihe-europe.org

23 - 26 — INTERNATIONAL SOCIETY FOR RADIOGRAPHERS AND RADIOLOGICAL TECHNOLOGISTS (ISRRT) 15TH WORLD CONGRESS
Durban, South Africa
www.isrrt.org

JUNE 2008

5 - 8 — 25TH INTERNATIONAL CONGRESS OF RADIOLOGY (ICR)
Marrakesh, Morocco
www.icr2008.org

10 - 13 — EUROPEAN SOCIETY OF GASTROINTESTINAL AND ABDOMINAL RADIOLOGY (ESGAR) 2008 ANNUAL MEETING AND POSTGRADUATE COURSE
Istanbul, Turkey
www.esgar.org

25 - 28 — EUROPACS ANNUAL CONGRESS
Barcelona, Spain
www.europacs.org

25 - 28 — CARS ANNUAL CONGRESS
Barcelona, Spain
www.cars-international.org

SEPTEMBER 2008

11 - 13 — 9TH ESGAR HANDS-ON WORKSHOP ON CT-COLONOGRAPHY
Berlin, Germany
www.esgar.org

11 - 14 — ESUR 2008 ANNUAL CONGRESS
Munich, Germany
www.esur2008.Org

13 - 17 — CIRSE 2008 ANNUAL CONGRESS
Copenhagen, Norway
www.cirse.org

17 - 21 — 11TH ESH CONGRESS: HYPNOSIS & HYPNOTHERAPY: TRAUMA AND PAIN
Vienna, Austria
www.emdr-netzwerk.at

18 - 21 — EUROPEAN SOCIETY OF NEURORADIOLOGY (ESNR) XXXIII CONGRESS AND 17TH ADVANCED COURSE
Krakow, Poland
www.esnr.org

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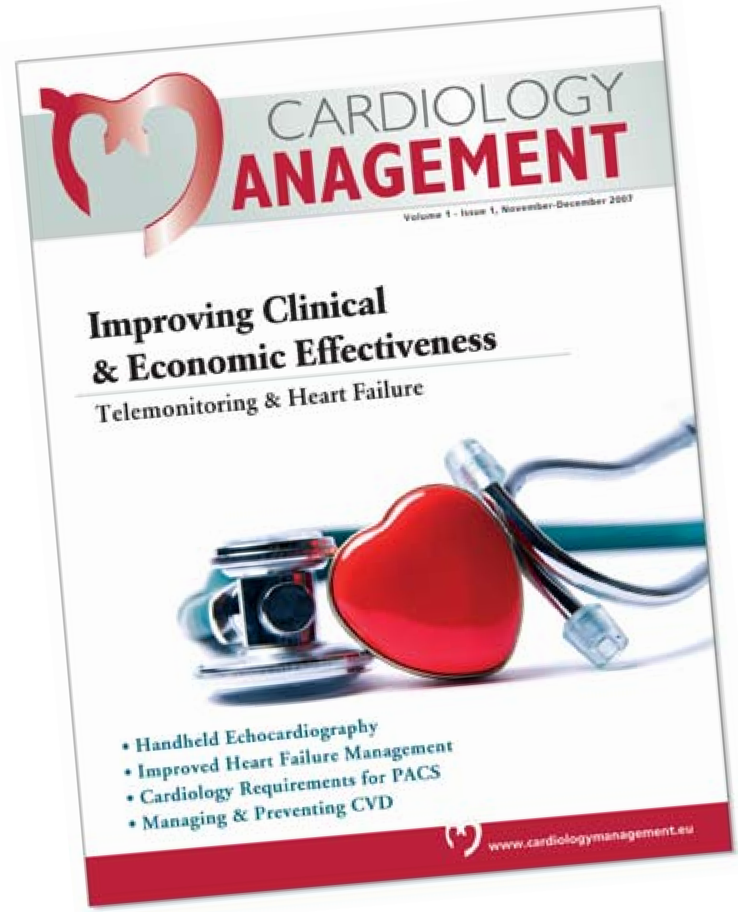

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