

Health

MANAGEMENT

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Volume 14 Issue 1 • 2014 • € 22 • ISSN = 1377-7629



Emergency & Trauma

● BREAST DENSITY ● FUSION IMAGING ● MATH OF DECISION IN RADIOLOGY ● PHARMACY & HEALTH IT ● BUILDING A CULTURE OF EXCELLENCE ● ECHOCARDIOGRAPHY ● IR IN TRAUMA MANAGEMENT ● TOP 10 HEALTH TECHNOLOGY HAZARDS ● COMPASS - CYPRUS

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EMERGENCY AND TRAUMA

Worldwide, emergency and trauma cases account for a large proportion of patients presenting at hospital. The World Health Organization estimates that injuries account for 9% of deaths. Clearly there is still much that can be done to improve outcomes in emergency and trauma, and our cover story considers some of the organisational issues. In the United States, for example, research has shown that receiving care at a Level I trauma centre can decrease the risk for death among seriously injured patients by 25 percent (Mackenzie et al. 2006).

Emergency departments may also cater for primary care needs. In the USA, it is expected that emergency department usage will increase following implementation of the Affordable Care Act (aka Obamacare). In trauma centres, the expertise of emergency radiologists undoubtedly contributes to multidisciplinary expertise in the emergency room. Teleradiology also has a contribution to make to emergency radiology. Dr. Arjun Khalyapur writes about the pros and cons of emergency teleradiology on page 19. We also interview Dr. Emanuel Rivers, a leading intensive care specialist, about the model of care whereby

critical care is brought to the emergency room, not only improving patient outcomes, but reducing healthcare costs. Interventional radiology has many applications in emergency care, which are outlined by Ciara Madden in our Interventions section on page 48.

In the UK, Northumbria NHS Healthcare Trust is building a new specialist emergency care hospital, the first purpose-built emergency care facility in the UK. We interview Project Director Dr. Birju Rana on page 16.

ECRI's top 10 health hazards list for 2014 features several that are of concern to radiologists. We go behind the headlines on page 52.

Our Management Matters section focuses on building a culture of excellence from the ground up. Alicia Campbell, director of a new healthcare pavilion in North Carolina discusses the key steps taken to hire and create a team and instil a culture of

excellence and accountability.

HealthManagement is a journal devoted to interdisciplinary working. We are pleased to include an interview with Prof. Andrew Jones, President of the British Institute of Radiology, the oldest radiological organisation in the world, which thrives on its multidisciplinary membership.

This month we prepare to meet in Vienna at the European Congress of Radiology, 6-10 March. I hope to see you at the Management in Radiology session on Saturday 8 March, when experts from around the world will be presenting on topics relevant to radiology leaders and managers. Please see page 62 for a preview of ECR highlights.



Section Editor-in-Chief - IMAGING

Prof. Lluís Donoso Bach

Reference

Mackenzie E.J, Rivara P, Jurkovich G, et al. A national evaluation of the effect of trauma-center care on mortality. *N Engl J Med* 2006;354(4):366-78.





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HealthManagement is a new cross-departmental journal, combining the Editorial Boards of IMAGING Management, Healthcare IT Management and Cardiology Management.

HealthManagement

is published by MindBYTE Communications Ltd
166, Agias Filaxeos Str., 3083, Limassol, Cyprus
Tel: +357 25 822 133
Fax: +32 2 868508
office@healthmanagement.org

Publisher

Iphigenia Papaioanou
i@healthmanagement.org

Editors

Claire Pillar
cp@healthmanagement.org

Lee Campbell
lee@healthmanagement.org

Web Editor

Carine Khoury
ck@healthmanagement.org

Communications Directors

Hilde Geuens
hilde@healthmanagement.org

Katya Mitreva
katya@healthmanagement.org

Luiza Kudelka
luiza@healthmanagement.org

Subscription Rates (4 Issues/Year)

One year:	Europe	85 euros
	Overseas	105 euros
Two years:	Europe	150 euros
	Overseas	180 euros

Production & Printing

Total classic and digital circulation: 62,500
ISSN = 1377-7629a
Printed in Luxembourg by jmtwagou

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Thales unveils ArtPix™

A new-generation of Digital Radiography Imaging sub-system with GUI customization and flexibility Workflow



Thales launches ArtPix™, the new Digital Radiography solution to empower the Pixium detectors. The product incorporates THALES' best in-class Pixium 3543EZ WiFi detector. The software application features a new state-of-the-art Graphic User Interface (GUI), an efficient workflow and outstanding image quality. The GUI can be completely customized by the OEM, then optimized by the hospital IT department or even 100% tailor-made by Thales.

The new application of the ArtPix™ solution will target the retrofit market for Mobile X-ray, as the perfect answer for CR replacement. The ArtPix™ is available with two specific configurations. The first one offers the application on a tablet PC, and combined with the auto-detection enabled WiFi 3543EZ flat panel, will give a complete autonomy to the user at bed-side. The second configuration, called Satellite, will allow the user to perform a complete round of exams, includes a dedicated device that will enable previewing and accept the images (up to 70), before transmitting, analyzing and post-processing the images on a dedicated workstation.

ArtPix™, supporting all line of Pixium DR detectors, will be available shortly for retrofit RAD rooms as well as for integration in new systems.

ART • PIX

The ArtPix™ is a totally new revolutionary concept, introduces a full modular architecture that allows the user to adjust the workflow according to its needs in order to create a unique and dedicated application to achieve the most efficiency, based on his own working procedure. The image appearance can be customized by the user to meet his likes and needs. The user can also choose any host system such as laptop, workstation or tablet for his convenience. To make such integration possible, a network-based architecture has been developed, incorporating remote Operator Control Devices using the undisputed HTML5 language. The use of HTML5 standard simplifies the interface design of the remote device making it as simple as developing an Internet page.

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Facing a new healthcare reality: How IT strategy can help healthcare organizations prepare and succeed

Interview H. Joerg Schwarz

As imaging has grown in the last ten years, during the conversion from film to the digitization of images, it has really spawned very strong departmental solutions. Given the transformation from film to where we are today, workflow improvements have certainly been phenomenal.

According to the OECD, healthcare expenditure in its member countries is outpacing the rate of inflation. *“While we are now seeing costs stabilizing all over, healthcare expenditure in all industrialized countries has been steadily rising since the mid-20th century,”* says Joerg Schwarz, *“up to a high of 17.7% of GDP in the US in 2009. Unfortunately, these higher costs do not necessarily mean better quality care.”*

Joerg Schwarz highlights the challenges by describing the pressures caused by chronic disease patients as an example. *“Chronic conditions account for about 75% of healthcare direct costs, whether you’re in a developed or a developing country, and most of that comes from only a handful of conditions, like diabetes, congestive heart failure, dementia, etc. Healthcare costs for a person with one of those conditions are double those for someone with no chronic disease. And when a patient has more than one chronic condition, expenses rise exponentially. In most countries, about 45% of citizens do have at least one chronic condition, so this is clearly an area that healthcare systems need to be prepared for.”*

The call for integrated care

In many countries, in fact, changes in healthcare delivery are already being implemented, he says, often involving a move towards regional consolidation and coordination. The economic model is evolving as well, moving away from ‘fee-for-service’ towards bundled payments for ‘episodes of care’.

“In France, the regional health authorities increasingly are responsible for coordinating care in geographical areas around hospitals, while in the UK, the National Health Service (NHS) is transferring

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A 5-step evolution towards IT for integrated care

- Step 1 – Results delivery and medical image consolidation
- Step 2 – Referral workflows
- Step 3 – Connecting hospital EMR with the wider care community
- Step 4 – Patient engagement
- Step 5 – Moving toward a “Population Health Management” approach

much of the control for funding decisions in local areas to Clinical Commissioning Groups,” Joerg Schwarz underscores. “We also see examples of how Integrated Practice Units, which were described by Porter and Lee in their Harvard Business Review paper, are improving patient outcomes while simultaneously improving healthcare efficiency. So in the US, healthcare players, including Medicare, are forming Accountable Care Organizations that use virtual delivery groups of hospitals and physicians to deliver all the necessary care for a patient. Germany, on the other hand, already adopted the model of bundled payments for ‘care episodes’, based on Diagnosis Related Group (DRG) codes. How much of a difference will this make? Well, McKinsey estimated that in the US alone, \$1 trillion could be generated if the entire system switched to integrated healthcare, with providers focusing on maintaining health and wellbeing. So the incentive to move towards this model both financially and in terms of the quality of patient care is enormous.”

This model requires a fundamental change in how hospitals perceive their role, as well as in how they operate. “Traditionally, hospitals would offer any type of service, and focused their attention on annual volume, not quality or cost. But that approach is no longer sustainable. To succeed in this environment of bundled payments for episodes of care, every service has to be provided at the optimum cost. Costs have to be benchmarked, and the decision of which healthcare player will provide which service will be based on those benchmarks.

The Vertically Integrated Delivery Network

“Vertical integration will allow the hospital to provide services cost-effectively using both insourced and outsourced specialists who can offer the best costs and outcomes. The hospital could increase its revenue base with additional services such as preventative services, could lower costs for low-volume services by contracting them to a higher-volume provider, and could add new services that make the patients true partners in their own care. Actions like these will increase the competitiveness of the hospital and its performance in terms of patient outcomes.”

5 steps towards an IT strategy for integrated care

Achieving integrated care and supporting the new payment models requires a supporting IT strategy, and Joerg Schwarz lays out a 5-step evolution. “Imaging is a good place to start consolidating regional data,” he says. “We already have an existing standard – DICOM – for capturing and consolidating data from multiple modalities into a Vendor Neutral Archive (VNA). The concept is pretty mature, and has been successfully implemented in regional and national projects in the US and Canada, for example.”

“What’s more, imaging is a big cost within the healthcare bundle. While imaging is a critical component for diagnosis and, often, treatment, with bundled payments there is no room for medically unnecessary or redundant exams. So it makes sense to invest in an

infrastructure that provides fast, reliable and secure access to all of the patient’s images, without being blocked by organizational boundaries. Real ‘imaging without borders’.”

The next stage is a referral workflow, he says. “Imagine that any referring physician can log into a clinical portal and start the patient’s workflow, ordering images or lab tests. But the physician can also upload or share the patient’s medical history. This would simplify and speed up the ordering process, and allow as much of the previous diagnostic work to be re-used as possible.”

In the next step, the hospital Electronic Medical Record (EMR) is connected to the wider care community. “Traditional EMRs were not designed for inter-organizational collaboration, but hospitals need to be able to receive and to share data with outside providers. The infrastructure to do this doesn’t need to be part of the EMR itself, but it has to be able to produce and consult Continuity of Care documents.”

For the next step, Joerg Schwarz comes back to the role of the patients in their own care: patient engagement. “When you put patients in control of their own healthcare, they become empowered. You can be more certain, for example, that they will correctly follow their treatment and can take on some basic care themselves (or their caregivers can). So the hospital needs to have an easy-to-use and accessible way for patients to handle things like making appointments or getting advice, themselves.”

Adopting a Patient Health Management (PHM) approach is the final step Joerg Schwarz has outlined. “If you want to successfully meet the requirements of value-based payment models, you have to continuously benchmark, measure and report clinical data, and to share information. Population Health Management requires coordination between all the care players: clinicians, caregivers and the patients.”

“Information systems that were designed and built for a fragmented care delivery model have to be integrated to be effective in the new environment,” Joerg Schwarz concludes. “Building an IT strategy based on the five steps will help prepare organizations for the next stage in facing today’s healthcare reality: creating a learning health system.”

Interview:

H. Joerg Schwarz,
MSIS, Global Business Development Director,
Agfa HealthCare



New Findings on Artherosclerotic Plaque

Dr. Marianna Selwaness of Erasmus University Medical Centre in Rotterdam presented new findings at RSNA 2013 on artherosclerotic plaque. There is a higher incidence of left hemisphere stroke. Whereas left sided infarction may lead to dysfunction of speech and of right hand function, clinicians may assume that right sided infarction may go unnoticed more easily as this side of the brain controls imagination, emotions and creativity. However, an alternative explanation may relate to artherosclerosis. Therefore the research team set out to look at the difference in distribution and composition of artherosclerotic plaque between left and right carotid artery in 1,414 stroke-free individuals, aged 45 and over, using MRI images. 85% of the participants had bilateral plaques. In the 15% with unilateral plaques they found two times more unilateral plaques in

the left carotid artery than on the right. The carotid wall was slightly thicker on the left side, while stenosis was equal on both sides. Carotid arteries on the left side showed a predominance of intraplaque haemorrhage and fibrous tissue, while the right side was more frequently calcified. Their findings suggest that the predilection of cerebrovascular disease to the left side may be explained by the vulnerable phenotype of plaques in the left carotid artery and the stable plaques on the right side. Local risk factors, such as geometrical and haemodynamic factors may be the reasons for differences between the carotid arteries in one individual.

Reference: Selwaness M, Van Den Bouwhuisen Q, Van Onkelen RS et al. (2013) Atherosclerotic plaque in the left carotid artery is more vulnerable than at the contralateral side. *Eur Heart J*, 34 (suppl 1) doi: 10.1093/eurheartj/ehs308.P2412.

Medical Research in Germany Highlighted at RSNA

RSNA 2013 featured a pavilion for Germany – Partner for Medical Technology, sponsored by the German Federal Ministry of Education and Research.

Lesion Tracking Software

Mint Medical developed the mint Lesion™ software to enable oncologists and radiologists to track lesions quantitatively. It can follow any kind of lesion in any kind of modality. Even if the lesion disappears the software tracks the same area of the anatomy, so if the lesion reoccurs, it can track it. The Workflow Software Solution creates visualisations, schematics and statistics

according to quantitative criteria based on the image data.

Ultra fast MRI

Researcher Leif Schröder from the Leibniz Institute for Molecular Pharmacology showcased a project to develop ultra fast MRI, to enable changes in tumours to show up earlier. The technology is based on using hyperpolarised xenon biosensors as a contrast medium. The idea is that patients inhale a xenon compound designed to bind like a cage to tumours on the molecular level, allowing for a clear image of the tumour with a very small dose of contrast medium.

D+ Grade for America's Emergency Care

Emergency physicians in the U.S. have reported a grade of D+ in the latest report card on support for emergency care. The Report Card forecasts an expanding role for emergency departments under the Affordable Care Act at the same time as resources are shrinking. The Report Card measures conditions and policies under which emergency care is being delivered, not the quality of care provided by hospitals and emergency providers.

“Congress and President Obama must make it a national priority to strengthen the emergency medical care system,” said Dr. Alex Rosenau, president of the American College of Emergency Physicians (ACEP). “There were more than 130 million emergency visits in 2010, or 247 visits per minute. People are in need, but conditions in our nation have deteriorated due to lack of policymaker action at the state and national levels. With so much changing in health care, emergency care has never been more important to our communities. This Report Card is a call to action.”

The last time ACEP's Report Card was issued, in 2009,

America earned an overall grade of C-. According to Dr. Rosenau, the lower grade in 2014 also reflects a misguided focus on cutting resources for emergency departments because of the popular but misguided view that emergency care is expensive, despite being less than five percent of overall healthcare costs.

“America's Emergency Care Environment: A State-by-State Report Card” — has 136 measures in five categories:

- Access to Emergency Care (30 percent of the grade): the nation received a D-
- Quality and Patient Safety (20 percent): the nation received a C
- Medical Liability Environment (20 percent): the nation received a C-
- Public Health and Injury Prevention (15 percent): the nation received a C
- Disaster Preparedness (15 percent): the nation received a C-

Scores are also available for individual states and districts.

The Report Card includes national recommendations for action, including investigating staff shortages, providing liability protection, evaluating innovative models of care, withholding funds to states that do not support key safety legislation, such as motorcycle helmet laws and .08 blood alcohol content laws, funding medical education and research and investigating whether additional strains are occurring in the emergency department safety

net as a consequence of the Affordable Care Act.

According to the Report Card, states continued to struggle with many issues, including healthcare workforce shortages, limited hospital capacity to meet the needs of patients, long emergency department wait times and increasing financial barriers to care.

Reference: American College of Emergency Physicians (ACEP) 2014 report card. Available at: <http://www.emreportcard.org/>

Consults on Palliative Care in the ER Lead to Shorter Hospital Stays

Initiating a palliative care consult in the emergency department (ED) reduced hospital length of stay (LOS) when compared to patients who received the palliative care consult after admission.

A review of information from 1,435 palliative care consults showed that half received a consult while in the emergency department. LOS was 3.6 days shorter in these patients.

The researchers hypothesised that hospitalised patients who receive PC consultation in the ED will have a lower LOS than those whose consultation occurs after admission. "By providing early palliative care, patient needs are met earlier on, either preventing admission or reducing length of stay and treatment intensity for patients," said

lead author Dr. Abraham Brody of the New York University College of Nursing. "Patients receiving palliative care are less likely to be readmitted as well. Early palliative care can better help patients to have their wishes met, and allow them to return to and stay at home."

The researchers note that further study is needed to examine why changes in LOS occurred, as well as whether there are potential differences in intensive care unit LOS, costs, clinical outcomes, and patient satisfaction outcomes. Additional study is also needed to examine the best methods for implementation of PC intervention in the ED.

Reference: Frances M. Wu, Jeffrey M. Newman, Andrew Lasher, Abraham A. Brody. Effects of Initiating Palliative Care Consultation in the Emergency Department on Inpatient Length of Stay. *Journal of Palliative Medicine*, 2013; 16 (11): 1362 DOI: 10.1089/jpm.2012.0352

Notes of a Radiology Watcher. *New Book*

Notes of a Radiology Watcher by Prof. Stephen Baker is a collection of discursive yet precise essays on the state, solutions and impressions of the radiology profession. Baker dedicates his book "to the many medical students I have mentored, who by their enthusiasm and energy, make my work a pleasure."

In 12 parts, the contents cover Residency, Fellowship, Radiology outside the USA, including Japan and Cuba, the Radiology Report, Radiologist responsibilities, Quality Considerations, Malpractice, Opportunities and Challenges for Radiologists, Research, Radiation Dose and "Nooks and crannies in general radiology."

Challenges Baker outlines include those to general radiology. He wonders if general radiology will become synonymous with emergency radiology, and argues that the radiologist must be a specialist to other specialists or face obsolescence. He makes the case for a specialty in geriatric radiology, including not only geriatrics and gerontology but consideration of design and architecture to improve safety for older patients. Other challenges facing American radiologists include non-radiologists performing imaging

exams, computer-determined diagnosis, trade liberalisation, dwindling raw materials needed for radiology devices, press intrusion and the economic outlook.

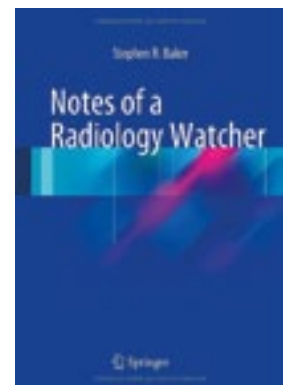
Did you ever consider the difference in language between radiology and surgery? Baker has, and notes that radiology far more than any other specialty depends on metaphors to transmit meaning and understanding. Surgery on the other hand abounds in eponymic markers as surgeons are eager to name their contributions after themselves.

In considering whether radiologists should tell patients their results directly, Baker argues in general against such communication, as it effectively dehumanises the patient. However, in three instances radiologists need to communicate results - in mammography, obstetrical ultrasonography and angiography.

Any radiologist will find this a readable and thought-provoking publication.

Prof. Stephen Baker is a member of the HealthManagement Editorial Board.

Reference: Baker Stephen R. (2014) Notes of a Radiology Watcher. Berlin: Springer.





PATIENTS VOTE FOR A HEALTHIER EUROPE

On 1 October 2013, the European Patients' Forum (EPF) launched a campaign entitled "Patients + Participation = Our Vote For a Healthier Europe" ahead of the 2014 European elections. This campaign is an opportunity for the patients' community to be heard by the candidates, and to help them to set the priorities for the new parliamentary session.

EPF knows from our 61 members throughout Europe - specific chronic disease groups at EU level or national coalitions of patients - that the challenges faced by patients' constituencies are enormous. Fundamental inequalities and lack of access prevail, even more as our population ages.

We need to ask ourselves what kind of society do we want, for us and for the future, and health is absolutely central to this. This is why the European Parliament Elections and new Commission 2014 represent a big milestone for patients in Europe to encourage politicians and policy-makers to commit to a healthier Europe.

EPF wants to create a sense of urgency and real imperative to address the fundamental roadblocks to patients' access to proper healthcare. We strongly believe that patients can be part of the solution to make health systems more effective and quality-oriented.

Patients' Views Matter

EPF asks European decision-makers to engage patients collectively and pro-actively through patient organisations in policy decision-making to ensure that all policies and practices reflect patients' real-life needs, preferences and capabilities.

Patients of all ages and conditions are 'experts by experience' as they live

with their chronic disease every day and regularly use health services. They have a unique perspective on healthcare and know what works for them and what does not. They know what is most important to them and conversely, what services are not needed.

Patients are not cost drivers - on the contrary, patient-centred care models have been shown to be cost-effective as well as to increase patient satisfaction and often improve clinical outcomes.

The benefits of integrated, patient-centred care are seen in terms of reducing avoidable hospitalisations, more effectively allocated healthcare resources, better quality care throughout the "patient journey" and better informed, motivated and empowered patients.

This is why patients should not be seen as passive recipients of services and benefits, but as active citizens and partners in chronic disease self-management. They can guide decision-makers on how to offer good quality care that is also cost-effective, and improve the way healthcare services are designed and delivered.

Although patient involvement is recognised as one of the shared operating principles of European health systems, there is still wide divergence across the EU in the recognition of patients as a legitimate stakeholder group and in the level of their collective involvement.

Empowered Patients, An Asset to Society

Patients want to be full partners in the management of their conditions according to their individual capacities and situation. Patients need to be supported to be able to contribute

to the sustainability of healthcare systems. Currently, this is not the case.

EPF asks European decision-makers to adopt an EU strategy on patient empowerment, which can be seen as a multidimensional process that helps patients gain control over their lives, increasing their capacity to act on issues that they themselves define as important.

To make genuinely informed decisions about their health and treatment, it is vital that patients can access all the relevant information needed to make those decisions, in an easily understandable format.

Although empowerment is much more than 'patient education', the right information and resources are fundamental tools for it.

Health literacy is a key dimension of empowerment and encompasses not just accessing, comprehending and evaluating health information, but also relating the information to oneself and one's health, and transforming it into appropriate actions.

Across the EU, there currently is a lack of accessible, reliable and understandable health-related information that meets patients' needs, although core quality criteria have been defined at European level.

Health literacy also has a critical relevance for health inequalities. Well-informed, health-literate people are more discerning about their health, make more informed choices and decisions and are more likely to seek earlier diagnosis and recover faster.

Conversely, people with low health literacy have poorer self-management skills, higher hospitalisation rates and more emergency visits. They have poorer overall health, more inappropriate and less effective use of healthcare resources.



Author

Anders Olaison



President
The European Patients' Forum
31, rue du commerce
B-1000 Brussels
info@eu-patient.eu
+32 (0)2 280 23 34

Links

You are invited to sign the EPF Manifesto to support this campaign and therefore commit to include a patients' perspective in your work:

www.eu-patient.eu/whatwedo/EPFCampaign2014Elections/1-support-EPF-Campaign/

More information about the campaign:
www.eu-patient.eu/whatwedo/EPFCampaign2014Elections/

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The importance of health literacy is likely to increase as the population ages, chronic conditions become more prevalent, and online information sources proliferate; people are increasingly expected to become familiar with technologies such as eHealth, mHealth, genetic testing, etc.

The degree to which healthcare systems are health literacy-friendly has a bearing on equity of access. EPF believes that healthcare services must be designed to meet the needs of all patients, including those with low health literacy.

Breaking Down Access Barriers

From a patient’s perspective, health inequalities mean unequal access to medical and other care, and disparities in the quality of that care. Patients and families on low incomes are at risk of poverty as a consequence of ill-health and catastrophic health expenditures, which in turn affect their access to healthcare and the quality of care, creating a vicious circle.

Access to healthcare is a basic EU citizen’s right, and one of the fundamental principles of European health systems together with safety, quality and equity. Treatment should be accessible to every patient who needs it, not only to those who can pay or who can make informed choices. Regrettably, this is not a reality for all.

Healthcare is accessible to patients when it is functionally available to the patient who needs it, e.g. it is possible to get an appointment without undue delay and without having to travel far, and when the cost is affordable.

There are huge disparities within the EU in the availability of treatments and their affordability, while health spending has stalled or fallen since 2009 in many member states. This means that existing inequalities are made worse by austerity measures such as new hospital fees,

cuts in health insurance coverage or increased co-payments, against a background of rising unemployment and reduced incomes.

EPF held two conferences in partnership with our Bulgarian Member, the National Patient Organisation (NPO), one on “Health Inequalities in the ‘New’ EU Member States and Candidate Countries”. The second one, which took place at the European Parliament on 26 June 2013, produced high impact results with the establishment of an EU partnership on patient access and equity and the setting up of an interest group of Members of the European Parliament (MEP) to address health inequalities and to promote equal access.

EPF calls for the support of these initiatives to ensure equitable access



Picture 1. EPF Campaign online form ready to be signed

.....
“healthcare needs a shift from a paternalistic medical model to a collaborative model”

to healthcare for all European citizens, regardless of their background or ability to pay. The strategy should also identify the specific needs of different target populations, such as minority and disadvantaged groups, and develop actions to address them.

Patient Involvement, A Healthier Europe

Patient empowerment and better access to high-quality healthcare present a challenge to the system and require specific strategies, including embedding meaningful patient involvement at every level in the health system.

Patient involvement is based on the premise that patients have a specific expertise derived from being

patients, which is a valuable source of knowledge.

At individual level it can mean the extent to which patients – or their families or caregivers – participate in

decisions related to their healthcare.

At the provider level (e.g. hospital), patients or their representatives play a role in improving healthcare using the specific experiences of patients as learning and educational tools to

Picture 2. EU Health Commissioner Tonio Borg signing the manifesto





Pictures.

Top
EPF Campaign manifesto is translated in all EU languages

Middle
Annette Dumas, EU Public Affairs Advisor for Alzheimer Europe and MEP
Dagmar Roth-Behrendt

Bottom
EU Health Commissioner Tonio Borg,
EPF President Anders Olausson, MEP
Dagmar Roth-Behrendt

design better services.

At the highest or policy level, patients – through their representative organisations – contribute to shaping the healthcare system through their involvement in healthcare policy-making.

EPF calls for a clear framework supporting active patient participation in policy-making and the designing of care delivery systems. Patients as healthcare users need to be involved in designing more effective healthcare of the future, including research to deliver new and better treatments. Patient involvement is needed to determine what innovation adds in terms of real value and improvement to people's lives.

Although access to new and improved medicines is crucial in many disease areas, innovation should be based on a patient-centred approach. Being driven by patients' needs, it has great possibilities to lead to innovative solutions that meet the real needs of patients.

Research should be centred on patients' medical and social needs. There is therefore a requirement for increased policy attention and investment in this type of research. This can only be achieved if patients are meaningfully involved throughout the research process, from the 'idea' stage to the proven intervention.

The involvement in research projects of patient and other civil society organisations should be made easier with simpler rules, less bureaucracy, and adequate funding.

Professionals need also to develop the necessary skills and attitudes to

adapt to the new patient role, shifting from a paternalistic medical model to a collaborative model.

Empowering patients to get involved in research requires training to support their participation in scientific discussions and address the inherent imbalance of power between the 'expert' and the 'lay person'.

Some tools and good practices already exist, through the Value+ and PatientPartner projects, and this is also the focus of the European Patient Academy on Therapeutic Innovation (EUPATI).

Patient involvement is also needed at the other end of the chain, to ensure that cost/benefit assessment of innovative treatments takes into account their impact on patients' quality of life, and that they promote equitable access. Patients should be involved in Health Technology Assessments, appraisals, prioritisation and reimbursement processes at national level.

Advocacy and awareness is needed to increase understanding of the patient's contribution. Capacity building for patient representatives is required to address the inherent imbalances of power.

EPF represents the voices of an estimated 150 million of patients who are also voters and, when they will cast their ballot for the next EU Elections, they want to be confident and feel good about voting for a healthier Europe, where patients are seen as a part of the solution for high-quality, sustainable and cost-effective healthcare. ■

Key Points

- On 1 October 2013, the European Patients' Forum (EPF) launched a campaign ahead of the 2014 European elections.
- This campaign is an opportunity for the patients' community to be heard by the candidates and to help them to set the priorities for the new parliamentary session.
- Patients' views matter as they are 'experts by experience' living their chronic disease every day and they can therefore guide decision-makers on how to offer good quality care that is also cost-effective.
- All patients in the EU deserve equitable access to care, but this is not a reality for all.

ECR 2014

Vienna

March 6–10

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EUROPEAN CONGRESS OF RADIOLOGY 2014 HIGHLIGHTS

European Congress of Radiology

ECR 2014

Vienna
March 6–10

Over 20,000 delegates are expected in Vienna from 6–10 March for the largest radiological event in Europe, the annual meeting of the European Society of Radiology. President of the 2014 European Congress of Radiology, Prof. Valentin Sinitzyn notes, “Today, it represents a unique mixture of tradition, innovation, and entertainment.”

New for 2014

Amongst the innovations this year is the Multimedia Classroom, which will provide doctor-to-doctor training at the workstation for the interpretation of cases in CT colonography, MDCT in trauma, cardiac CT and oncologic imaging.

Live Broadcasts

Many sessions will be broadcast live, and will be accessible via ECR Live.

In addition, ECR Live’s Social Media Wall can be viewed online and on screens throughout the congress centre. Social media engagement continues to grow. At ECR 2013 delegates sent over 3,000 messages..

Technical Exhibition

The technical exhibition will feature more than 300 exhibitors in a 26,000m² exhibition space, allowing delegates to experience the very latest cutting-edge imaging technology.

Plenary Sessions

Thursday 6 March, 17:45–19:15

Opening Ceremony

Presentation of Honorary Members

Opening Lecture

Etudes in space radiology

Oleg J. Atkov, Moscow, Russia

Friday 7 March, 12:15–13:15

Presentation of the ESR Gold Medal Awards

Josef Lissner Honorary Lecture

Research in cardiac imaging: how I do it
Albert de Roos, Leiden, Netherlands

Saturday 8 March, 12:15–12:45

Wilhelm Conrad Röntgen Honorary Lecture

Mysteries of the human brain unveiled: imaging of white matter microstructure and neuroplasticity

Paul M. Parizel, Antwerp, Belgium

Sunday 9 March, 12:15–12:45

Samuil A. Reinberg Honorary Lecture

The tempestuous genesis of MRI: credit and discredit

Morton A. Meyers, East Setauket, USA

ESR meets...

Friday 7 March, 10:30–12:00

ESR meets Russia

Crossroads of diagnostic imaging in the big country

Saturday 8 March,

10:30–12:00

ESR meets Serbia

A guided tour of radiology in Serbia

14:00–15:30

EFRS meets Russia

The role of the radiographer in image acquisition and processing

16:00–17:30

ESR meets ESC (European Society of Cardiology)

The role of imaging in the cardiac patient

Sunday 9 March, 10:30–12:00

ESR meets Mexico

Oncology imaging in Mexico

New Horizons sessions look at new developments and conclude with a panel discussion.

Friday 7 March,

08:30–10:00

Imaging the hallmarks of cancer

16:00–17:30

The human connectome: a comprehensive map of brain connections

Sunday 9 March, 14:00–15:30

Imaging in precision medicine

State of the Art Symposia gather the experts on a subject.

Friday 7 March,

16:00–17:30

Cardiac computed tomography: from diagnosis to prognosis

Saturday 8 March, 08:30–10:00

Radiology and obesity

Sunday 9 March, 16:00–17:30

Tumour response assessment in clinical practice

Special Focus Sessions

Topics at the cutting edge of development and clinical application. Special Focus sessions include:

Thursday 6 March, 16:00–17:30

Pitfalls in FDG PET/CT imaging

Friday 7 March, 16:00–17:30

Renal artery denervation in the management of resistant hypertension

Imaging biomarkers in cancer drug development

Saturday 8 March, 08:30–10:00

Image-guided prostate biopsies: a paradigm shift

Sunday 9 March

14:00–15:30

Treatment with MR-guided focused US (FUS)

16:00–17:30

Evidence-based radiology, comparative effectiveness research, and health technology assessment

Monday 10 March, 08:30–10:00

Structured reporting

Elastography as a new tool

Professional Challenges Sessions communicate and exchange information on professional issues.

Thursday 6 March, 16:00–17:30

Radiology: opportunities and threats

Friday 7 March, 08:30–10:00

Interventional radiology in oncology

Saturday 8 March, 16:00–17:30

The role of social media in radiology

Sunday 9 March, 10:30–12:00

Doing good not harm – understanding audit and its role in reducing patient dose

Multidisciplinary Sessions promote a multidisciplinary approach to cancer detection and treatment, integrating radiologists, surgeons and oncologists to share their expertise.

Thursday 6 March, 16:00–17:30

Multidisciplinary approach for detection and treatment of malignant primary bone tumours

Friday 7 March, 08:30–10:00

Pancreatic neuro-endocrine tumours

Saturday 8 March, 16:00–17:30

Characterisation and treatment of renal tumours: new paradigms

Mini Courses on Friday 7 March include a joint one day course on Emergency Imaging by the ESR and RSNA, and a course on Controversies in chest imaging, including CT screening for lung cancer and diagnosis of pulmonary embolism

Refresher Courses

Refresher Courses on Computer Applications include:

Thursday 6 March, 16:00–17:30

Mobile IT in radiology

Monday 10 March, 08:30–10:00

Improving workflow efficiency and quality

Refresher Courses on Physics in Radiology include:

Saturday 8 March, 16:00–17:30

Novel developments in CT and their impact on dose

Sunday 9 March

14:00–15:30

Good radiation and bad radiation? How to assess and communicate radiation risk to patients and referring physicians
16:00–17:30

IT tools for dose tracking and workflow optimization

Accompanying Sessions

Thursday 6 March, 16:00–17:30

EIBIR Session

Biomedical image analysis: novel tools in neurodegenerative disease and breast cancer

Thursday 6 March, 16:00–17:30

Joint Session of the ESR and COCIR (European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry)

Friday 7 March

08:30–10:00

Joint Session of the ESR and EFSUMB (European Federation of Societies for

Ultrasound in Medicine and Biology)

Advances in diagnostic ultrasound: better results through combinations
10:30–12:00

ESR Radiation Protection Session

Launch of the ESR EuroSafe Imaging campaign: dealing with the challenges of radiation protection

Friday 7 March, 14:00–15:30

ESOR Session

Mentoring in radiology

Saturday 8 March

08:30–10:00

Joint Session of the ESR and ESMRMB (European Society for Magnetic Resonance in Medicine and Biology)

Diffusion MRI: everything you always wanted to know but never dared to ask
10:30–12:00

Joint Session of the ESR/ESMOFIR (European Society of Molecular and Functional Imaging in Radiology) and ESMI (European Society for Molecular Imaging)

Molecular and functional imaging methods for interventions

MANAGEMENT IN RADIOLOGY @ ECR

Management in Radiology addresses current challenges and provides a forum for education and the exchange of ideas and concepts.

Saturday March 8, 13:00–17:30

Session 1: Clinical decision support and radiation protection training

Denis Remedios, Harrow, UK

Appropriate imaging: Aspiration, inspiration or reality

James Brink, Boston, USA

Practical use of decision support

Lluis Donoso, Barcelona, Spain

European Perspective of CDS

Peter Vock, Berne, Switzerland

ESR activities in radiation protection: an overview with respect to global initiatives

Donald Peck, Detroit, USA, **Annalisa Trianni**, Udine, Italy

What is the truth in talking on radiation risk?

Session 2: Patient-centred radiology and economics

Elisabeth Schouman-Claeys, Paris, France

Economic situation in radiology 2013: insights from an ESR survey and MIR workshop

Mansoor Fatehi, Tehran, Iran

Radiology management in a special economic situation

Giuseppe Turchetti, Pisa, Italy

The economist's perspective

Catherine Mandel, East Melbourne, Australia

Incident reporting, safety culture and patient-centred radiology

Charles Kahn, Milwaukee, USA

Communication and the visible radiologist

Erik Briers, Hasselt, Belgium

The patient's perspective





Next generation digital R/F system:
Sonialvision G4

Best-in-class

Equipped with the largest available FPD at 43 x 43 cm and Shimadzu's newly developed digital imaging platform, the Sonialvision G4 covers the widest possible range of examinations with inter-departmental hospital capability. In both functionality and operability, the Sonialvision G4 multipurpose R/F table is far beyond other R/F systems. It provides "Best-in-class" features.

- Smart system architecture supports outstanding clinical flexibility for a wide range of examinations
- Comprehensive dose management package ensures today's highest safety of patients and operators
- Excellent image quality provided by the advanced "SUREngine" technology enhancing the entire image for clearer details
- Premium application software supporting useful applications, such as tomosynthesis for general radiographic imaging

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Deep insights meet new medical applications

As one of the world's leading manufacturers of advanced imaging systems and equipment for medical diagnosis and treatment, Shimadzu has remained a pioneer of technology and design for more than 100 years since the company had produced Japan's first X-ray apparatus for medical use in 1909.

Vascular interventions from head-to-toe: Trinias angiographic system series

Shimadzu's latest Trinias angiography series are true multipurpose systems for cardiovascular and angiographic procedures and are available as floor- and ceiling-mounted or as a biplane system.



Trinias is equipped with a 30 x 30 cm FPD supporting a wide-range of vascular interventions from head-to-toe, from cerebral, cardiac, and abdominal blood vessels to peripheral blood vessels in the upper and lower extremities or with a 20 x 20 cm FPD supporting specialist cardiovascular interventions.

Trinias F12 – crossover angiography system

The Trinias series is equipped with innovative designs applying the SCORE, SMART and SMILE philosophy that sets Shimadzu apart:

- SCORE imaging technology ensures powerful support for advanced interventions while reducing patient dose and increasing radiographic and fluoroscopic image quality
- SMART design allows significant enhanced operability with fast response time while the SMILE concept provides a safe and comfortable environment for patients and medical staff alike
- SMILE concept is primarily about comprehensive X-ray dose management and comfort of patients and operators.

Best-in-class: Sonalvision G4 multifunctional R/F system

The new Sonalvision G4 is a high performance R/F table which provides numerous best-in-class features improving the functionality and operability significantly.

The Sonalvision G4 covers the widest possible range of examinations with inter-departmental hospital capability. It is equipped with the largest available FPD at 43 x 43 cm and Shimadzu's next generation digital imaging platform. Combined with the large longitudinal stroke of Sonalvision G4, the FPD provides an extensive imaging area. In combination with an additional ceiling-mounted telescopic arm, a Bucky wall stand, and a second mobile FPD, the system easily extends to a sophisticated multifunctional R/F room.

In addition, advanced "SUREngine" technology contributes to creating excellent image quality. It enables the natural enhancement of the entire image for clearer revelation of all examination areas including small, faint targets.

Shimadzu's premium application software offers the most recent improvements for diagnostic imaging, such as tomosynthesis for general radiographic imaging and slot scanning.

Opescope Acteno – C-arm with high operability and image quality

The new Opescope Acteno surgical C-arm system enables free and easy positioning and optimal performance to meet the demands of the operation and emergency rooms. The system combines high image quality with ease-of-use. The fully counter-balanced C-arm provides extra-light and quick C-arm movements and positioning. The exclusive manual C-arm vertical movements enable much quicker height adjustments in routine operation.



Opescope Acteno – surgical C-arm system

Shimadzu's unique C-arm lock/release button at the image intensifier allows the C-arm to be positioned from the clinician's side without going back to the cart unit. The enlarged 78 cm wide opening of the C-arm makes approaches to the patient easy, minimizing the risk of contact with the operating table.

Evolving technology with highest flexibility

The MobileDaRT Evolution incorporates highly developed functions to improve the clinical workflow. A new FPD with a large field of view of 43 x 43 cm is available. Additionally detectors with a FOV of 35 x 43 cm and 27 x 35 cm allow operators to act even more independently when taking images in areas such as radiology, emergency rooms, traumatology, orthopaedics, paediatrics, or on the ward. The detectors combine high sensitivity with the lowest possible dose of radiation and provide sharp, high quality images. For hospitals, the choice of different detectors provides highest flexibility: like running two different detectors to enhance the range of applications, retrofitting the analogue MobileArt series or even sharing the detectors with compatible digital X-ray rooms.



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in Vienna, Austria
6. - 10. March
Expo C, stand 312

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PROVIDING SPECIALIST EMERGENCY CARE

A NEW HOSPITAL

Northumbria Healthcare NHS Foundation Trust is building a 29,000m² specialist emergency care hospital, which will open in 2015. The new hospital will include 30-bed units for respiratory medicine, GI medicine, surgery, trauma, an acute medical unit, elderly/stroke care and cardiology. In addition it will provide an 18 bed critical care unit, ambulatory care unit, a maternity unit and a paediatric department as well as a full range of diagnostic services. HealthManagement Managing Editor, Claire Pillar, spoke to project lead Dr. Birju Rana.

What was the thinking behind building a hospital just for emergency care?

Our healthcare Trust covers a population of 500,000 across a large geographical area, much of which is quite rural, from Berwick, on the borders of Scotland down to North Tyneside and Haltwhistle in West Northumberland. Currently we have three acute hospital sites and seven community hospital sites. The three acute sites, Hexham, Wansbeck and North Tyneside all take emergency admissions, with accident & emergency (A&E) departments on each site. The national evidence is that patients in an emergency situation who are seen by senior doctors early in their care pathway have better outcomes. Around 2006 we started thinking of how we could deliver this kind of service over all of our acute Trust sites. To provide specialty level, consultant cover, seven days a week over three sites would be extremely difficult to do. Our clinical teams believed that providing this level of medical cover was the right thing to do for our patient population, and so they looked at ways to try and provide this level of care. The clinical teams looked at a number of possibilities, but felt that the best solution was to combine the existing rotas into one emergency rota and to then separate emergency and elective work so that each had its own diagnostic and theatre provisions and its own rotas to deliver the emergency work. In addition, the separation of emergency and elective work and seven-day working for

consultants (for emergency work) would provide excellent training opportunities for medical and nursing trainees. Furthermore the 24/7 presence of A&E consultants provides additional support for the clinical teams working into A&E, ensures senior decision-making at the earliest part of the patient pathway and also ensures that the department runs smoothly and efficiently.

The recently released proposals from Sir Bruce Keogh, Medical Director of NHS England (NHS England 2013a) include a number of clinical standards that Trusts will be required to deliver from 2016/17 onwards (these include patient experience, time to first consultant review, multidisciplinary team review, shift handovers, diagnostics, intervention/key services), with a view that Trusts will start planning for these changes from 2014/15. We are in a position to feel confident that we will be able to deliver these targets (some of which we have already developed quite extensively) as we open the new hospital in 2015.

Is this the first specialist emergency care hospital in the UK?

From what we know, it's the first one that has been purpose built. Some trusts have existing sites where they have designated one site as 'hot', and another as the 'cold' site, and adapted existing infrastructure. The opportunity to build a new hospital has allowed clinical teams (in the broadest sense) to work closely with architects to design a building that meets their clinical requirements and

an environment that would be good for patients. This has meant that the clinical teams have determined the proximities and adjacencies of each of the departments. The hospital has been designed to ensure close clinical working and integration of services and to reduce 'travel time' within the hospital, both for the transferring of patients and for clinical teams moving around the hospital. For example, the radiology department is partly embedded within the A&E department as is the department of paediatrics. You can see from the image that it's an unusually shaped hospital. There are very few straight corridors. From a time efficiency point of view, travel time between departments is greatly reduced.

What is particularly innovative about it?

The hospital is innovative in the way it is built, how it will look and the way it will work. As a Trust we are really committed to providing excellent emergency and elective care. It is great that we are able to provide a new, purpose built hospital for specialist emergency care, which also offers us the opportunity to enhance our base sites so that the environment for our elective services is also improved. As a Trust we already provide seven day consultant cover for our acute emergency admissions, and extended working for A&E consultants over seven days, but the development of the new hospital will see us moving to seven day specialty working. In the new hospital there



Interviewee

Dr. Birju Rana

Executive Director
Northumbria Healthcare
NHS Foundation Trust
North Shields
Tyne and Wear, UK



Picture.
Aerial View of Specialist Emergency Care Hospital (computer-generated)

will be 12 consultants working seven days a week. In addition there will also be a number of A&E consultants working into the emergency department seven days a week with one being present 24/7. The new hospital functions with specialty admission wards so that as patients come into A&E they are assessed and then transferred directly to their required specialty, as opposed to first going into a 'general admissions ward'. In this way, we are able to move the whole specialist intervention component of care earlier in the patient pathway. The patient is seen more quickly by the most appropriate senior person for their presenting condition. To have specialty consultants working seven days a week 12 hours a day will provide excellent quality of care, and ensure that required decisions are taken early and at an appropriate time within the patient pathway. As a Trust we are always looking to improve, and I personally believe that as a trust this new way of delivering emergency care will further enhance the care we are able to provide to our local population.

What has been the hardest 'sell' for the project?

We have engaged extensively with the staff, and continue to do so as we move closer to the opening date of Spring 2015. We are down to the micro-detail in engaging with staff, and what it will actually mean to them as an individual. From a staff point of view, because this has

been a project led by the Chief Executive and our clinical teams, they were 'sold' on the wider vision from its inception. The wider clinical body bought into it as they knew and believed it was the right thing to do, so it was all about how and when we do it, rather than whether we do it.

With the public, we did a lot of pre-engagement work, before we went out to consultation with the public. This involved being able to explain the model and find out from the public what they didn't understand about the model. We went back till we had covered all the areas they had concerns about or didn't understand before we went out to public consultation. A number of Trusts have talked to us about how we did it, and one thing we advise is not to underestimate the time and effort you need to put into consultation and engagement. The more you do beforehand the better it will be in the long term. It will feel really difficult, but it will be worth it. We continue to track our public perception towards the new hospital. Our communications strategy will gain momentum from mid 2014, as we need to ensure that everyone's clear about the model and how to self-direct to the appropriate care.

The new hospital will take all acute emergencies, but we also maintain what we term 'base' hospitals at Hexham, North Tyneside and Wansbeck, which will provide elective care, outpatients, diagnostics, and walk-in A&E services. We want to make sure that the public

are very clear about how to direct themselves to the appropriate service. There are a number of focus groups that have tested the public's knowledge about their understanding of both the current and future local healthcare service plans. We have been pleased to note the level of awareness of the proposed changes already, and how people have been able to establish the best place to go, based on their understanding of a number of clinical conditions. We propose to build on this communication and understanding further as we move closer to the opening of the new hospital.

Please tell us more about the clinical strategy for the new hospital. Where do you expect to be 3 years after it's opened?

From an emergency point of view we expect to be a leader in the field. We'll be measuring a number of outcomes and efficiency measures through an outcome framework that has been devised by the project group. As an organisation we do believe that seeing a consultant early in the pathway leads to better patient outcomes, and will also lead to a number of efficiencies in the patient journey. As per the Keogh report (NHS England 2013c), having consultant presence seven days a week will improve outcomes and services for patients. The Trust is confident that its new specialist emergency care centre will help it to fulfill these requirements and deliver the

expected improved outcomes as outlined in the report.

You are already implementing seven day working. Could you tell us more about how this has been achieved?

We moved a few years ago to a model of working that allowed us to provide seven day consultant cover into our acute admission wards. Over time our A&E consultants have also moved to extended days and seven day cover. This ensures that all our emergency admitted patients are seen by a consultant. All our emergency admissions come in through A&E and are moved to the medical admissions unit (MAU). The MAU is covered seven days a week by consultants from 8am until 10pm. Every emergency that comes in is seen by a consultant. The change has been a gradual one over time and has been led by the clinical body. The model of working at the new hospital (specialty admission wards) builds on our current model of working and is really viewed as the natural next step in delivering emergency care.

shape of the departments, and ensured that their needs were met in terms of the duties that they needed to undertake on a daily basis so that they were able to meet the needs of their patients. The overall result was a hospital design that was able to fulfill the needs of both those working in the hospital and the patients that they were looking after.

How will radiology services be configured in the new hospital?

The new hospital will have two CT scanners, an MRI scanner, ultrasound and x-ray equipment. This equipment will be situated in close proximity to the A&E department as the radiology department is embedded and situated partly within the A&E department. There will be a radiologist presence seven days a week. There has been a commitment to provide fast access to diagnostic services as this is a key part of emergency services. This has required some capital investment as these services will also continue to be provided on the base sites for our elective work load so trans-

satisfaction now, so it will be interesting to see what happens with the development of the new hospital and the reconfiguration of our services.

What IT systems will be used to manage bed demand/ admissions across the community hospitals and the new specialist emergency care hospital?

We can transfer our existing systems into the new hospital. However, we have just been successful with a technology bid, and we are hoping to implement a ward information management system. Our clinical teams have been looking at a couple of systems that are out in the market to see if we can implement those in advance of us moving. These systems are more electronic, more visual, and allow us to do additional things – not just bed management, but at the ward level, for example, ensuring that tests have been undertaken on individual patients, including discharge information, rather than being paper-based.

What are the financial implications of the new emergency care hospital?

The Trust did not develop this clinical model to save money. The model was developed as it was believed that we would be able to further improve the care we were able to deliver and was in line with national and international evidence – our clinical teams were ready to take this step and drive any clinical improvements that would provide excellent care to our local population. We do believe that seeing a consultant early in a patient’s pathway, and on a daily basis, will lead to natural efficiencies. The model isn’t based on achieving these efficiencies, but we do expect it to be a natural by-product of the new system. We’ve modelled various scenarios, particularly around length of stay. For example, if we cut length of stay by X days what will that do to the bed base, etc. Our main driver has always been about improving patient care. ■

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“our main driver has been about improving patient care”
.....

What has been the multidisciplinary involvement in designing the new hospital?

Each department met with the architect to design their area. The architect had quite an interesting way of teasing out what was important to the people that were in the room. It was always multidisciplinary, as each member of the team had something to offer in terms of designing the space that they would be working in. When the meetings were organised, it wasn’t just consultants who came along, it was the full multidisciplinary team, including allied health professions and healthcare assistants. They were heavily involved in designing the

fer of all radiology equipment has not been feasible. The separation of emergency and elective work will ensure that both streams of work are not disrupted or delayed by new emergency cases coming in through the department. If a patient attends the new emergency department by ambulance, they will be seen quicker, and, if admitted, be seen by the appropriate consultant for their condition. If a patient needs walk-in care, for example needs bandaging up or needs medication, they will get seen quickly on the base sites as there will not be any emergencies that will divert resources in the department. It’s win-win for everybody. We have good patient

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THE ROLE OF TELERADIOLOGY IN EMERGENCY RADIOLOGY PROVISION



Teleradiology is today a word, which epitomises innovation in healthcare, symbolises efficiency in healthcare delivery, and represents a significant success story within the overall spectrum of telemedicine. From its early and fledgling days not much more than a decade ago, it has grown into a billion dollar industry which has been the subject of business case studies at academic institutions while simultaneously providing significant value to patients, physicians, radiologists and entire healthcare systems.

Nowhere has teleradiology made greater impact than in the setting of emergency care, and it is this aspect that forms the focus of this article.

Impact of Teleradiology on Decreasing Report Turnaround Times and Improving Service Levels in the Emergency Setting

The primary value proposition offered by emergency teleradiology is in the outsourced setting. A significant number of hospitals utilising teleradiology services in the United States (the first and to date the largest adopter of teleradiology) are small to midsized community hospitals. In these emergency rooms, prior to the adoption of emergency teleradiology, the scan often remained unreported until the next day, which could result in significant delays in treatment of critical conditions. Alternatively, the practice required the technologist to perform the CT scan and then wake up a radiologist at home in the middle of the night who had to come in to the hospital each time to review the scan (and then work the next day). With the implementation of teleradiology systems the benefits have been

dramatic. In the early days of our teleradiology practice, we repeatedly received feedback from emergency room physicians who commented on how much more preferable it was to work with a cooperative radiologist who was awake and desirous of providing support, in comparison with the previously existing model. The service mindset of professionally run teleradiology companies has also led to higher service levels. Tight service level agreements between the hospital and the teleradiology service ensure very rapid report turnaround that benefits both the patient and the treating emergency physician. Thus, teleradiology has raised the bar for clinical service within the area of emergency care.

Clinical Role of Emergency Teleradiology

The clinical entities which are most greatly impacted by emergency teleradiology include the most life threatening conditions, such as pulmonary thromboembolism, aortic dissection, ruptured aortic aneurysm, and acute stroke, in all of which the cost of delayed diagnosis can be catastrophically high. By creating a framework whereby all emergency scans are reported within a 30 minute time frame, with further electronic prioritisation of critical examinations as STAT (i.e., immediate) priority, teleradiology has allowed for immediate diagnosis of such conditions, which in turn facilitates early intervention and superior patient outcomes.

In the setting of acute stroke, teleradiology plays a critical role. The development of stroke centres at community hospitals across the US has allowed for early treatment of acute

ischaemic stroke in keeping with the dictum 'Time is brain'. Teleradiology plays an important role in minimising the time to thrombolysis by allowing for immediate detection and communication of the earliest changes of acute ischaemia on CT scan within a few minutes of post scan completion. The teleradiologist can simultaneously define the patient subgroup wherein thrombolysis is contraindicated and further guide therapy. In emergency teleradiology practices such as our own, stroke examinations form an interesting and challenging subset. By reporting stroke examinations performed halfway across the world within a 10-15 minute timeframe, practices such as ours allow for continued success of hospital stroke programmes allowing them to meet their time compliances consistently and reliably.

Technology Advances

Technology advances, such as the use of mobile devices, have further extended the reach and improved the efficiency of teleradiology, especially in acute stroke. Today, teleradiology is used by neurologists to view head CTs on their tablet devices and smartphones in the setting of acute stroke. The obvious corollary is that emergency teleradiology is now not restricted to radiologists' reading rooms, and can be accessed by physicians and radiologists while on the move, thereby enhancing their availability and productivity and decreasing time to diagnosis in the emergency setting.

Other technology paradigm shifts, such as the use of wifi and the Internet cloud have further strengthened teleradiology practice by allowing efficient image distribution that



Author

Arjun Kalyanpur

Chief Radiologist and
Chief Executive Officer
Teleradiology Solutions
Bangalore, India

arjun.kalyanpur@telradsol.com

obviates any potential delays in the emergency care environment.

Teleradiology in the Emergency Setting Enhances Report Quality

Emergency teleradiology has engendered a cadre of specialised generalist radiologists, who excel in acute care interpretation. These radiologists have considerable expertise and experience in the diagnosis of acute conditions, as well as a comfort level in a wide range of modalities that renders them uniquely competent to fulfill their role. Their understanding of the needs of the emergency milieu also renders their reporting more focused and directed and hence, more relevant for the emergency setting. Thus, overall, reporting quality is enhanced in the setting of emergency teleradiology.

Furthermore, teleradiology services are intrinsically associated with a strong peer review process. First, many emergency teleradiology reports are delivered in a wet-read format, which is overread by an onsite radiologist the next day, effectively resulting in 100% peer review. Additionally, the competitive nature of the teleradiology market necessitates that providers of teleradiology services need

otherwise/previously available on-site.

Further, the use of the day-night emergency teleradiology model promotes superior radiologic reporting quality as numerous studies have demonstrated that physician decision-making is superior by day than by night, for reasons of physiology and biorhythm.

Teleradiology Increases Radiologist Productivity and Diminishes Healthcare Costs

The practice of emergency teleradiology is geared towards reporting efficiency, given that its primary goal is to generate and deliver an accurate and comprehensive report in the shortest possible time. This in turn promotes the most efficient usage of that most valuable commodity, radiologist time, which has the potential to greatly decrease systemic healthcare costs. Distribution of the caseload across the teleradiology enterprise ensures that radiologist time is never wasted and is most efficiently utilised, while at the same time accommodating for spikes and troughs in workload.

The reduction of healthcare costs by emergency teleradiology is further facilitated by the day-night model

only productive every alternate week, requiring time to restore biorhythms). In the day-night model however, the radiologist performs a day job and therefore works a full quota of days in a year, thereby delivering greater productivity for lesser cost.

High Communication Levels Between Clinicians and Teleradiologists

In the setting of emergency teleradiology, most communication occurs via two media, electronic and verbal (telephonic). Given that within the healthcare enterprise today, a significant quantum of physician-physician communication is telephonic, the additional distance of the teleradiologist in no way detracts from the level of interaction. Similarly, collaborative workflows allow for simultaneous viewing and discussion of complex cases.

Critical values communications are frequent in emergency teleradiology, given that the clinical spectrum is primarily directed towards acute care. In contrast to the initial concerns that teleradiology diminishes verbal interaction, the quality of verbal communication is in fact enhanced by emergency teleradiology, since the physician and radiologist staffing patterns tend to parallel each other, allowing for strong, albeit virtual physician-radiologist relationships.

Teleradiology providers today utilise sophisticated workflow platforms that allow for efficient distribution of images and reports across the enterprise. These platforms are extremely sophisticated and may even outperform large enterprise type PACS. A combination of utilisation of e-faxing systems and online report access from the Radiology Information System allows for seamless connectivity between hospital and teleradiology centre. Coupled with messaging systems technology that

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“teleradiology has raised the bar for clinical service within the area of emergency care”
.....

to demonstrate high quality levels in order to retain their business. In our practice a significant amount of radiologist time is spent in peer review related activities, including CME, and our research into this area reflects the same focus. This is derived from the fundamental philosophy that teleradiology is only viable if it affords a quality of service that exceeds that which was

wherein teleradiologists are geographically based diametrically across the globe from the hospitals where they provide services, a model that was pioneered by our organisation, among others. This ‘follow the sun’ model ensures that the radiologist does not need to stay awake at night, which obviates the need for a night shift module (wherein a radiologist is

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alerts referring physicians to positive results, the entire electronic enterprise that forms the foundation for teleradiology is geared towards effective and efficient communication of positive and, in particular, critically positive results.

Emergency Teleradiology: The Cons

Having listed the pros of emergency teleradiology it is necessary to also examine its cons.

Some teleradiology providers have in the recent past become increasingly corporatised and investor- or market-driven. With private equity investors actively seeking out funding opportunities and rapidly growing teleradiology firms who see value in taking external investment to rapidly scale, the stage has been set for aggressive growth and funding/investment in teleradiology. The issue with this is that it subjects teleradiology providers to influences that are determined and driven by financial constraints rather than the quality of care.

Competition and the pressure to grow rapidly and be profitable also lead to rapid changes in business model, which are not always desirable. Over time, emergency after hours teleradiology providers begin to provide

24 x 7 coverage with on-site staffing. The effect of this is to pit the teleradiology provider as a predatory antagonist pitted against the on-site radiologist, which is not a healthy situation. Teleradiology is meant to be a support for existing radiologic practice, and should not aim to replace the on-site radiology practice, which will always remain a critical part of the healthcare paradigm. In the United States, some large corporatised teleradiology providers have come under scrutiny for adopting practices that have led them to compete with, and potentially displace locally established clinical radiology practices.

One of the challenges that is currently faced in the practice of emergency teleradiology is the lack of relevant and comprehensive clinical data. All too often the clinical information provided is in the form of a cryptic 'abdominal pain' or 'trauma' with no reference to the specific location or nature of the pain/trauma, associated symptoms or relevant clinical examination, laboratory results or pertinent surgical history. Interpreting scans without the availability of relevant clinical information is not in the interest of optimal patient care. However, this is only a temporary challenge, as Health Level 7 (HL7) interfaces permit the extraction of relevant information

from the hospital information systems (HIE) to be made available to an interpreting radiologist on their Radiology Information System (RIS), and so this negative will soon be history.

The evolution of increasingly large imaging datasets, in the era of ultrathin section, high resolution CT and MRI, also poses a potential challenge to emergency teleradiology. If the scan takes a longer time to transmit because of large file size, then this may potentially impact on the reporting time. However, solutions already exist in the form of technologies such as multi-threading routers and with the ever-increasing magnitude of high bandwidth connectivity spectrum, this too shall pass.

Conclusion

In summary, the benefits afforded by emergency teleradiology by far outweigh the negatives, and the overall value proposition of teleradiology in the emergency setting remains sound and robust.

If practised conscientiously and, if permitted to grow and deliver its true value, emergency teleradiology has the potential for sustaining a paradigm shift that will truly benefit emergency medical care, enhance patient outcomes and save many lives. ■

Key Points

- Teleradiology has had a major impact in decreasing report turnaround time, and in improving service levels in the emergency setting.
- Teleradiology in the emergency setting is usually associated with a strong peer review and quality assurance process. It has generated a cadre of specialised generalists, who excel in acute care interpretation. Hence report quality is enhanced.
- By using the centralised reading room coupled with the night-day model, radiologist productivity is increased and healthcare costs are reduced.
- In the emergency setting, communication levels between clinicians and radiologists remain high, commensurate with on-site radiology.
- The cons are related to insufficient adherence to regulations, corporatisation and predatory practices, which are economic and investor-driven rather than in the interests of patient care. Insufficient clinical history and large imaging datasets present a challenge.

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CRITICAL CARE IN THE EMERGENCY DEPARTMENT



Interviewee

Dr. Emanuel Rivers

Vice Chairman and Director of Research
Department of Emergency Medicine
Senior Staff Attending, Departments of
Emergency Medicine and
Surgery (Surgical Critical Care)
Henry Ford Hospital
Detroit, Michigan

Clinical Professor of Emergency
Medicine and Surgery
Wayne State University
Detroit, Michigan
USA

Interviewed by

Claire Pillar

Managing Editor
HealthManagement

Your landmark study of early goal-directed therapy for high-risk patients with infection proved the benefits of providing this therapy early on, in the Emergency Department (Rivers et al. 2001). What organisational change was needed to bring critical care into the Emergency Department at Henry Ford Hospital?

The model is not unique in hospitals that see high-level acuity patients such as trauma, heart attacks and stroke. These hospitals' emergency departments (ED) divide the patients into geographic areas based on acuity levels, which are categories of illness, I through IV. The ED assigns nursing and doctor personnel based on acuity level. That format has been in our ED since we began over 30 years ago. With that model we were able to create a concept where patients receive higher levels of care in the ED

No, I am an intensivist as well as an emergency physician. One of the benefits of working in both places is that I am able to see a continuum of care between the ED and ICU. By providing critical care in the ED, patients not only do better, but you decrease hospital length of stay and healthcare resource consumption. Patients come off the ventilators quicker, they don't require as much haemodialysis, and therefore healthcare resource consumption decreases. We decreased hospital length of stay by an average of five days for septic shock patients. Duration of mechanical ventilation was diminished by about three days, and we were able to show a reduction in hospital costs of over US\$12 million a year from treating sepsis early alone.

As a result of the early goal-directed therapy study, the institution had objective data that shows that this concept works, so they were able to

the model also requires physician and nursing coverage and physical plant capability, to manage patients for up to 24 hours. These patients may be on a ventilator or need advanced monitoring. Those equipment costs have to be accommodated. Basically all those costs are recouped, based on the cost savings that you have. The patients need the care. There's not a major hospital in the U.S., and I would say not even in the world, that do not have some delay in terms of patients being able to get to the critical care unit in a timely fashion. Every major hospital needs some ability to manage critically ill patients in the ED.

In 2002, you and your colleagues wrote, "The care provided during the emergency department stay for critically ill patients has been shown to significantly impact the progression of organ failure and mortality. Despite these trends, formal critical care training for emergency physicians is limited." (Rivers et al. 2002) Has the situation improved since then?

Yes, in the last few years critical care training was finally opened up for emergency physicians. They can now attain critical care training through internal medicine, anaesthesia, surgery and neurology. All those specialities have opened their pathways to emergency physicians to train in critical care medicine.

In 2009, you wrote, "Future emphasis should be placed on overcoming logistical, institutional and professional barriers to the implementation of standardized order sets, which can save the life of one out of every five

.....
"if you provide critical care in the emergency department the patient does better [and] you decrease hospital length of stay and healthcare resource consumption"
.....

before they go to the intensive care unit (ICU). We are able to do invasive monitoring and give a level of nursing care that's a little higher than most EDs, simply because we have been able to create that concept right upon hospitalisation.

expand the critical care bed area in the ED from 8 to 16. We doubled our ability to manage critically patients in the emergency room, and accommodated nursing care and physician coverage for the extra beds.

In your study, did the fact that the intervention saved healthcare resources as well as decrease mortality surprise you?

What are the main challenges for implementing critical care therapies in the emergency room?
It is one thing to have the data showing that it is cost-effective, but

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to six patients presenting with severe sepsis and septic shock.” (Rivers et al. 2009) What are the main barriers to improving treatment for patients presenting with severe sepsis and septic shock?

The main barriers have to do with a paradigm shift. For example, with heart attack – two decades ago mortality was 30-40%, and now a heart attack is a priority, so if a patient comes in with chest pain there’s a series of events that has to occur immediately without question that prevents that patient from dying. It is the same for stroke and for trauma. For some reason sepsis has not got the same aggressive attention, because people have not realised that this is very similar to other diseases. The main barrier is a change

in the paradigm of how people think about sepsis, that it is an emergency and that people die. Fifty per cent of people with septic shock will die. Once you create a paradigm that the first physician who sees the patient understands that this has a high mortality then people will change their approach.

Secondly, early recognition. Sepsis is not a very simple disease to recognise. Sometimes the patient may come in with symptoms of another disease, but it ends up being sepsis. Early recognition is very important, especially for the emergency departments, because the patients don’t necessarily present very clearly.

Thirdly, being able to mobilise resources so that the emergency physician is not stuck with managing

a critically ill patient. Colleagues throughout the hospital must cooperate with the ED so that you can mobilise the resources necessary to move that patient either rapidly to an ICU or the critical care staff come down and give the level of care necessary. It is not always the emergency physician’s responsibility, but there must be a standard operating procedure so they can activate the resources that can get the patient aggressive care. We do that with heart attack, for stroke and for trauma patients. We have to change our paradigm where we now do that for septic patients. We have a sepsis alert, just as we do for myocardial infarction and so on. We see the critically ill patient right away, and provide those resources right up front. ■

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BREAST DENSITY

WHY WOMEN NEED TO KNOW



Interviewee

Dr. Nancy Cappello, Ph.D.

Executive Director and Founder
Are You Dense, Inc & Are You
Dense Advocacy, Inc.
Woodbury, CT
USA

nancy@areyoudense.org

Interviewed by

Claire Pillar

Managing Editor
HealthManagement

Further information

<http://www.areyoudense.org>
<http://www.areyoudenseadvocacy.org>

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Are You Dense iPhone and iPad App
http://www.areyoudense.org/workcms_published/resources_page181.shtml

What prompted you to found “Are You Dense”?

I was diagnosed with advanced stage breast cancer in 2004, six weeks after my lab-normal mammogram. My cancer had metastasised to 13 lymph nodes. Being a very faithful patient, who never missed an appointment, had all the mammograms and ate healthy, with no risk factors that I knew of, I was shocked that my cancer was diagnosed at such a late stage. I was 51 when I was diagnosed, that was my 11th yearly mammogram. Knowing that later means a worse prognosis and tougher treatments I went back to my doctors and said, “What happened? I don’t understand this”. Each of my doctors said, “Well, Nancy, as a matter of fact, you have dense breast tissue”. I said “What? Dense breast tissue?” I ended up doing a literature search. What shocked and outraged me was that there was a lineage of research dating back to 1995 about

these 40% of women just like me that come to your office and they are going to have cancer that was missed by mammogram?” and each of them said, “No, we just don’t do that, we can’t, it’s not the standard of care”. When I went back and got my reports from my radiologist that were sent to my referring doctor for 11 years, each of my reports said, “Patient has extremely dense breasts, no change from prior exam”. I know my doctors did not have confidence that cancer wasn’t lurking within the masking of the dense tissue.

So, working with the Connecticut legislature, we started with insurance coverage for ultrasound screening, and then when doctors still weren’t telling women about their dense tissue, ended up with density reporting legislation, which finally passed after lots of drama. We passed the first legislation in the United States, and hence the density movement was formed.

.....
“it’s critically important that women are aware of the density of their breasts”

the masking effect of dense tissue by mammogram, about 40% of women having it, and about added ultrasound or MRI to find cancers the mammogram miss.

I had basically a very slight chance to have my cancer found by mammogram. I had extremely dense breasts. So, what do you do with that information? I went back to my doctors and said, “Shouldn’t you start telling

Why do you think you encountered such resistance, particularly from healthcare professionals?

You may wonder why we have to have legislation, shouldn’t doctors routinely tell women? Most radiologists report this issue to the referring doctor, but the only person that doesn’t see it is the woman who has the dense tissue. Unfortunately, we have to use legislative means, because doctors

aren’t routinely telling women. The objections run from “we don’t like legislation”, through unfounded anxiety claims, “there’s not enough science”, to “mammogram is the only randomised controlled trial test”.

It is very frustrating to have to work this diligently and relentlessly to get this information to patients. I was diagnosed 10 years ago, so we are getting more and more focused in understanding the issue, and more and more doctors are supporting our work, but clearly not the majority.

Is the legislation working, to your knowledge, in the 14 states that have passed a law?

In Connecticut we were the first to pass density reporting legislation, in 2009. We have 3½ years’ worth of data now. I know from the research from Dr. Hooley (Hooley 2013) and also Dr. Weigert (Weigert 2012) that we are finding more cancers. Dr. Hooley reports a 70% (seventy percent) increase in invasive cancers by adding in the ultrasound. I’m hoping there are more conversations between women and their healthcare providers about the impact of dense tissue on missed cancers by mammography. I do know that our work has absolutely educated so many women and doctors too about this important issue.

Women can ask for copies of the radiologists’ reports, which most likely has information about their breast tissue composition. What’s the follow-up to receiving the notice that you have dense breasts, are doctors making sure that women have conversations with them? That’s the tough one. There is research about those conversations, but it hasn’t

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How to Save Patient Lives, Time & Money.

A different kind of diagnostic monitor

Dome has been in the market place since 1989. We asked: **'Who should be responsible for image quality?'** The end-user (resulting in frequent adjustments and system monitoring) or the manufacturer?"

This simple question has led to a very special monitor principle many radiologists are largely unaware of. Radiologists are held personally responsible for their reading capabilities. We believe they should be knowledgeable about and critical of their main working tools and circumstances: their diagnostic monitor, maintenance and ambient conditions.

'What are the main parameters for the 'ideal' monitor for diagnostics and good working conditions?'

1. **Optimal image quality over time**
2. **Zero maintenance (costs)**
3. **Highest possible accuracy with regards to JND 's,**
4. **Silent and**
5. **Made with radiologists in mind.**

Not easy, but not impossible. The Image Quality (IQ) for any diagnostic monitor (intended use diagnostics) is defined by the DICOM part 14 workgroup: the Grey Scales Display Function (DICOM GSDF) keeping as close as possible to this curve (with the lowest possible (maintenance-) costs is key for diagnostic monitor IQ. Not just when the monitor is first powered on, but ideally for its entire technical lifetime. When there is a deviation on this curve, the essential question is: 'How much is acceptable before we start missing life threatening pathologies?'

Can a (reading-/ interventional-) radiologist accept a breast mass or brain tumor not detected because the monitor is off the ideal curve?

What if there was a kind of closed loop process built into the monitor that constantly monitors it and makes minute adjustments to the JND's 'creating' the ideal GSDF at any luminance? It would solve a lot;

- **No more degradation of IQ, without any service needed.**
- **Operational costs close to zero.**
- **It could potentially save lives.**

Hospitals pay twice

Dedicated calibration service companies check and adjust these monitors to the ideal curve. That 's a recurring variable cost factor Total Cost of Ownership is more and more a spear point from financial departments. Over the typical economical lifetime of a monitor (5-7 years) total costs have doubled. The hospital pays twice.

Display trust

How well can a radiologist trust the monitor in terms of optimal IQ just a day before the calibration service is deployed?

The GSDF might be 15% off the optimum. Is this acceptable? The radiologist provided his services for patients - they depend on his professionalism. An optimal tool for reading cases is of paramount importance.

What is needed is a monitor that can be trusted in unprecedented IQ over time. Not just on day one, that's relatively simple. Keeping it in that quality without any maintenance costs is a complete different ball game. It's our pedigree: Optimal IQ from day 1 until the technical end of the monitor.

Not all displays are created equal.

Image quality

The second equally important aspect of IQ is ensuring that at any luminance level radiologists are assured of maximal 255 (8 bit data word) different levels of grey. It is a complex process making sure that all these 255 differences are effectively there and that the differences remain visible over time and - even more complex - with every luminance level.

Almost impossible for most humans is to get the combination of getting very close to the ideal GSDF curve, making sure the 255 different levels of grey are just recognizable and to top it, over the lifetime of the monitor.

This is known to be nearly impossible to accomplish. That is said for a human, not for a computer. The computer beats both humans in speed and accuracy. A good thing we have more than enough computational power these days to perform this task with ease. We build one in our monitors.

Not to worry about IQ at any time and zero maintenance costs. The kind of simplicity even Da Vinci would agree with, the ultimate sophistication. **The Right Choice for Radiologists.**

The radiologist

Is a human, not a machine. We are in continuous contact with radiologists, clinical physicists, IT personnel and financial administrators and know their specific needs well. The radiologist's typical working environment is a controlled room with low and constant lighting conditions that create best possible reading conditions.

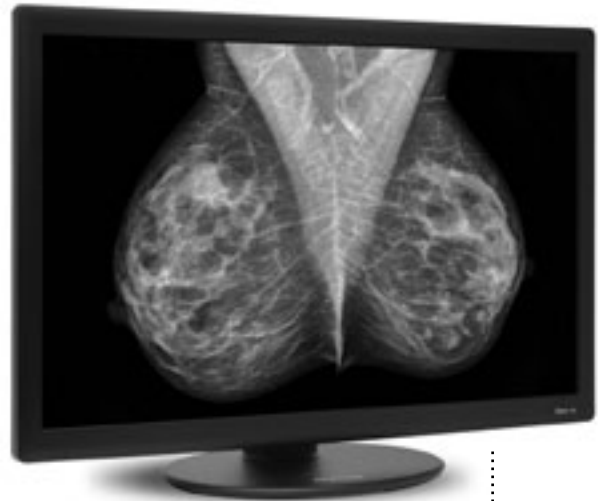
These conditions are also catered for by the monitor;

- **No reflective material,**
- **No front 'power-on' LED shining directly in the eyes of the radiologist,**
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been published yet.

There is clearly more awareness about the issue, but still many women don't know. In the survey done by Stanford University (Dave 2012), the greater majority of women were still unaware of their own personal density, and what that means for the accuracy of their mammogram.

women who have extremely or heterogeneously dense breast tissue.

I would say to doctors that it's critically important that women are aware of the density of their breasts and, when they have their screening mammogram, there should be conversations about what that means, and women should know the risk and the benefit of the screening test. At the same time, physicians and radiologists need to understand the impact of density on the accuracy of the mammogram. We've known for almost two decades now that breast density is the strongest predictor of the failure of the mammogram to see through the density to find the cancer. Most women are totally unaware, and expect if they choose to have screening that if the cancer is there, it's going to be found early. That's not the case, because typically, if it's missed and missed and missed, it's only found by the time it's felt, like in my case, and you can say goodbye to early detection.

What would you advise women in Europe who perhaps have not heard about breast density?

A woman should know about breast tissue composition, whether she has fatty breasts, scattered fibroglandular tissue, or extremely dense tissue, and what it means for her personally. I would suggest that they talk to their doctors about, first of all, what is their breast tissue composition, and then have other conversations about their density, the masking of density by mammogram and also their other risk factors, if they have any.

I thought I was an educated patient and I wasn't. The sad thing is that if women don't even know what to ask, they really can't have informed conversations. If they could only depend upon what their doctor tells them, well, how would they even know about this? I would just say what would you want for your sister,

mother, daughter or yourself, would you want this information? You can only act on information given to you. If you get this information, and you don't want to do anything about it, that's fine, but it's about informed consent and not withholding information that is very important. If this wasn't a critical risk factor, both the masking and the cause of risk, why would we have folks studying it for nearly 30 years now?

Many companies are now bringing out new tools to assist in imaging dense breast tissue. What role does industry have to play in informing radiologists and women about the issue of screening dense breasts for cancer?

We hear from doctors all the time, so a woman knows she has dense breasts, now what? First of all, a woman has the right to know, it's a basic doctrine of informed consent. Secondly, we know that hand-held ultrasound as a technology has been around for decades, and, we know that ultrasound and MRI will find more cancers certainly than mammography in women with dense breasts. We also know that there are more false positives too. One of the solutions is to find more reliable screening tools that are efficient, with increased specificity and sensitivity, and that's what's happening now.

The responsibility to inform the patient should be between the patient and the doctor through a notice, but clearly industry has a role in educating the physician about what technology they can utilise and how it could actually work in their practice.

Please tell us about the "Are You Dense" app.

It explains the issue of density and also reviews technology, including ultrasound, mammography, molecular breast imaging, tomosynthesis and automated ultrasound. ■



What would you say to radiologists in Europe about breast density and their responsibility to women?

In October 2013 I was invited to present at the European Society of Breast Imaging congress in Rome about the vast scope of our work. Clearly this crosses any border, state or country. What was remarkable to me was that there was a lot of interest from radiologists in Europe about the issue of density. Many of these radiologists are very much involved with their patients; they know their patients. It seems to be different than what happens in the United States. In Europe it appears that doctors are really hands-on, and many of them acknowledge the fact that they want to tell women about their density. They certainly know as radiologists what density looks like, and they know that they're missing some cancers. In Europe each country's breast screening programme differs, but I know that the Austrian state screening programme is going to tell women about their density, and will also offer the ultrasound to

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MEDICAL FUSION IMAGING

PAVING THE WAY FOR BETTER DIAGNOSIS OF TUMOURS



Author

Raghumar Madanagopal

Healthcare Research Analyst
Frost & Sullivan

Medical imaging involves creating images of the human body to assist medical practitioners in effective clinical diagnosis. A number of imaging techniques have been developed over time that not only help in anatomical diagnosis, but also assist in functional diagnosis. The imaging scenario has continuously evolved from x-ray film and cassettes to using computers and digital techniques. The aim of such reinventions in imaging techniques is to provide excellent patient care, without compromising on accuracy of diagnosis. As technology evolved, for accurate diagnosis different imaging modalities were being used one after another. The clinicians obtained physiological and anatomical information on separate machines. These images were viewed together after using special registry software to superimpose images from each of the participating modalities. Recently, there has been an improved need to utilise different modalities together for effective diagnosis, and this has promoted a novel hybrid technology called fusion imaging.

Fusion imaging is a combination of two independent imaging modalities, where one depicts an organ's functional aspects, while the other modality aims at indicating the anatomy of the organ. The combination of modalities provides a level of diagnostic superiority that allows clinicians to achieve unparalleled accuracy in diagnosis. The most advanced hybrid fusion imaging equipment is capable of performing examinations of two different modalities simultaneously. The resultant image data is merged automatically,

forming a composite image. Fusion imaging, by bringing together the molecular function and anatomic form on a common scale, helps in understanding the human body with a very high level of precision. The first commercial hybrid fusion imaging machine in 1995 was a combination of Computed Tomography (CT) with Single Photon Emission Computed Tomography (SPECT). This CT-SPECT hybrid was later followed by a more advanced combination where Positron Emission Tomography (PET) is combined with CT imaging.

Advancing technology drives the need for better ways to acquire clinical information by non-invasive means. Medical decision making is now being supported by a wide

exact location of the tumour may go undetected. When combined with a CT system, the tumour detected by the PET can be located on the anatomical representation from the CT image. By integrating different, but complementary working principles, imaging technology can be used to provide highly efficient non-invasive diagnosis of tumours. The potential of these technologies to enable effective treatment planning for radiation therapy drives the demand for such hybrid imaging machines. A PET-CT scan offers a precise reference point for radiation therapy by indicating the functional attributes of the tumour and indicating where to target the radiation. This ensures that the tumour receives maximum radiation.

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“the most important criteria of fusion imaging are obtaining best image quality while delivering minimum radiation dose”

choice of imaging technologies. Conventional cross sectional imaging techniques like CT have important roles to play in non-invasive diagnosis. CT scans are highly efficient in anatomical diagnosis. However, CT can be incapable of non-clinical malignancies that have a potential to metastasize and become difficult to treat. Nuclear medicine procedures like PET and SPECT are the best known techniques that identify the metabolic function of an organ. These techniques are excellent indicators of tumours and malignancies, but the

PET-CT Fusion Imaging

PET-CT fusion imaging combines PET with 16 slice CT modality. PET is an excellent indicator of tumours, while CT forms the anatomical base in the fusion image. PET, as a nuclear medicine procedure, is performed by injecting 15-fluorodeoxyglucose (FDG) intravenously. The glucose in FDG is taken up by the tumour cells that seek high levels of sugar in comparison to the other cells. As a result of this sugar seeking behaviour, large amounts of FDG are absorbed

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into the malignant tumours, hence making the smallest of tumours visible in the scan. Through PET alone physicians can effectively identify potential tumours, with an uncertainty about the exact location, while CT provides the anatomical details. PET-CT fusion imaging merges the best of the two worlds. PET-CT not only can identify cancers, it also plays an important role in radiation therapy by monitoring how tumours respond to chemotherapy treatment.

The major advantages of PET-CT are:

- The ability to correct attenuation of PET using CT image as co-efficients.
- This enables analysing all PET derived biochemical information on a common single morphological volume.

The limits of PET-CT are:

- In some clinical cases, PET-CT fusion imaging may not meet the adequate requirements for diagnosis.
- With time PET-CT hybrid may become very routine, with increasing demands for new research targets for fusion imaging.

Drivers of fusion imaging

- Cost cutting in healthcare institutions across the globe calls for excellent management strategies that are cost-effective. Fusion imaging is a cost-effective approach whereby the cost of two different imaging technologies can be reduced by combining both technologies into one.
- Earlier, software registrations were used to fuse images from two individual modalities. Though this added clinical value as it was a well-developed approach, with advancement in technology, a need developed for a far more innovative hybrid that could perform what the software does,

in a single machine automatically at a lesser cost.

- An increasing demand for effective treatment of various cancers using non-invasive means encourages research to develop more variants of hybrid fusion imaging technologies.
- Advancements in computation power provide flexibility for real time image fusion using independent imaging technologies combined into a single hybrid, in a cost effective and affordable manner. In an attempt to streamline workflow, hybrids play a crucial role as the patient is needed just once for performing diagnostic analysis.

Limitations of fusion imaging

- Fusion of images from two incompatible modalities is possible using software registration, but a hybrid system for these modalities is not feasible.
- In an individual CT examination, an average of four to five patients is scanned every hour. But in a hybrid system fusion scan, an average of 12-15 scans can be performed in a day. Therefore this makes the process of scanning more elaborate.
- Operating personnel are expected to have advanced qualifications in order to understand the regulations of operating hybrid equipment.
- In hybrid hardware integration, the technology of the constituents of the fusion may lag behind individual modalities, due to development required in terms of research, time and money.

Though there is high emphasis on the information sought rather than the technology used, with extended research and new biomarkers being developed all the time, strategies that are applied today may be outdated in a few years' time.

Conclusion

The most important criteria of fusion imaging are obtaining best image quality while delivering minimum radiation dose. Hybrid fusion systems form the core of fusion imaging and hold the key for advancements in the future. There is much research that is looking into different types of multi-modality fusion, and the hybrid technology still has a long way to evolve. The PET-CT technology has been competent in tumour non-invasive examination, and the difficulties that were posed initially have been successfully overcome. But emerging fusion technologies involving magnetic resonance (MR) and ultrasound, like PET-MR, having shown promise during research, still have a long way to go before being applied for full scale diagnosis. The main aim for developing fusion imaging technologies was to provide high quality patient care. In order to ensure that the patient gets the best service, emphasis has to be on training the personnel to perform the fusion imaging procedures. In spite of the continuing debate regarding the efficiency of hybrid fusion imaging like PET-CT, it has been observed that healthcare institutions are adopting the technology rapidly, hence showing explosive growth. The promising performance of fusion imaging in effectively identifying tumours and targeting radiation for various malignant cancers, including but not restricted to hepatic cell carcinoma, pulmonary nodules, colorectal cancer, melanomas and lymphomas, is expected to encourage more research to develop a number of advanced hybrid modalities for fusion imaging. ■

THE MATH OF DECISION IN RADIOLOGY



Assume that a physician has asked for your consultation regarding a low quality CAT scan. It looks like there is sulcal hyperdensity in left Sylvian fissure that is suggestive of a subarachnoid haemorrhage (SAH), but you cannot be entirely sure. Wouldn't you like to learn something that was helpful in the diagnosis of SAH? Every radiologist would like to learn more about the complaints of the patient in similar situations. If the finding is somewhat incidental and the patient has no complaint, then the probability of a subarachnoid haemorrhage would be very low. However, if the CAT image belongs to a young female who is experiencing the worst headache of her life on that particular day, the probability of SAH would definitely be increased. What would be the probability of SAH in the first case? Although you will not be able to provide an exact numerical answer to this question, you might estimate it to be 'very low'. On the contrary, the answer would be 'very high' in the latter case. Although you might not think that numbers are a way of expressing your thoughts, are you aware that there are certain probability calculations taking place in your mind? So, what type of mathematical processes lead to different probability evaluations in these two cases?

Probability in Daily Practice

This famous old quote from Sir William Osler underlines the importance of mathematics in medical decision-making: "Medicine is a science of uncertainty and an art of probability" (Bean and Bean 1950). Indeed, physicians are constantly dealing with probability calculations during their daily practices, whether consciously

or not. In this article, I will try to explain the underlying mathematical calculations that physicians in general, and radiologists in particular, come up against during such decision-making processes.

In reality, every human being has a certain probability of contracting each disease. This probability varies between 0 and 100 percent. For instance, the probability of any particular 45 year-old Caucasian female having breast cancer is theoretically equal to the breast cancer prevalence

of 45 year-old female Caucasians. Each finding or symptom the individual shows either increases or decreases this probability, adjusting it to a new value. In some cases, definite diagnosis might not be possible, so treatment begins when the probability reaches a certain threshold. What is important for clinicians is to decide on whether 'to treat' or 'not to treat'. This decision directly depends on the probability of the disease. Radiologic diagnostic tests are therefore essential instruments in evaluating the probabilities that are crucial for the decision to start a treatment. Nevertheless, radiologists often face decision-making problems following the diagnostic test findings, and must revise the probabilities.

More often than not physicians do

not use these probabilities as 'point estimate' values. Rather, they perceive them in terms of being 'low', 'high', 'very high' and so on. Casford proposed 101 different descriptors, which may take place in radiology reports matching every integer percent values from 0 to 100 in his interesting letter (Casford 2000). Every physician has an approximate probability estimation related to his or her patient, and this probability changes to a new level depending on new test results or findings. The clinical information of the patient

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“radiologic diagnostic tests are essential instruments in evaluating the probabilities that are crucial for the decision to start a treatment “

covered in the radiological orders is also important for pre-diagnosis probabilities. Moreover, radiological reports contain valuable clues about the post-test probabilities. In some cases, this information may be quite clear, such as in the exact ruling in or out of a disease. Radiologists and physicians always revise probabilities. Although the underlying mathematical steps in such instances are generally not consciously known, they are nonetheless the bases of all probability revisions.

Heuristics

It is clear that continuous calculations of probabilities using mathematical operations in a medical environment are neither easy to calculate, nor easily applicable. For complex problems



Author

Prof. Utku Senol MD, PhD

Consultant Professor of Department of Radiology
 Head of Division of Neuroradiology
 Akdeniz University School of Medicine
 Department of Radiology
 Antalya, Turkey

utkusenol@gmail.com

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such as those encountered in medicine, 'mental shortcuts' are often preferred over mathematical calculations. Such shortcuts are known as 'heuristics'. Heuristics are used in decision-making, and they facilitate the process (Marewski and Gigerenzer 2012). However, ultimately they are only subjective probability estimates. In radiology, there are two well-known major error sources resulting from subjective probability estimates: pseudodiagnosticity and premature diagnosis (Wood 1999). Additionally, a number of heuristics might also cause errors due to being subjective.

There are several different types of heuristics. An example of 'availability heuristics' is when a physician has recently read or learned about a certain disease, he or she might quickly recall this during the differential diagnosis phase, even though it is actually quite unlikely. Another example of such heuristics is the 'value-induced bias'. In this case, a certain disease is wrongly assigned a higher degree of probability due to its perceived importance. 'Anchoring and adjustment', 'representativeness' and 'affect heuristics' are the other examples of common heuristics that may cause errors in similar ways (Levy and Hershey 2008; Senay and Kaphingst 2009). As with the other subjective probability estimations, heuristics are prone to errors. Therefore, it is very important to be aware of all these processes and know the mathematical calculations that are the basis of probability evaluations.

Calculating Probabilities

Diagnostic tests are crucial for calculating disease probability. Sensitivity and specificity scores of the tests are mostly used for excluding and confirming certain diseases and are generally known, thus leading to easier probability calculations when compared to other medical processes. Therefore, radiologists are at something of an

advantage for probability revisions in comparison to other physicians.

What should physicians do if they would like to mathematically calculate the probabilities and revisions? There are several different methods for conducting such calculations, although almost all are based on Bayes' Conditional Probability Theory. Nomograms, conditional probability graphs, 2 x 2 tables and decision tree revisions are some of the methods used for this purpose (Straus et al. 2005). In this article, I will try to explain the method, using likelihood ratios in detail. Likelihood ratio can be described as "the likelihood that a given test result would be expected in a patient with the target disorder compared with the likelihood that the same result would be expected in a patient without target disorder" (Straus et al. 2005). The likelihood ratio defines the strength of the test, and enables estimation of the post-test probability, with the help of the post-test odds. As shown in the formula below, multiplication of the pre-test disease odds with the likelihood ratio gives us the post-test odds.

Post-test odds: Pre-test odds X the likelihood ratio:

Let's see how to calculate odds and the likelihood ratio:

a-Pre-test odds: Pre-test probability / (1-pre-test probability)

b-Likelihood ratios: The likelihood ratio is a single number that is calculated by using sensitivity and specificity values. It is called 'positive likelihood ratio', when the test is positive and 'negative likelihood ratio' when the test is negative.

Positive Likelihood Ratio: Sensitivity / (1-Specificity)

Negative Likelihood Ratio: (1-Sensitivity) / Specificity

As shown in the above formula, two elements are essential for calculating

the probability following a radiological test result.

1. Pre-test probability: It is possible to obtain correct probability estimations before doing any tests, with the help of accurate and complete clinical information. This explains why accurate clinical information included in radiological orders is both necessary and important. It is logical to expect a correct post-test probability estimate from the radiologists only when the pre-test probability has been completely provided. The above formula is the mathematical demonstration for this argument.

2. Likelihood ratio of the test: This is calculated by using the sensitivity and specificity of the diagnostic test. Such information regarding the radiological tests is usually available in the literature. It is important to ensure that the testing method is identical in order to be able to apply this knowledge from the literature to our own circumstances. At this point, another question arises: Is it possible to use the predictive values for post-test probability calculations? Generally in the literature, such predictive values are provided along with the diagnostic characteristics. However, it is vital to remember that those predictive values regarding the diagnostic tests are valid only in the specific conditions of the original research. It cannot simply be a case of direct transfer to other study environments. An exception, however, is where the prevalence is exactly equal to the original research, since the predictive values are dependent on the prevalence. However, the likelihood ratio can be transferred to any study or situation, as long as the test method is preserved.

Examples

Let's try to explain the calculation of post-test probabilities with two examples:

Question 1 - A CT scan reports a lymph node of 11 mm in short axis suggesting lymphadenopathy in the mediastinum. Assuming that the sensitivity is 90% and specificity is 80% for this method, what is the real lymphadenopathy probability? In this case, post-test probability cannot be calculated, because the pre-test probability is not known. Remember that the pre-test probability would be different for a young, healthy individual and a 60-year-old patient with lung cancer.

Question 2 - A breast cancer-screening programme is carried out in a population where the disease prevalence is 0.1%. Let's assume that a patient is diagnosed with mammography and the mammography sensitivity and specificity are both 95%. What is the real probability of having a correct diagnosis for this patient?

In this situation, clinicians tend to assign a high probability based on high sensitivity and specificity scores. However, since the pre-test probability is quite low, the probability is also very low: about 2%. With a pre-test probability of 1/1000, pre-test odds for the test will be 1/999. In this case, the positive likelihood ratio is calculated as $0.95/(1-0.95)=19$. Post-test odds can be calculated as 19/999, and the post-test probability is exactly 1.87% (since $\text{post-test probability} = \text{post-test odds}/(\text{post-test odds} +$

1)) for this specific example. This is, perhaps surprisingly, quite low. Let's confirm it; a specificity of 95% would mean that the false-positive rate is actually 5%. This in turn means that out of 1000 cases, only one real positive case is expected, while around 50 false-positives would be diagnosed.

Specific Tests

Sometimes younger colleagues might think that pre-test probability is not important if a very specific radiologic finding has been obtained. How can we explain such a statement? Consider this example: a radiograph of a ER patient apparently shows that the tibia is fractured

finding is 'SPECIFIC' or 'SpIN' (stands for a highly specific test, positive test result, rule the disease in)' as named in the evidence-based medicine terminology (Straus et al. 2005).

Conclusion

In conclusion, like all physicians, radiologists have to deal with mathematical processes during their everyday practices. Deciding on the post-test disease probability after radiological tests requires certain probability calculations. To conduct these calculations, pre-test disease probability, test sensitivity and test specificity must be known. This notwithstanding, radiologists often make such calculations sub-

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“learning mathematical processes is crucial for physicians as well as radiologists”

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into two. Although we do not have any patient history, we do not need pre-test probability to diagnose the fracture. In this situation, the finding has a specificity of 100%. In such cases, the positive likelihood ratio would approach infinity, if calculated. No matter what the pre-test probability is, the multiplication with the pre-test odds will provide a post-test probability of 100%. In other words, the

consciously, with the help of mental shortcuts they have developed through their experiences. However, heuristics may easily cause errors. This is why learning mathematical processes is crucial for physicians as well as radiologists. At the same time, it is somewhat intriguing to observe such similar medical practices in everyday routines. ■

Key Points

- Radiologists are constantly dealing with probability calculations during their daily practices, whether consciously or not. To be aware of underlying mathematical processes may help to avoid errors due to subjective probability estimations.
- It is logical to expect a correct post-test probability estimate from the radiologists only when the pre-test probability has been completely provided. This argument can be mathematically proved.
- The likelihood ratio is an excellent tool to define the strength of the test and to estimate the post-test probability.

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PHARMACY AND HEALTH IT



Author

John Chave

Secretary General
Pharmaceutical Group of
the European Union

pharmacy@pgeu.eu

A patient walks into a European pharmacy. She hands a paper prescription to the pharmacist. The pharmacist is unfamiliar with the prescriber, and struggles at first with the handwriting, but after a call to the physician, the medicine and its dosage are clarified. The medicine might possibly interact dangerously with others, but the patient cannot remember exactly what she is taking (she is an elderly citizen, and takes nine prescription medicines during the course of each day, as well a non-prescription medicine from time to time). Again there is a call to the physician, but when the pharmacist finally gets through, the doctor is unsure what he has prescribed recently and he does not have the time to go through his records. Besides, the patient was recently hospitalised, and prescribed additional medication during her hospital stay. The doctor does not know what these medicines were. But, it transpires, the patient will not get the medicine prescribed in any event. Just in time, the pharmacist remembers the fax sent earlier that morning recalling that medication, due to discovery of a quality problem.

An unrealistic scenario? No. In Europe, the majority of prescriptions are still scribbled on paper. Examples of coordinated electronic medication records are thin on the ground. Systematic reconciliation of medicines prescribed in secondary and primary care is rare. And in terms of recall efficiency, the pharmaceutical sector often lags behind other sectors, particularly given the potential impact of substandard medicines on patients. It is to be hoped that in my scenario the patient does not join the hundreds of thousands each year in Europe who suffer illness, injury or death through avoidable adverse drug reactions. Happily, change is coming.

Electronic Medication Records

We are all familiar with the challenge posed to European societies and health systems by demographic change. Medication use is one of these challenges. Cases of patients taking nine prescription medicines (or more) concurrently, ('polypharmacy' is the technical term) are already common, and will become more so. We face the prospect of an increasingly medicated society. Given the known susceptibility of the elderly to medication related problems, we cannot afford to tolerate systems of prescription and dispensing which, despite the best efforts of stakeholders, are often imprecise and badly informed.

The use of electronic prescribing in Europe has increased significantly in recent years. While e-prescribing is well established in Nordic countries such as Denmark and Sweden and in some regions of Spain, systems have also recently been implemented on a national scale in Estonia, Romania and Greece.

There is significant evidence that e-prescribing reduces prescription and dispensing errors, not only in terms of eliminating illegibility, but also by allowing prescribers to make better medication selections. E-prescribing can also help streamline dispensing processes, leaving more time for pharmacists to engage with patients. It also increases the transparency of the prescribing system, a useful asset for those governments trying to control pharmaceutical budgets. Although procurement of e-prescribing systems can be slow (notably, none of the EU's four larger members, Germany, France, Italy or the UK, have a fully operating national system in place), it is reasonable to expect that electronic prescriptions will become the norm in Europe in the next decade.

But e-prescribing is perhaps a necessary, but not a sufficient, step in making our prescribing and dispensing practices safer. The real added value of e-prescription, at least in public health terms, arises from the potential to integrate prescriptions into electronic health or medication records.

Pharmacists have the skills, experience and knowledge to help ensure medication use is safe and effective. But they do not always have the tools. Without a comprehensive understanding of an individual patient's medicine use, the potential for adverse drug events is never far away.

In France, the pharmacists have developed a pharmacy based medication record (the Dossier Pharmaceutique, or 'DP'), which records the patient's medication use of both prescription and non-prescription medicines, for the previous four months. The DP is available in any pharmacy upon presentation of the patient's health insurance card – so a patient on holiday in Nice can access the record if his or her local pharmacy is in Paris.

The results show the benefits are real. The DP increases communication between pharmacists and physicians, and leads to alterations in prescriptions in on average 10% of the cases where the prescriber has been contacted.

Now the Dossier Pharmaceutique will be extended to hospitals, bolstered by evidence that two-thirds of medication records in French hospitals contain incorrect information, and that the hospital/community interface (when a patient is admitted or discharged from hospital) is the point at which nearly half of all prescription errors occur.

Similar systems are planned in several European countries, including Belgium and Austria. But the main challenge to the development of

pharmacy accessed electronic medication records are not technical or legal (data protection is of course a key issue – see below), but cultural. There is often resistance to the inclusion of pharmacists in the scope of medication records programmes, sometimes caused by the sort of silo thinking that inhibits more systematic collaboration between health professionals. But exchange of information is at the heart of collaboration, and without collaboration, I would suggest, health systems will fall short of properly addressing the challenges they face.

Medicine Serialisation

Prompted by concerns over the growing threat of counterfeit medicines in the legal supply chain (falsified medicines from illegal Internet sources are already a disagreeable reality), the European Union recently adopted legislation which will require most prescription medicines to carry an individual serial number, embodied in a bar code. The legislation envisages that pharmacists and other supply chain actors verify the authenticity of a medicines package by scanning the bar code and comparing the serial number to one uploaded onto a database, much in the same way as credit cards are verified. The European Commission is currently designing the technical framework of the verification system, and it is expected to become a reality in EU Member States in 2017.

The immediate aim of the system is to detect and deter counterfeits. But the scope for utilising bar codes for a broader range of health related interventions is huge. For example, in Belgium, where such a system is already in place in more than 60% of pharmacies, pharmacists are able to receive messages and support information related to the scanned product at the point of dispensing. In the UK, a European Commission funded project is examining how scanned bar codes can

link to video tutorials on medicines use.

More basically, the system will ensure that expired medicines are not dispensed, since the serial number will incorporate the medicine expiry date. And the days of recalling substandard medicines through the only partially reliable means of telephone, fax and email will be over – it will not be possible to dispense recalled medicines, and the whereabouts of relevant packs will be easily identified.

The advent of medicines verification and e-prescription will generate a wealth of data on prescribing habits and patient use of medicines. We perhaps need to think constructively about how the new world of pharmacy related data, which is coming upon us, can be used to tackle persistent problems such as poor adherence and unnecessary polypharmacy.

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“experience suggests that patients are willing to submit data to medication records systems if adequate safeguards are in place, and if the overall benefit... is clear”

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Data

The use of data (and its potential abuse) is of course an issue that goes hand in hand with the rise of Internet use and of electronic information systems. The issue is particularly sensitive in healthcare, because of the highly personal nature of health information, and the existing ethical framework governing patient and health professional relationships.

The European Parliament is currently considering a reform of the European rules on data protection. Under the proposed legislation, health data will be considered as a special category of data for the first time, reflecting the fact that the scope for generating such data is growing rapidly.

Experience suggests that patients are willing to submit data to medication records systems if adequate safeguards are in place, and if the overall benefit of such records is clear. For example, the Dossier Pharmaceutique is based on patient’s explicit consent – but only a small minority of patients say no.

Back to the Future

A patient walks into a European pharmacy, following a remote consultation with his physician that morning. He hands the pharmacist his health insurance card, and the pharmacist downloads the prescription from a server. While the medicine is being retrieved by the pharmacy robotics system, the pharmacist inspects the patient’s electronic patient record, noting that a previous suggestion from the pharmacist entered on the record that the dosage be lowered (the patient had been complaining of side effects) has been acted upon. Moreover, the physician has switched the patient’s medication to a similar product more compatible with another medicine prescribed during a recent hospital stay. The pharmacist scans the product, and is advised that the product is subject to special monitoring by the National Medicines Agency. The pharmacist enters the national Medicines Agency Portal directly through the verification system, and reports the patient’s side effects.

It’s time to make this a reality. ■



BUILDING A CULTURE OF EXCELLENCE FROM THE GROUND UP

This article discusses the key steps taken to hire and create a team at a new facility and details the education and onboarding that was used, as well as the foundations required to create a culture of excellence. Each new team member hired was considered an investment in the future success of the group. Each leader was committed to finding the right people for the new team even if that meant opening the facility with vacancies.

Author

Alicia Campbell

*Facility Director
CMC-Waxhaw
North Carolina
USA*

Alicia.Campbell@carolinashealthcare.org

For the last 13 years my world has been imaging. Eight of those years I was mentored by a great director who taught me about dedication, accountability, and what leadership truly means. In 2011, I was given the opportunity to step out of the imaging world and take a director position at a brand new freestanding healthcare pavilion. I took the position at the new facility because it gave me the opportunity to apply many of the lessons I had learned from my imaging director, work with a true multidisciplinary team, and build a culture of excellence from the ground up. This was a once in a lifetime chance that took me and our team on an amazing journey.

A healthcare pavilion is a relatively new concept in healthcare. CMC-Waxhaw healthcare pavilion was only the second of its kind in the Charlotte, NC area. It houses a freestanding emergency department (ED); outpatient CT, x-ray, and ultrasound; outpatient laboratory services; and physician practices. The ED is comprised of 10 beds—seven general ED beds, two observation beds, and one resuscitation room. Part of my new position involved educating the public on what services we had as well as what a freestanding ED was. For the majority of the public, this is a foreign concept. Most people think of the centre as an urgent care or a hospital. In truth, it is neither. The facility is licensed through a main hospital, part of the Carolinas HealthCare System, about 18 miles away and acts as a department of the hospital located off the main campus. Patients can be held up to 24 hours, but patients who need to be admitted are transferred to the appropriate facility depending on their needs or choice.

Breaking Down the Silos

Seven areas make up the team at the pavilion: nursing, respiratory therapy, security, laboratory, imaging, environmental services (EVS), and registration. In a hospital environment, people tend to function in their own silos. In the pavilion setting, the team could not be successful working from this same model. Our team was expected to be efficient, self-sufficient, and patient focused. The leadership team understood that there could not be silos or the team would fail. Working with the directors and managers of the primary areas, the goal was to create one team solely focused on creating an exceptional experience for every visitor, every time. A culture centred on the patient was a necessity.

To start the hiring process, the leadership team looked at the job descriptions of each area. It was quickly realised that the traditional model would not work in the new centre. The scope of practice for each area was evaluated and the team worked together to determine how each area could do things that were not 'typical' in a hospital environment, but were within the team members' scope of practice. Registrars were cross trained as unit secretaries and patient representatives. Registrars were also sent to notary classes, as well as additional computer classes to assist with imaging registration. Security officers were trained to do some light maintenance work, and learned how to do monthly checks on fire extinguishers and other items.

Respiratory therapists and imaging technologists were likely the most hybrid positions. Therapists and technologists were trained to take vitals, do phlebotomy, and perform EKGs. Imaging technologists

were sent to ACLS classes to assist them when performing EKGs and help them feel more comfortable with being involved in a code. All team members, including non-clinical areas, were trained in BCLS. This was important as there are only 10–15 team members on-site at a time and if a code blue (CPR) is called, all team members must respond and may have to assist with compressions.

Creating the Foundation

The leadership team wanted to ensure that the right people were in the right positions from the start. Before posting any positions, meetings were held with the service excellence coordinator and human resources (HR) director. The key qualities to look for when hiring team members were discussed and a list of desirable characteristics for team members, as well as leaders, was created. The ideal team member characteristics were: customer focus, self reliance, adaptability, teamwork, collaboration, ownership, and time management. From these characteristics, books on behavioural based interviewing were reviewed. Seven sets of behavioral interview questions were developed—three sets for team level positions and four for leadership positions. A process was then developed that each candidate would follow.

Each new team member hired was considered an investment in the future success of the group. Each leader was committed to finding the right people for the new team even if that meant opening the facility with vacancies.

Directors, managers, and HR recruiters were educated on the hiring process prior to posting positions. Each of the respective directors came up with hiring requirements



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for their areas (e.g. imaging would require two years of experience and certification by the ARRT). HR set up screening of applications based on the criteria developed by the director. Figure 1 is a flow chart of the hiring process for team members.

The applications were screened by HR based on the manager/director's criteria and then sent to the hiring manager. The hiring manager conducted a phone interview of candidates who were qualified. If the candidate passed the initial phone interview he or she was scheduled for a peer interview.

Candidates were told to plan to be at the facility for 1-1.5 hours. They would interview with the peer teams and then with me, the service excellence coordinator, and/or the director of HR. If candidates passed both the peer team and the second interview then they were set up for final interviews with the leader of the respective modality (e.g. imaging, nursing, respiratory, etc). For staff level team members, that was the final step and the respective leader decided whether to make an offer. If the candidate was interviewing for a leadership position, there was one more interview. The final leadership interview was conducted by the directors and managers who would have areas at the new facility. This made the hiring of the on-site leaders truly a team decision. It was essential that directors and managers had input into the on-site leads as this was the first step in ensuring this was one team with one focus.

The current hiring process is similar to what was done during the opening with the exception that the team members from the centre conduct the peer interviews instead of those that were originally used from the hospital.

The Peer Interview Team

A peer interviewing team was developed across the seven disciplines. This team consisted of high performers that currently worked at the hospital and demonstrated many of the behaviours we were looking to have in the new team. Peer interviewing training was conducted and the team was taught how to look for the

desired characteristics. The peer team solely focused on behaviours. The managers/directors scrutinised qualifications and each candidate was interviewed by the peer team. Imaging techs did not interview imaging candidates. The peer team was a multidisciplinary team interviewing all candidates. Each peer team member was taught how to score someone based on the STAR technique developed by Development Dimensions International. STAR stands for: situation, task, action, and result (<http://www.ddiworld.com/>). For each question the peer team asked they were looking to see if candidates answered the following:

- What was the situation or task?
- What action did the candidate take?
- What were the results of the actions taken?

Education

Once the initial candidates were hired they attended a general hospital orientation. All training was done at the hospital for about 6-7 weeks prior to the opening of the pavilion. In addition, a two-day team orientation specific for the facility was conducted, which took place about two weeks prior to opening. For much of the team, this was the first time they met so orientation was done as one large group. This orientation not only reviewed items such as life safety, facility layout, and parking, but a number of team building exercises were also held. Team members were divided out by shifts, not specialties. This was very purposeful, as it was a key step in ensuring leaders were not enabling the silo effect.

Emphasis was placed on Studer's AIDET concept, which stands for acknowledge, introduce, duration, explanation and thank (Studer 2004). Team members were taught how to develop their own AIDET and how to utilise 'key words at key times'. The expectation was set that AIDET would be used for 'every patient every time'. Additionally, there was a four hour class focused solely on the patient experience and on how to communicate with the patient, actions that could be taken to provide a higher level of care,

and how to perform service recovery if the patient's expectations are not being met.

Team members were taught about the expectations for being a part of the team. The expectations are similar to what Studer calls "standards of behaviour" or Michael Cohen calls "conditions of employment" (Cohen 2006). They include items such as:

- Refrain from negative/disruptive behaviour (e.g., complaining, gossiping, communicating in an inappropriate manner, etc);
- Everyone is required to work as a team with specialty team members as well as the rest of the healthcare team;
- Use respectful tone of voice;
- Be aware of body language and how it affects the message being conveyed;
- Refrain from using/making inappropriate comments; and
- Collaborate with the healthcare team regarding the care of the patient.

All team members signed these expectations during orientation with the understanding they were accountable for them and failure to follow these expectations would result in progressive discipline. A large portion of the orientation focused on patient and team centred culture. Ownership was emphasised and there was a tremendous amount of buy-in as this initial team knew they would set the stage and create the culture through their daily behaviours.

Accountability and Sustaining the Culture

Merely selecting and educating a team was not enough to create a culture of excellence. After all the selection and training came the hardest part for the leaders. Leaders had to ensure that what was taught in orientation was implemented. For many teams, this is where failure occurs. With opening a new centre there was a lot of excitement and energy, but eventually people got comfortable and lost some focus and energy. The leaders had to keep that focus and make sure the mission and vision of the team were at the forefront.

To help ensure team members stay

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focused, leaders rounded on patients daily. Outpatient imaging patients and ED patients were rounded on by leaders. During patient rounding leaders talked with patients about their services. The following questions are asked during patient rounding:

- Have you been receiving excellent care?
- Have you had any delays?
- Is there anyone you would like to recognise?

After rounding with the patient, the leader provides feedback to the team member caring for the patient. If an issue is identified the leader will perform service recovery immediately. The nurse manager of the ED rounds on outpatient imaging exams, as well as ED patients. The imaging lead does the same. The expectation is that all leaders are responsible for all patients.

Leaders are expected to round with team members every 4–6 weeks. Team members can be rounded on by any leader, not necessarily who they report to directly. Team members are asked what is going well, who they would like to recognise, and what process may not be working (and suggestions to improve that process). Leaders are expected to 'manage up' wins as taught by the Studer group. If a team member asks that someone be recognised, the leader sends the team member a thank you note or uses another form of recognition to let that person know another team member appreciates him or her. This has helped to create bonds across the team and reinforces the concept of 'one' team.

Team members are encouraged to look for ways to continually improve services. Every quarter, there is a team roundtable that includes the seven areas that work in the ED section of the pavilion. During these meetings, current patient perception scores or other performance improvement initiatives are discussed.

A unit based council (UBC) was developed to help the team address issues and implement improvements. The UBC is made up of team members from all seven areas. During the roundtable meeting, the last 30–45 minutes is led by the UBC and is used to

promote communication and process improvement across all areas of the team.

Results

The facility has been open for a little over a year and over 350 interviews have been conducted. There are still some vacancies to fill, but the team is okay with that. The team is phenomenal and willing to fill in the gaps until the right people are found. So far, there have been well over 16,000 ED patients seen and over 13,000 imaging studies have been performed. There is an amazing sense of ownership across the team, as members know how important their roles are to other areas in the team. Because the roles are very different than what is typical to a hospital, there was a period of adjustment for team members to acclimate to the new model and build trust with each other.

Patient perception scores are managed by Professional Research Consultants, Inc. For 2012, the outpatient imaging quality of care was in the 96th percentile and likelihood of recommendation was in the 96th percentile. ED quality of care was in the 100th percentile and likelihood of recommendation was in the 99th percentile. Recently, CMC-Waxhaw was notified it will receive the PRC Top Performer Award for being the top performer in the national PRC ED database.

Employees are surveyed annually on employee satisfaction. The team was ranked as a Tier 1 by Morehead Associates,

which is the highest tier attainable. The greatest strengths shown in the survey were teamwork or how the team members relate to each other and customer service. In the era of healthcare reform, all positions must be as cross-functional and efficient as possible. The staffing model as utilised at our facility is being looked at as a model for future centres.

Conclusion

Merriam-Webster defines culture as the set of shared attitudes, values, goals, and practices that characterises an institution or organisation. For many, culture is influenced by upbringing, education, and often past experiences. Leaders are responsible for creating the vision and maintaining the culture that lives in their respective departments.

Whether hiring one team member, managing an existing team, or building an entirely new team of people, the concepts and models that were used to build the culture at this centre can be applied. Behavioural and peer interviewing are essential to establishing the desired culture from the very first interaction with candidates. To be innovative and truly improve, performance improvement must be owned by the team, not just the leader. Team members need clear expectations set for them from the moment they are hired and, more importantly, leaders must hold team members accountable for these expectations. ■

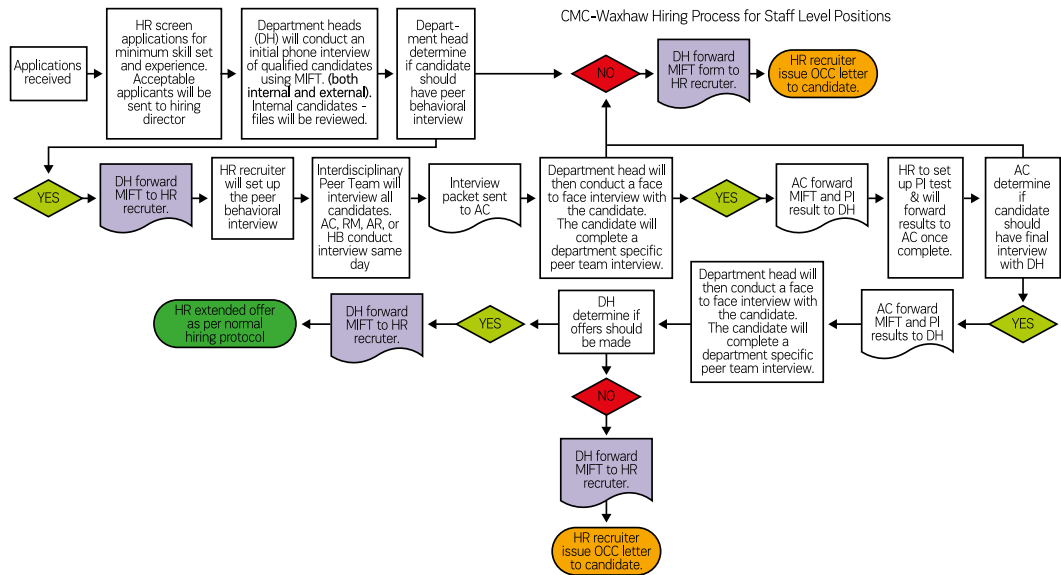


Figure 1. Flow chart of the hiring process for team members.

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ECHOCARDIOGRAPHY AS A MULTIMODALITY CARDIAC IMAGING TECHNIQUE



Author

Prof. Petros Nihoyannopoulos MD, FRCP

Professor of Cardiology,
Imperial College London
Hammersmith Hospital
London, UK

Historical Note

The year 2013 was the 60th Birthday of the founding of Echocardiography and the 160th anniversary since the death of Johann Christian Doppler (1803-1853). Those two events marked modern cardiology by not only shaping up a more accurate diagnosis of heart disease but also guiding patients' management. Echocardiography has to be included among the top 10 greatest discoveries dating back to the discovery of piezoelectricity by Pierre and Jacque Curie (Curie and Curie 1880). Echocardiography was conceived in 1953 when Inge Edler, a physician from Lund University in Sweden, together with Hellmuth Hertz, a Swedish physicist and the son of a Nobel laureate

Museum of Medical History in Lund. The images of the heart were crude and the knowledge of what it represented false. In October 1953, Edler and Hertz recorded the first 'Ultrasound Cardiogram' and published their findings the following year (Edler 1955; Edler 1956). Figure 1 shows one of the first echocardiographic recordings of the heart some 60 years ago. Edler went on to be a pioneer in echocardiography, while Hertz went on to invent the inkjet printer. There was little progress for a decade until 1963, when Harvey Feigenbaum, frustrated by the numerous limitations of cardiac catheterisation and angiography, borrowed an unused echoencephalography machine to scan the heart, and noticed that cardiac images could

interest to cardiologists. It was not until 1969 that during the first World Conference of Ultrasonic Diagnosis in Vienna I. Edler and K. Lindstrom presented their ultrasound Doppler studies, including the first 40 clinical cardiac Doppler recordings for the evaluation of aortic and mitral regurgitation (Lindstrom and Edler 1969). Although cardiac Doppler was described fairly extensively in Europe, it was not until Holen (Holen and Simonsen 1979) and Hatle (Hatle and Angelsen 1985) showed that accurate haemodynamic data could be determined with Doppler ultrasound that Doppler revolutionised the non-invasive assessment of cardiac haemodynamics in clinical practice. Echocardiography and Doppler, better termed as 'Echocardiology' have expanded enormously and become an integral part of the diagnostic pathway for every patient with known or suspected heart disease.

Never before has the pace of innovations in echocardiography been so swift. Echocardiography today has been revolutionised alongside competition from other imaging modalities, such as cardiovascular magnetic resonance imaging and computer tomography. It is by far the most used cardiac imaging test, with over 23 million echocardiographic studies performed in the U.S. annually and 2.5 million stress echoes. The most common use is the assessment of ventricular function, valve disease and the haemodynamic assessment using Doppler, so that it has become essential in management of all forms of heart disease. The daily cardiac haemodynamic assessment is now based on Doppler haemodynamics for valve disease and diastolic function, while invasive haemodynamics are

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“echocardiography has come a long way over the past 60 years and is now the prime and most-matured diagnostic cardiac imaging modality”

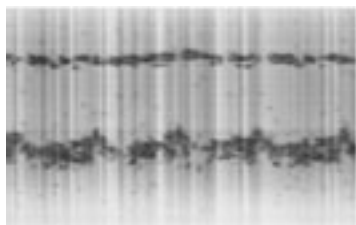
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in physics, performed the first human echocardiogram, which they called Ultrasound Cardiography (UCG) (Edler and Herz 1954). They used a shipyard sonar machine (Siemens Co, Germany) in Malmö that was used to detect structural flaws in boats, called 'ultrasonic reflectoscope', now in the

be recorded. He became the first person to describe pericardial effusion (Feigenbaum et al. 1965). By substituting 'cardio' with 'encephalo' it was this machine's origins that gave the name 'echocardiography'.

In the meantime, in 1956 in Japan, Yoshida and Nimura were the first to apply the Doppler principle to cardiac recordings, but the resulting signals were wrongly interpreted as being caused by movements of the heart muscle and the valve leaflets. No signal was attributed to blood flow, and consequently the method was of little

Figure 1.
One of the original M-mode recordings of the heart depicting the left ventricle



only reserved for when clinical discrepancies occur. That saves patients from unnecessary and potentially hazardous ionising radiation.

During the 1970s and 1980s, invaluable collaboration between engineers and physicians culminated in the development of two-dimensional echocardiography, Doppler echocardiography, colour-flow Doppler echocardiography and transesophageal echocardiography. In Europe Bom et al. (1973) developed a multi-element transducer to provide electronic linear grayscale scans of real-time two-dimensional cardiac images. More and more equipment manufacturers recognised the importance of developing their own transducers to be better matched with their equipment to provide high front-end compatibility and further improving image quality.

From the initial poorly understood M-mode echocardiographic recordings of the left ventricle, two-dimensional echocardiography added spatial resolution to the imaging of the heart, and more clinicians were able to appreciate the anatomy and function of the heart, so that the method was adopted even by the most sceptical clinicians. Figure 2 is a four-chamber projection of the heart from the apex, clearly demonstrating the relative chamber sizes and valves. Notice the presence of an organised apical thrombus at the apex (arrow). However, while imaging quality continued to improve, two-dimensional echocardiography could not always match the clarity of some of the cardiac magnetic resonance imaging as it entered the clinical arena and some sceptics thought that cardiac MRI was the reference technique and that echocardiography was a technique of the past. How wrong they were!

The Present

Technology in echocardiography, like progress, is always changing, and for the better. The wide variety of transducers,

frequencies, and applications that are available today for the echocardiographer is unlimited and will be so in the foreseeable future. New technologies such as tissue Doppler and speckle tracking are getting established while improving three-dimensional echocardiography image clarity is dominating technological development at a breathtaking speed so that sub-specialising on the various echocardiological modalities is becoming necessary. Figure 3 depicts an apical four-chamber projection of the heart with real-time three-dimensional imaging. Note that endocardial trabeculations are clearly visualised so that the heart looks more like a real anatomic specimen. These type of images are now routine in clinical practice.

Technology has responded to new clinical challenges with the explosion of interventions for structural heart disease, so that echocardiography with real-time 3D transoesophageal echocardiogram (TOE) has become indispensable in a modern cardiac catheterisation laboratory and cardiac operating theatres. Guidance for therapeutic procedures is now so routine that a new subspecialty in echocardiography has emerged, that of interventional echocardiography (Zamorano et al. 2011). Dedicated individuals need now to be familiarised with the procedures and communicate their results with the interventionalist. Procedures like mitral clip cannot be performed without TOE guidance, while TOE during transcatheter aortic valve implantation (TAVI) has become indispensable both for a more accurate assessment of the aortic annular diameter, the positioning of the TAVI valve, and the early detection of complications. Figure 4 depicts a surgical view from the transoesophageal approach of the mitral valve, with the respective description of the Carpentier's segmentation of the anterior and posterior leaflets in three equal thirds.

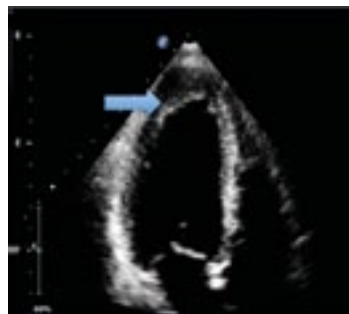


Figure 2. Two-dimensional echocardiographic image from the apical four-chamber view depicting the left ventricle with an organised apical thrombus (arrow)

The Role of 3D Echocardiography in the Assessment of Mitral Regurgitation

Transoesophageal three-dimensional echocardiography has revolutionised the visualisation of the mitral apparatus on the beating heart. This has led to the better understanding of the mechanism of mitral regurgitation, and facilitates the choice of methods of treatment, particularly as more and more options become available, both in terms of surgical repair and also in transcatheter mitral clip placement. Never before has the mitral apparatus been seen and understood so well in the beating heart (Marsan et al. 2009). Mitral regurgitation can arise from a variety of mechanisms and may occur in combination. It is traditionally described by Carpentier's classification based on leaflet motion (normal motion, prolapse or restriction of a leaflet segment). The location and extent of abnormal leaflet motion guides the various treatment options (Grapsa et al. 2012). An accurate description of the mechanism of valve failure is therefore required to predict the complexity of techniques needed to repair the valve and hence the likelihood of achieving a

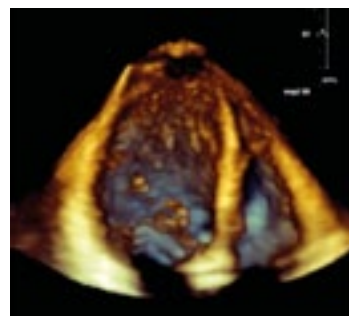
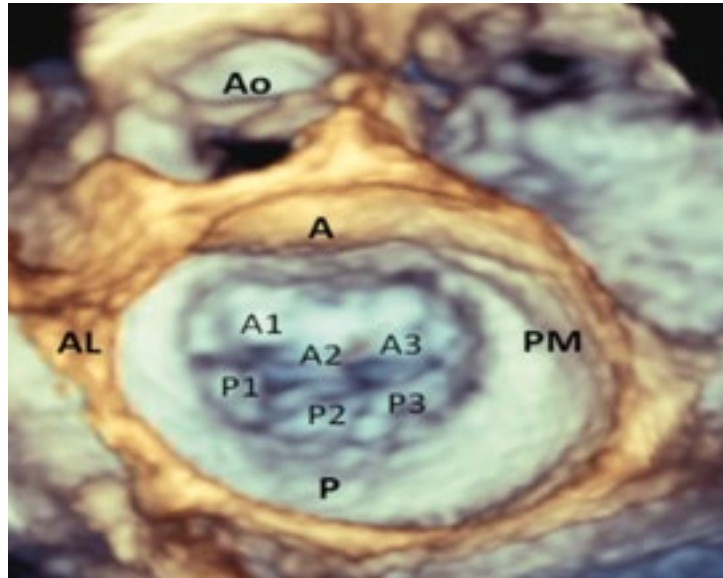


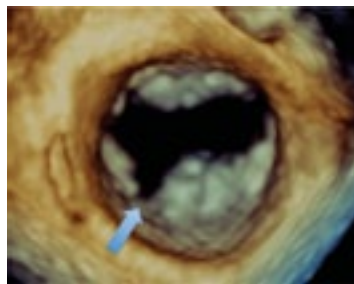
Figure 3. Three-dimensional echocardiographic image from the apical four-chamber view depicting the left ventricle. Note the difference from figure 2 with the left ventricular trabeculations and surface clearly identified.

Figure 4.

Transoesophageal surgical view of the mitral valve. Superimposed is the mitral leaflet segmentation. A=Anterior, AL=anterior-lateral commissure, Ao=aorta, A1 anterior leaflet lateral segment, A2= anterior leaflet middle segment, A3= anterior leaflet medial segment, P=posterior, PM= posteromedial commissure, P1=Posterior leaflet lateral segment, P2=posterior leaflet middle segment, P3=posterior leaflet medial segment.

**Figure 5. (Left)**

Transoesophageal surgical view of the mitral valve leaflets depicting the anterior leaflet and the posterior leaflet. Note the deep cleft identified in the region of P3 (arrow).

**Figure 6. (Right)**

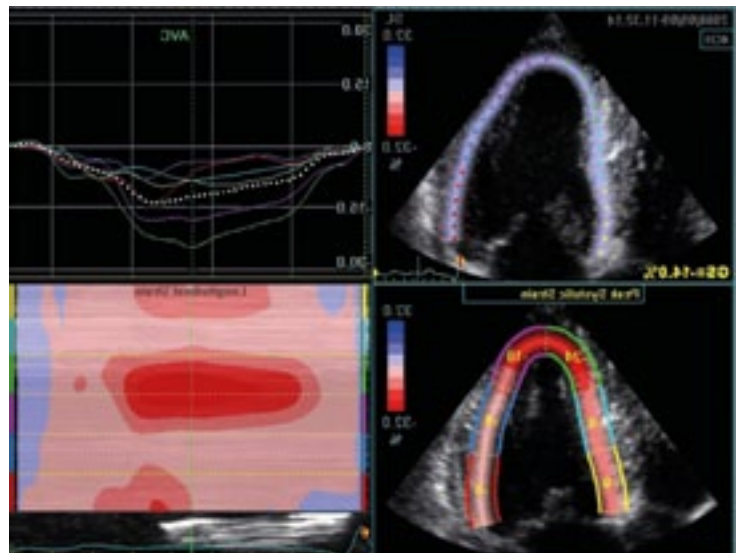
Two-dimensional speckle tracking of the left ventricle from apical four-chamber projection (as in figures 2 and 3). Top left depicts the tracking of all left ventricular walls (septal, apex and lateral walls). The value of -14% implies that the global strain (GS) is markedly reduced. Bottom left shows in colour coding the regional segmentation of the left ventricle in 6 segments with the respective strain values. Note that the lateral wall has the lowest strain values corresponding to myocardial fibrosis. Top right shows the strain values of each segment throughout the cardiac cycle. Bottom right is a colour-coded map of the longitudinal strain of the entire left ventricle from apex to base throughout the cardiac cycle.

successful mitral repair. Figure 5 is a surgical transoesophageal view from a patient put forward for a clip procedure, but three-dimensional imaging detected an unpredicted deep cleft of the posterior leaflet (arrow), which was prohibitive for a successful clip repair, and the patient had to be surgically repaired.

Assessing Myocardial Function

Cardiovascular medicine is changing. It is progressively becoming more and more disease-based for diagnosis and therapy with the development of multidisciplinary meetings that are often image-guided. Some of the early changes have been noted in heart failure, coronary artery disease, pulmonary hypertension and cardiomyopathies, with the development of specialised clinics where imaging plays a pivotal role. Emphasis has been put on detecting preclinical disease and

match the detailed assessment and quantitation of myocardial function globally as well as regionally both in systole and diastole in such high time resolution. New outcome data are rapidly accumulating in all sorts of clinical scenarios (Ersbøll et al. 2012; Olsen et al. 2011). New measures such as the global longitudinal strain and also radial and circumferential strains are entering the clinical routine. Figure 6 is from a patient with hypertrophic cardiomyopathy, where speckle tracking imaging identifies reduced regional and global myocardial contraction despite a normal ejection fraction. Studies have shown that where strain measurements are significantly reduced, they correspond to areas



adopting prevention strategies. The development of genomics and proteomics in diagnosis has revolutionised the understanding of the disease regulation and development, but has not replaced the pivotal role of imaging. Measurement of ejection fraction has dominated clinical decision making for decades. While widely accepted that it is subjected to severe limitations due to cardiac loading conditions, speckle tracking echocardiography and deformation imaging have emerged to better assess and quantify ventricular contraction (Mor-Avi et al. 2011). No other imaging modality can

of myocardial fibrosis seen by cardiac magnetic resonance imaging (Urbano-Moral et al. 2013).

We have new challenges looming, however. As machines are getting bigger and better, providing more information than ever before, others are becoming smaller and cheaper, potentially available to all. While the world of echocardiography is still coming to terms with these new systems, the small hand-held echo machines are rapidly becoming smaller, pocket-size, with ever improving image quality. While this can help in training junior doctors and

doctors beyond cardiologists, they will require some further training. There is no doubt that those pocket-size devices will be a useful complement to the clinical examination and supplement to the good old stethoscope (Panoulas et al. 2013), but will not replace the larger, more comprehensive systems.

The Need for Regulating Echocardiography

One of the big problems of echocardiography in the past, not applicable to other imaging modalities, was the lack of a regulatory body to ensure training and quality control. Unlike nuclear medicine and radiology that tightly control MRI and nuclear imaging modalities, echocardiography was (and still is) open to everybody in a very cost-beneficial way. This almost guarantees clinical disasters when performed by the wrong hands. Not surprising, therefore, when people not appropriately trained perform echocardiographic examinations in an uncontrolled fashion, this is diminishing the standards of the technique. Consequently, several countries have established local certification programmes, some more rigorous than others. For this reason, the European Association of Echocardiography established universal accreditation standards (Fox et al. 2007), in order to standardise the quality of echocardiographic examinations across Europe.

Echocardiography performed in well-organised departments provides, de facto, a high standard and comprehensive description of the cardiac anatomy and function. All imaging techniques, from echo to cardiac MR (CMR) and nuclear are 'operator-dependent' and are as good as the person who drives them. It is a fallacy to believe that nuclear or CMR methods are more 'objective' than

echocardiography. It is the openness, unregulated and wide use of echocardiography by non-experts that occasionally give a bad reputation to the technique.

The issue of training is of pivotal importance in every aspect of life, including medicine, and regulatory bodies have been set up in order to safeguard the patient.

The European Association of Echocardiography has put in place an accreditation process with an exit examination for all potential echocardiographers, doctors and scientists alike. This is now widely accepted as the European standard and promoted by the European Society of Cardiology, and individual member states, and national Societies, such as the Hellenic Cardiological Society are called to adopt it. While this is not currently linked to reimbursement, it will eventually become a requirement, and will help to improve training and delivery of echocardiography services nationally.

The Future

The future of echocardiography is bright. Investment in research and development has doubled over the past five years and technological innovations are put into clinical practice at such a speed that it has become very difficult to follow, even for dedicated echocardiographers. There is now sub-specialisation in echocardiography by contrast experts, deformation imaging experts, transthoracic and stress echo experts and three-dimensional experts, with the latest subspecialisation by interventional echocardiographers. It is very difficult for a single person to be expert in all those modalities, unless they operate in a well-developed and organised department with good technical support available for all modalities. A new breed of 'Academic echocardiologist' is appearing, who

devotes teaching and research time, as opposed to simple application of the technique as a clinical tool.

The trend in imaging is the development of the study of ventricular function and the non-invasive imaging of the coronary arteries, while the traditional perfusion methods are rapidly outmoded. The cost of ionising radiation by the traditional nuclear modalities, as well as the new multi-sliced computer tomography will always be a prohibiting factor in future applications and lead to their possible demise, while echocardiography will always remain the first choice in cardiac imaging.

Cardiac magnetic resonance imaging is rapidly entering routine clinical practice, but its high running cost prohibits its routine use. When Magnetic Resonance Angiography (MRA) becomes reality, it will certainly be a major breakthrough in clinical cardiology, but it will be costly and any healthcare system will not afford its wide use.

Echo and CMR are the imaging modalities of the future and are complementary, with echo being the most cost-effective and patient-friendly examination, and CMR the high end of cardiac imaging for tissue characterisation. During the next decade we will enjoy the explosion of new, more sophisticated echo and CMR modalities to ultimately benefit our patients.

Conclusion

Echocardiography has come a long way over the past 60 years and is now the prime and most-matured diagnostic cardiac imaging modality. Its non-invasive nature, which does not require ionising radiation, puts it in the forefront of cardiac investigations and has become essential in the management of heart disease in a most cost-effective manner. ■

Key Points

- *Echocardiography; the past, present and future*
- *Recent advances in echocardiography*
- *Multimodality imaging*

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CARDIOVASCULAR IMAGING

EUROPEAN SOCIETY OF CARDIOLOGY POSITION PAPER ON USE OF MEDICAL RADIATION



Interviewee

Dr. Eugenio Picano, FESC

Director General
Echocardiographic Laboratory
Institute of Clinical Physiology, CNR
Pisa, Italy

Interviewed by

Claire Pillar

Managing Editor
HealthManagement

What prompted the European Society of Cardiology to produce this position paper on the appropriate and justified use of medical radiation in cardiovascular imaging?

The European Society of Cardiology (ESC) wants to make cardiology wards and laboratories safer places for patients and doctors. The benefits of cardiac imaging are immense and often life-saving, and we can maximise them and minimise risks by simply acting on the radiation awareness of doctors and patients. The position paper tries to improve the culture of safety and radiological responsibility in the cardiology community. Appropriateness ("the right exam in the right patient") and justification ("at the right dose") are indicators (and certainly not the least important) of good clinical practice in contemporary cardiology practice.

Is the risk of radiation exposure due to cardiac imaging growing?

Medical imaging is one of the main causes of environmental cancer listed in 2010 by President Obama's Cancer Panel, and is a growing problem, with radiation exposure from medical imaging showing a sixfold increase over the last 20 years, and now totalling the radiologic dose equivalent of 150 chest x-rays per person per year in the USA. Small individual risks of a single exam multiplied by billions of examinations become a significant population risk. For the individual patient, radiation risk is a cumulative one: exam added to exam, dose to dose, and risk to risk, often creates - in cardiology patients - a non-negligible cumulative cancer risk. Increased dose means increased risk of cancer, years down the line.

How does the growing challenge of obesity affect cardiac imaging?

Obesity can lead to higher patient exposure in three ways. First, the obese patient is more vulnerable to cardiovascular disease, requiring diagnostic and therapeutic radiation. Second, for any given examination, radiation exposure is higher in the obese than in the lean patient, due to thicker interposed tissue between the target organ and the radiation source and the more pronounced attenuation phenomena. Third, in obese patients non-ionising techniques (such as ultrasound and magnetic resonance) lose accuracy and feasibility, and this leads to preferential use of ionising techniques.

What is the ESC doing to encourage cardiologists to minimise inappropriate cardiac imaging?

In theory, formal training in radioprotection is a part of the interventional cardiology curriculum and even required by law in many European countries as a prerequisite for entering the cardiac catheterisation laboratory. In practice, at least one-fifth of interventional cardiologists did not receive any formal training in radioprotection and - with or without training - their radiation awareness is disappointingly low. In its document released in 2011 and dedicated to "Patient and Staff Radiological Protection in Cardiology", the International Commission on Radiological Protection recommends that "since the amount of radiation employed by interventional cardiologists both per patient and annually is no less than that used by an interventional radiologist, the training standards of radiation physics and radiological protection should be the same as for other interventionalists".

Is there a role for a Dose Index Registry for cardiac imaging exams?

Absolutely yes. The paper recommends that patients should be given the estimated dose before a procedure, and the actual dose in writing afterwards if they request it. This could become a legal requirement through the European Directive Euratom law 97/43, but application of the law is being delayed by technical and practical difficulties. The dose of each exam should be digitally stored in patients' records.

In the position statement, you say that radiation risk is not the most important risk to be considered when weighing up the risk-benefit of an imaging test for a patient, but the one that is the least well-known and the least considered. What is the most important risk to be considered?

All risks should be included on the risk side of the risk-benefit assessment quintessential to the appropriateness of every examination. Risks include acute risks occurring during examination (for instance, cardiac death during a coronary interventional procedure, ventricular fibrillation during dobutamine stress, cardiac asystole during dipyridamole stress or myocardial infarction during exercise stress), subacute risks (for instance, contrast-induced nephropathy with invasive coronary angiography occurring days after the examination), and long-term risks (such as cancer occurring decades after the ionising test). The most important risk depends on the type of exam and the type of patient. In a child with Kawasaki disease or a young woman with chest pain, candidates for myocardial scintigraphy or coronary CT, the most important risk is probably a long-term one; in

an elderly patient with acute coronary syndrome who undergoes percutaneous coronary intervention, the dominant risk to consider is the acute one.

You observe that companies are fighting the 'dose war.' In your opinion, can industry do more to improve the dose minimisation/image quality balance?

Companies who develop better ways of reducing doses will win in future global competition. Radiological sustainability is becoming a competitive marketing advantage. The best way is not only to develop better ways of achieving the same information with a lower dose (for instance with low-dose coronary CT) or no dose (for instance with near-zero fluoroscopy techniques in electrophysiology), but also to have standardised open systems using a common standard to display the dose and archive it in digital patient records. The field suffers enormously

from lack of standardisation and difficult communication, not only among physicians, but also between the physician and the machine, and different machines of different vendors. Things are improving, but perhaps too slowly.

You say that "Cardiologists are the true contemporary radiologists". Please explain this comment.

Cardiology accounts for 40% of patient radiology exposure. Nuclear cardiology accounts for > 80 % of cumulative exposure from nuclear medicine. Even from a professional exposure standpoint, interventional cardiologists and electrophysiologists are three times more exposed than diagnostic radiologists. Unfortunately, radiation risks are not widely known to all cardiologists and patients, and this creates a potential for unwanted and avoidable damage that will appear as cancer decades down the line. For interventional cardiologists and

electrophysiologists, adequate training in radioprotection and diligent use of protection can reduce the received dose tenfold and even more. We need the entire cardiology community to be proactive in minimising radiological friendly fire in our imaging labs.

Can you comment on the importance of multidisciplinary collaboration between radiologists and cardiologists?

Radioprotection is best achieved through close interaction and communication between cardiologists, radiologists, health physicists, radiology technicians, industry and patients. The best shield against useless radiation exposure is radiation awareness, and this can be obtained only through better communication and understanding of the basic principles of radioprotection. This is much easier if specialists talk to each other, possibly in a common language. ■

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INTERVENTIONAL RADIOLOGY CELEBRATES 50 YEARS OF ANGIOPLASTY

On 16 January 1964 at the University of Oregon Hospital in the United States Dr. Charles Dotter (pictured) performed the first percutaneous transluminal angioplasty procedure. Inserting a Teflon catheter into a patient's superficial femoral artery, Dr. Dotter opened a blockage in the artery to restore blood flow and eliminated the need for amputating the foot.

Dotter used one of the first commercially produced catheters to carry out the procedure after meeting the catheter manufacturer, Bill Cook, at a medical trade show the previous year. Cook had recently started his own company and was displaying how Teflon tubing could be shaped using a blowtorch to create a catheter that could access a blood vessel through a needle puncture, rather than by opening the body surgically for access. Together Dr. Dotter and Cook visualised and designed the starting blocks for the future of minimally invasive medical treatments. This was the birth of interventional radiology.

It is estimated that more than 60 million vascular angioplasties have been performed worldwide since Dotter introduced the procedure. This versatile technology is now used to open blocked vessels throughout the body, often as an alternative to surgery. Risks of interventional procedures are rare, due to improvements in equipment, the way they are used and better patient selection.

Further Advances

HealthManagement spoke to Prof. Duncan Ettles, President of the British Society of Interventional Radiology about angioplasty's success,

potential and future.

Angioplasty has proven success for treating blood vessels in the legs, heart and many other parts of the body. The technique heralded the introduction and development of other interventional procedures which have become increasingly important in the treatment of cancer.

Prof. Ettles cited two such successful catheter techniques for cancer treatment. TACE (transarterial chemoembolisation) is a technique whereby the catheter tube is passed directly into blood vessel close to the location of the cancer to inject chemotherapy drugs. Similarly, for radiotherapy, SIRT (selective internal radiotherapy) takes radioactive particles and directs them to the area where the tumour is located. RFA (radiofrequency ablation) is also increasingly used. Under local anaesthesia a probe is passed through a small incision in the skin and can either burn the cancer away using radiowaves or freeze it with cryoablation.

"There are now many different ways of treating a tumour without the need to remove the organ or make a large incision. These are important applications in interventional radiology to treat cancer", said Prof. Ettles.

Future of Angioplasty

Drug-eluting stents and drug-eluting balloons are currently important areas of research. Researchers will continue to experiment and research with these techniques, particularly to prevent the re-narrowing of blood vessels which can happen after the initial treatment.

Interventional radiology has been at

the forefront of most of these techniques in the UK, but more consultants are needed. Prof. Ettles noted, "We know from recent NHS workforce surveys that IR is still understaffed by about 200 consultants in the UK. We continue to stress that it is very important to provide 24/7 coverage across England, for example to treat potentially fatal bleeding in young women following childbirth and in other emergencies.

Angioplasty and related techniques will continue to evolve, added Prof. Ettles. "Angioplasty equipment has been made much smaller in size and so a procedure that used to require an overnight stay in hospital now takes only a couple of hours. Patient acceptability and safety will continue to increase. With new devices such as stents and drug-eluting balloons, long-term outcomes of these procedures will get better and the range of patients who can be treated will increase, particularly patients with cancer."

"Robotics will develop further. For example, if we scan a patient and find a blockage in an artery or a cancer, we will be able to programme that dataset into a machine and a robotically controlled device can target that lesion, tumour or malformation very accurately and probably treat it without the need for a human operator to perform the whole procedure."

Future challenges will also include increasing obesity and associated diabetes around the world, which will mean more arterial disease, stroke, heart disease and diseases of the blood vessels. ■



Dr. Charles Dotter

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Cardiovascular and Interventional Radiological Society of Europe



THE ROLE OF INTERVENTIONAL RADIOLOGY IN TRAUMA MANAGEMENT



Author

Ciara Madden

Head of Media and Publications
CIRSE – The Cardiovascular
and Interventional Radiological
Society of Europe

Trauma represents a major burden to hospitals and healthcare systems, affecting 135 million people worldwide every year, with 5.8 million of these dying as a result (World Health Organization 2008). Within Europe, these injuries are mostly caused by road traffic accidents, as well as falls from heights and violent altercations (see Table 1). Worryingly, figures from the UK show that trauma is one of the few disease categories in which mortality is increasing (Department of Health 2008; Department of Transport 2008).

While severe injuries often require complex reconstruction and rehabilitation, the most pressing concern of any trauma team is stopping active haemorrhage, which is the most common cause of death in polytrauma patients. Blood loss triggers a downward spiral of decreasing blood pressure, hypothermia and acidosis, and early resolution of this lethal triad is vital.

The Importance of Imaging

Modern trauma management relies heavily on imaging, particularly CT scans. Increasingly, hospitals are locating CT scanners adjacent to or within emergency departments, to enable swift imaging with minimal delay, countering the 'doughnut of death' phenomenon of the 1980s. Most major centres now forego plain

X-ray imaging in favour of diagnostic CT, as this provides much higher sensitivity, and can clearly demonstrate any active extravasation or bleeding. Evidence suggests that timely CT use increases the probability of survival for polytraumatised patients (Huber-Wagner et al. 2009).

Interventional Radiology

Interventional radiology (IR) is uniquely placed to assist in this crucial stage of trauma management. Not only can interventional radiologists easily interpret the CT scans and thus optimise the management of patients, but the IR techniques of embolisation and stent-grafting are extremely effective at stemming active haemorrhage.

Embolisation utilises image guidance to steer catheters to the site of bleeding, where occlusive agents such as gelfoam or coils can be selectively placed to stem the flow of blood. In addition to avoiding the iatrogenic trauma of surgical repair, embolisation is also suitable for surgically precluded injuries, such as blush-bleeding of the liver or kidney, and for locating and treating intimal vessel tears. Stabilising bleeding is the priority, even if surgical intervention is also needed at a later stage for bowel or parenchymal repair or resection.

Not only can embolisation help stem bleeding in important organs such as

the liver, kidney, spleen and pancreas, it is also useful for treating retroperitoneal and pelvic haemorrhage, both of which are difficult to access surgically. External compression banding is the treatment of choice for venous pelvic haemorrhage, reducing organ pressure and aligning bones, but early angiography and embolisation are essential for treating arterial bleeding (Cook et al. 2002). Multi-slice CT with IV contrast is particularly useful in identifying the presence of pelvic haematoma, as well as the presence and the site of arterial bleeding.

Stent-Grafts and Stents

Penetrating or blunt trauma can cause the aorta and peripheral vessels to be punctured, dissected or otherwise damaged, and scaffold materials such as bare stents and stent-grafts can be deployed via catheter delivery to stop life-threatening haemorrhage, re-establish tissue perfusion and prevent delayed haemorrhage.

Thoracic aortic injury is the second most common cause of death in patients with blunt injury: it is estimated that 85% of these patients die before reaching the hospital (Garcia-Toca et al. 2010; Aladham et al. 2010).

Using image guidance and catheters, a stent-graft can be delivered to the site of injury, providing support for the damaged vessel, as well as

Table 1.
Causes of death by age group and frequency.
European Region, 2004 (WHO Statistics)

0-4 years	5-14 years	15-29 years	30-44 years	45-69 years
#8: Road traffic injuries (1,740)	#1: Road traffic injuries (4,180)	#1: Road traffic injuries (39,300)	#4: Road traffic injuries (33,200)	#16: Road traffic injuries (36,500)
#17: Violence (590)	#9: Violence (640)	#3: Violence (14,900)	#8: Violence (22,600)	
#19: Falls (660)	#13: Falls (530)	#13: Falls (3,500)	#15: Falls (7,000)	

stopping the bleeding while preserving normal blood flow.

In recent years, this procedure – TEVAR (thoracic endovascular aortic repair) – has become widely used. This is due to the sound body of evidence that shows that the procedure has a lower mortality and morbidity rate than traditional surgical therapies in the thoracic aorta.

In one meta-analysis of ruptured descending aortic repair (Jonker et al. 2010), including 224 patients treated between 1995 and 2011 (mean age 70 years), a significantly lower 30-day mortality rate was revealed in the TEVAR group. Moreover, myocardial infarctions and paraplegia occurred more often after open repair.

Another meta-analysis comparing open vs. endovascular repair in 589 patients (mean age 38.8 years) suffering from traumatic rupture of descending thoracic aorta also revealed a significantly lower procedure-related and 30-day mortality rate after TEVAR (Xenos et al. 2008). In a sub-analysis, the risk of procedure-related spinal ischaemia was also significantly lower in the endovascular group.

In many institutes, such as the Klinikum Passau in Germany and elsewhere, TEVAR is the treatment of choice for thoracic aortic injury, and open repair in thoracic aortic diseases is now reserved predominantly for ascending and aortic arch pathologies.

A Boon to Any Hospital

When included as part of a trauma team’s repertoire, these techniques can vastly enhance the patient’s outcomes. The goal of trauma management is damage limitation – helping minimise and resolve the injury caused to the patient – and favouring minimally invasive techniques over surgical repairs helps avoid further iatrogenic trauma.

Surgery is still required for major tissue damage, such as diaphragmatic

tears and bowel injuries, but appropriate imaging and interpretation allow for optimal referral, ensuring that patients are treated speedily and appropriately, and making best use of a hospital’s resources.

Additionally, professional societies such as the Cardiovascular and Interventional Radiological Society of Europe (CIRSE) have published best-practice guidelines (Chakraverty et al 2012). One of the authors of CIRSE’s

.....
“a multi-disciplinary team is the only way to approach such complex [trauma] cases”

Guidelines

While no binding regulations are currently in place to ensure the inclusion of IR in the trauma team, a glance at the websites of Level 1 Trauma Centres across Europe shows that interventional radiology is widely utilised. Reflecting the growing interest in improving trauma outcomes across Europe, many countries, such as the Netherlands, Germany, France and the UK, are establishing networks of Level 1 Trauma Centres. The UK National Institute for Health and Care Excellence (NICE) Guidelines on major trauma care are currently being drawn up, with an estimated publication date of June 2015.

Quality Improvement Guidelines for Endovascular Treatment of Traumatic Hemorrhage, Prof. Otto van Delden outlines the role such documents play:

“This important document highlights several key facts about IR’s involvement in trauma care. It is vital to offer a 24/7 service, to be called early in the course of the case, to have all the logistics in place, and to have on-call rotas for everything.

“There is still a lot of work that needs to be done in implementing this, but the move towards Level 1 Trauma Centres is visible everywhere in Europe. Smaller hospitals are not equipped to handle severe trauma and care should be centralised. This Standards

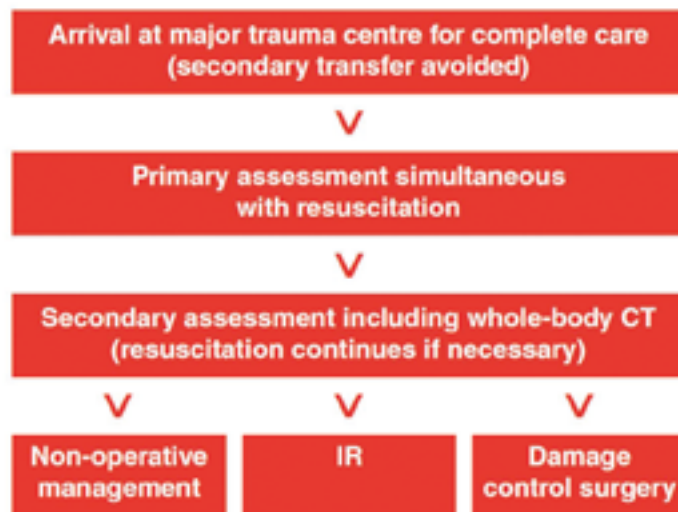


Figure 1. Major trauma centre patient journey

Adapted from CIRSE Standards of Practice document: Quality Improvement Guidelines for Endovascular Treatment of Traumatic Haemorrhage (Chakraverty et al. 2012)

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Image 1.

Amsterdam Trauma Workflow: Potentially harmful transfer of patients from trolley to table is avoided by using a single trauma trolley on which the patient stays from resuscitation onwards. All other equipment, including the CT scanner, is compatible with this trolley.

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of Practice paper is a decisive step in the right direction.”

Optimising Logistics

Prof. van Delden is recognised as one of Europe’s foremost trauma IRs, and enjoys an excellent working relationship with his colleagues. While acknowledging his hospital’s reliance on IR techniques, he remains firm in his belief that a multi-disciplinary team is the only way to approach such complex cases: “We have a dedicated trauma team that consists of an anaesthesiologist, surgical residents, radiology residents, trauma surgeons, and radiologists – it’s a fixed team. Trauma surgeons are very much the case managers: their skills in this field extend beyond performing surgery.

They are leading the case, supervising all the imaging and treatment types: the anaesthesiologist initiating ventilation of the patient, a resident or nurse inserting a chest tube, the radiologists interpreting the imaging studies; all of this is managed by the trauma surgeon.”

His hospital, the Academic Medical Center of the University of Amsterdam, also has an excellent logistical set-up. Alongside 24/7 rotas and smooth teamwork, the hospital has invested in a dedicated CT scanner. This guarantees an efficient workflow and prevents the dangerous transfer of critically ill patients, as well as avoiding delays and inconvenience to non-emergency patients who have scans scheduled in the radiology department. Moreover, their innovative set-up utilises a sliding

CT gantry that sits on rails. It serves two emergency rooms, with a radiation-shielding wall that can close behind it, and allows CT to be performed feet-first so IV-lines and monitors do not need to be re-positioned.

The Benefits of IR in Trauma Care

Trauma patients are often young, active patients, and being able to improve survival rates for patients who are otherwise in their prime has obvious social and economic benefits. Interventional radiology can actively contribute to reducing the rate of accident fatalities, and should be considered by any accident and emergency department which does not already benefit from this unique skill-set, and by any health-care authority which wishes to improve its trauma outcomes.

Offering cutting-edge IR therapies positively contributes to the reputation and performance of any trauma centre. This helps not only the patients themselves, but also the hospital as a whole, preventing patients from entering that rapid downhill spiral of acidosis, hypoxia, and hypothermia, keeping them out of intensive care or reducing the length of their stay there. ■



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TOP 10 HEALTH TECHNOLOGY HAZARDS FOR 2014

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ECRI

ECRI Institute
29 Broadwater Road
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Welwyn Garden City
AL7 3BQ
United Kingdom

Tel: +44 (0) 1707 831001
Fax: +44 (0) 1707 393138
info@ecri.org.uk
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The Top 10 Health Technology Hazards for 2014 will be published in *HealthManagement* in two parts

ECRI's annual Top 10 list highlights the technology safety topics that we believe warrant particular attention, and is intended as a starting point for patient safety discussions and for setting health technology safety priorities. These generic hazards reflect use errors that our research shows are being repeated by clinicians or that our experts determine may become more prevalent.

Alarm Hazards (no. 1)

A clinical alarm hazard is one that results in staff failing to be informed of a valid alarm condition in a timely manner or to take appropriate action in response to the alarm. Excessive numbers of alarms can lead to alarm fatigue, and ultimately patient harm. Caregivers may be overwhelmed, distracted or desensitised. Patients may also be at risk, from noise from excessive alarms, alarms not activating when they should, staff not responding and alarms not working properly. Staff in general may be at risk from noise from excessive alarms as they can create a more stressful work environment for staff. Such factors may prompt caregivers to take unsafe actions, such as decreasing

the alarm volume to an inaudible level or even turning off the alarm completely.

Goals for an alarm management programme will include minimising the number of clinically insignificant or avoidable alarms so that the conditions that truly require attention can better be recognised and optimising alarm notification and response protocols so that the patient receives the appropriate care at the time it's needed.

Recommendations

- Recognise that alarm hazards are not just a technology problem, but involve issues of organisational culture and processes.
- Address the problem through a coordinated, multidisciplinary effort.
- Invest the time to understand how alarms are used at your facility.
- Consider the needs of each care area individually.
- Involve frontline staff in identifying and implementing improvement strategies.
- Assess the effect of the strategies that are implemented, and revise or refine as needed.
- Promote your successes.

Infusion Pump Medication Errors (no. 2)

Infusion safety is often discussed in terms of the "Rights of Medication Administration," namely the right patient, the right drug, the right dose, the right route, and the right time. Pumps equipped with "smart" technology—onboard drug libraries that trigger alert limit warnings for gross misprogrammings—do a good (but not perfect) job of helping to get the dose correct. However, they don't help ensure the other "rights." Infusion pump integration—that is, connecting the servers for the infusion pumps with other information systems—can help achieve a few of the other "rights."

Recommendations

- During selection and purchasing, assess the human factors of prospective infusion devices during trials.
- When implementing a new system, take advantage of vendor consulting programmes.
- Emphasise to clinicians the importance of infusion pump technology safeguards. Recognise that the introduction of new infusion technologies may

necessitate some changes in workflow.

- Dedicate resources to regular training and assessment for routine users, incoming staff members and infrequent users.
- Identify inappropriate practices by staff and rectify as soon as possible.
- When using smart pumps:
 - ◆ Develop and maintain appropriate drug libraries.
 - ◆ Invest in resources to analyse infusion pump to improve work practices and policies. Develop a procedure that identifies the staff member responsible for data analysis and that describes how and when infusion pump data will be captured, analysed, and disseminated.
 - ◆ Begin (or continue) to implement infusion pump integration with information systems for checking orders and documenting administration.
 - ◆ Implement a roadmap for integration, recognising that this is a multistep, multiyear process.
 - ◆ When selecting new infusion pumps, consider the technology's ability to be integrated with electronic ordering, administration, and documentation systems (both current and anticipated within the pumps' life span).

(Nos. 3 & 4 will be in HealthManagement's next issue)

Occupational Radiation Hazards in Hybrid ORs (no. 5)

If a hybrid OR is to be implemented, health-care facilities must have in place a radiation protection programme that provides staff with the knowledge and technology they need to minimise occupational radiation exposures in this unique environment. The programme should include training, shielding and monitoring.

1. Training educates staff about the risks of ionising radiation and the protective measures that should be taken—some of which may not be intuitive. For example, the angulation of the imaging system can affect the radiation dose

received by the staff.

2. Shielding: this can include lead and additional lead barriers, such as those suspended from the ceiling.

3. Monitoring: Radiation monitoring badges are used to keep track of clinician exposure to radiation so that regulatory dose limits are not exceeded. Effective monitoring requires that the badges be properly worn, maintained, and reviewed, and employers must plan to assess and verify badge compliance. To augment the use of traditional badges, facilities may also choose to institute the use of electronic badges that provide real-time readings of the dose rate. While real-time electronic badges do not replace traditional badges (because they lack traditional badges' ability to record a permanent radiation record), they can be used to aid clinicians in immediately adjusting their behaviour (e.g., repositioning themselves) to comply with occupational radiation safety procedures and reduce their exposure.

Recommendations

- Verify that all hybrid OR staff (including surgeons) obtain OR-specific radiation protection training and that they put this training into action. Consult with a medical or health physicist when developing your radiation protection and safety programme.
- Nominate a member of the hybrid OR team to assume day-to-day responsibility for verifying that radiation protection policies and procedures are being followed. This role is not to be confused with that of the radiation safety officer (who oversees procedures for the entire organisation).
- Assess the adequacy of existing built in radiation protection infrastructure. Consider implementing additional personal radiation safety equipment as needed, such as specialised radiation shield garments.
- Consider implementing real-time monitoring to ascertain the effectiveness of radiation safety training,

particularly if the analysis of badges proves ineffective at determining the cause of—and steps needed to correct—clinician overexposure.

Inadequate Reprocessing of Endoscopes and Surgical Instruments (no. 6)

When reprocessing is not performed properly patient cross-contamination is possible. In addition incidents involving improperly reprocessed instruments can damage an organisation's reputation, reduce patient satisfaction, prompt review by accrediting agencies, and lead to citations and fines from regulatory bodies or lawsuits from patients.

A variety of factors can contribute to improper reprocessing, including:

- The intricacy of the instruments;
- Lengthy manufacturer instructions for cleaning, or incomplete or missing instructions;
- Time pressures on reprocessing staff;
- After-hours requests for instrument reprocessing, possibly performed by insufficiently trained personnel;
- The lack of standardisation of processes among multiple reprocessing areas;
- Coordination and cooperation issues between OR and reprocessing staff.

Recommendations

- Provide adequate space, equipment, trained staff, instructional materials, and resources for the reprocessing function to be performed effectively.
- Verify that an appropriate reprocessing protocol exists for all relevant instrument models in your facility's inventory.
- Develop a protocol to ensure that loaner instruments go through the same reprocessing processes as hospital owned instruments before initial use and between uses (following manufacturer recommendations for each device).
- Ensure that current documented protocols are readily available to staff and that staff are trained to understand and follow them.
- Monitor adherence to protocols and quality of instrument cleaning.

- Periodically review protocols to ensure that they are clear and comprehensive and that they reflect the current environment.
- When developing or reviewing protocols, ensure that all steps are addressed and documented in adequate detail— from precleaning of equipment at the site of use, when appropriate, to safe and aseptic transport of equipment back to that site for subsequent use.
- Seek input from reprocessing department staff when assessing instruments for purchase to identify devices that may require additional time, steps, or resources to reprocess effectively.
- Foster communication and collaboration between reprocessing personnel and the departments they support so that the groups understand each other's needs.

(Nos. 7 & 8 will be in *HealthManagement's* next issue)

Robotic Surgery Complications due to Insufficient Training (no. 9)

Robot-assisted surgery involves the use of robotic arms that are fully controlled by the movements of a surgeon located at a control console several feet from the patient. The control console incorporates a video display on which the surgeon views 3-D video of the surgical site, as well as hand and foot controls that the surgeon uses to control the position and functions of the robot's arms, instruments, and endoscope.

Recommendations

- Before conducting unsupervised robotic surgery procedures, surgeons should do the following (note that the number of cases or sessions below are minimum values based on our discussions with large teaching hospitals; facilities should establish appropriate requirements to help ensure that surgical staff have the necessary procedure-specific skills):
 - ♦ Complete initial training sessions provided by or recommended by the device supplier.

- ♦ Observe at least two cases, including room and instrument setup.
- ♦ Serve as a bedside assistant for a minimum of five surgeries.
- ♦ Perform simulation training and training on appropriate inanimate or cadaver models.
- ♦ Complete a minimum of three proctored sessions. Note that if issues arise during the surgery that require the proctor's assistance, that session should not be counted as a completed, proctored session. Also be aware that if an external proctor is used—for example, if the hospital does not have an inhouse surgeon who can serve as a proctor—the external proctor is unlikely to have surgery credentials within the hospital and thus would not be able to directly intervene in the procedure if there's a problem.

- In addition:

- ♦ Facilitate team training. Surgeons and nurses will each require their own training because of their different responsibilities. However, teamwork is essential during robot-assisted surgeries, and some users have found that the safest surgeries are those that have been performed by a team that has experience working together. Therefore, we recommend that joint training sessions also be conducted, including interdisciplinary dry lab, cadaver, and simulation training that involves the OR nurses.
- ♦ Verify sustained proficiency. If the caseload for a particular procedure is insufficient to fulfill this requirement, consider whether simulation training would be adequate to maintain the necessary skills to manoeuvre the robot arms and EndoWrists.

Retained Devices and Unretrieved Fragments (no. 10)

Reports of surgical items unintentionally left inside patients following surgery or an interventional diagnostic procedure (which may take place outside the OR) typically

involve one of the following:

- A retained device, in which an entire device (including soft goods like a surgical sponge or towel) is unknowingly left behind.
- Unretrieved device fragments, in which a portion of a device (e.g., catheter tip, forceps jaw) breaks away and remains inside the patient. Clinicians may be aware that a device fragment has been left in the patient, but decide that the fragment's location within the anatomy makes retrieval too risky. In such cases, risks to the patient can include (1) prolonged or additional surgery, as would occur when an RSI is discovered and its removal is deemed appropriate, or (2) future complications, some potentially serious, as could occur when an RSI leads to infection or causes damage to the surrounding tissue. For example, retained metal could rotate if the patient undergoes a magnetic resonance examination; the result could be damage to internal tissue or structures.

Recommendations

- Visually inspect devices just before use.
- Be alert for significant resistance during device removal, which could indicate that the device is trapped and at risk of breakage; consider what options are available (e.g., repositioning the patient) before continuing.
- Visually inspect devices as soon as they are removed from the patient. If a portion of the device appears to be missing, immediately take appropriate action (e.g., examine the treatment site, request radiologic evaluation).
- Adhere to accepted surgical count procedures.
- Consider whether adjunct technologies (e.g., surgical sponge detection systems) should be adopted. Cleaning and reprocessing staff should be cognizant of obvious damage to reusable instruments and devices and should pull suspect devices for evaluation. ■

* *To be continued in HealthManagement Vol. 14 (2)*

The Full 2014 List

1. Alarm hazards
2. Infusion pump medication errors
3. CT radiation exposures in paediatric patients*
4. Data integrity failures in EHRs and other health IT systems*
5. Occupational radiation hazards in hybrid ORs
6. Inadequate reprocessing of endoscopes and surgical instruments
7. Neglecting change management for networked devices and systems*
8. Risks to paediatric patients from "adult" technologies*
9. Robotic surgery complications due to insufficient training
10. Retained devices and unretrieved fragments

BRITISH INSTITUTE OF RADIOLOGY

WHERE SCIENCE MEETS MEDICINE FOR THE BENEFIT OF THE PATIENT



Professor Andrew Jones is a consultant clinical scientist within medical physics at The Christie NHS Foundation Trust in Manchester and is Group Leader for non-ionising imaging. He has been a member of the BIR since 1983, and became President in 2012.

What are the goals and mission of the BIR?

The BIR is the oldest radiological institute in the world (founded in 1897). We are unique in that our membership is formed from radiologists, oncologists, radiotherapists, radiographers, scientists and our industry partners. We therefore bring together the whole network of our working environment.

Ultimately we are a membership organisation, so we produce benefits for our members. As a charity, we need to produce benefits for the delivery of healthcare, to patients and for the public. There are three main strands in our strategy:

Publications: We publish our flagship journal *BJR* (British Journal of Radiology), a journal *Imaging*, and we offer increasing opportunities for Open Access publications. We also publish some books and a range of guidance type documents to support work within radiology and radiotherapy.

Education: We offer a blended mixture of education, including face-to-face meetings, our annual BIR congress, and we are a partner in UKRC, the largest UK annual radiological congress. In addition, we provide and signpost to online learning. Overarching that education arm is a new accreditation process that provides a quality accreditation of learning. It measures both learning outcomes and delivery of courses, and produces a quality index rather than just a measure of how many hours somebody has attended a course. The plan is that we can accredit our own and other organisations' courses, and it gives a valuable measure both for the individual and employers about the true

value of the education and competencies gained. Accredited learning can then be structured within a portfolio for a particular topic to produce what we hope will be a BIR Diploma in a particular subject. For example, a very topical issue at the moment is musculoskeletal ultrasound, where clinicians need some form of accreditation of compe-

collaborations with the various elements of our membership, including our corporate partners. Engagement is about the BIR trying to influence decisions and agendas and producing the best possible outcomes for imaging and radiotherapy in the healthcare sector, for those who work in it and, ultimately, the patients.

BIR

The British Institute of Radiology



tence, so we could engineer that using our courses, signposting and accrediting other courses, so that participants will be awarded with a diploma. The value of that diploma, ultimately, will be as a view of what has been produced in terms of the competencies of those people. There are examples in other areas where it's become the default qualification or requirement in order to prove competency.

External Affairs: This refers to a wide spectrum of external engagement, which includes giving information to patients, engagement with decision-makers – the Department of Health, the National Institute for Health and Care Excellence (NICE), and

In relation to industry partners, for many other organisations it's very easy to put a barrier up, that you're the professionals delivering a service in the hospital environment, and industry is providing facilities and as a result they have a different view on things. We are fully inclusive of our industry members and whilst we may have different reasons for doing our work, ultimately we get the best outcomes if we collaborate. That is one of the BIR's key strengths and one of the rewarding elements. One of the things that gives the BIR a unique perspective is that we can produce position statements and consider challenges in conjunction with the manufacturers. If we consider initiatives



Interviewee

Professor Andrew Jones

President
British Institute of Radiology
London, UK

Interviewed by

Claire Pillar

Managing Editor
HealthManagement



to increase the provision of imaging equipment throughout the UK, then whilst this will benefit manufacturers in terms of potential sales, it also has benefits in terms of provision of resources for patients. The equipment manufacturers have already been very helpful

of research now is driven from multi-collaborative groups that by necessity have an international portfolio. You can't necessarily get big grants now if you are one hospital in one country; you need international collaborations, as it gives a wider focus.

that we are an organisation that has all the different professional groups within radiology as members. Most of our UK and analogous overseas organisations represent their different professions, so it allows us to have a unique perspective that reflects the multidisciplinary mix that exists within the actual work environment. Many of us experience our best days at work when we are working as a team and as a single unit. Everyone is collaborating and communicating effectively, working to their own strengths but aligned to an overall objective. The healthcare sector can be viewed as an industry, where if professions work in their own particular silos, then they may end up looking after their own interests. The advantages to the healthcare sector of multidisciplinary working are that it allows the focus to be on the patient, the patient pathway and how you manage that process. When we look at evidence from departments that are less effective, it's the manner they approach change, modernisation and optimisation that differentiates the best from the worst performers. This is reflected in the way they deliver their services, and deal with their patients. The best patient services consider all the different aspects of care and service delivery, cutting across the profession based silo mentality.

As president of the BIR, I find my role and duties hugely rewarding because I get to work as a team with our collaborators, our members who work within our committees or as trustees, and with the permanent staff of the BIR. It is this team working that has transformed the BIR into a modern and dynamic organisation, fit for purpose in the 21st century.

Please tell us about your own multidisciplinary work environment.

I am a medical physicist based at The Christie, an internationally renowned cancer hospital in Manchester, in the north west of England. The department's work covers all areas of medical

.....
“the best patient services consider all the different aspects of care and service delivery, cutting across the profession based silo mentality”

in providing data about location and use of equipment. The BIR, via collaboration, can then analyse and present the information to the wider healthcare community.

BIR has an international focus. Why do you think it's important for professionals involved in imaging to take an international approach?

Internationally there are different structures of healthcare delivery and management of the different professions that deliver healthcare. However, generally they are geared to the same goal, and experience the same problems. Sometimes we have to approach matters in different ways, but we are dealing with the same equipment, we are buying the same CT scanners, for example. We are purchasing equipment based on throughput, image quality excellence and using the same indicators. Internationally we share expertise in scientific and medical discoveries, and in due course, where appropriate, you can share experiences about service delivery. Politics and the charging mechanisms of healthcare will give a slightly different emphasis in different countries, but when we look at our working lives we don't limit our journal reading to those from the UK, we look worldwide for information. Lots

How did you become involved in the British Institute of Radiology?

I was encouraged to join when I started my first job. My first boss was John Massey from Manchester. He was a very well-known physicist, and he was later president of the BIR. He basically told me I had to join! Once I joined however, I very quickly realised that it reflected the most rewarding parts of my job, which was dealing with different groups, with clinicians, radiographers, and fellow scientists. That was the bit that gave me the buzz, not just dealing with my physicist colleagues. It gave opportunities for networking, growing experience in both my scientific discipline and in my management skills by working on committees, and it's grown from there. We have learnt a lot at the BIR from our younger members, and in today's modern world they rightly expect tangible and recognisable benefits from their membership fee. We are very much now focused on making sure these benefits meet our members' needs, and they are well marketed and effectively delivered.

The BIR is a multidisciplinary membership organisation. What do you see as the strengths and importance of multidisciplinary working?

The 'unique selling point' of the BIR is

physics, including radiotherapy, radiology, nuclear medicine and engineering. We were historically a regional department, offering a peripatetic service to all the different hospitals around the North West. We give the opportunity across the fields of nuclear medicine, MR and diagnostic radiology for all the Trusts to share expertise and have access to medical physics support. With regard to MR, for example, my specialism, the vast majority of district general or smaller hospitals do not need full time physicists to support their clinical service, but we can provide the best of both worlds. They get somebody visiting for between half a day or two days a week depending on the demands of their service, and it places us in a good position to share experience and knowledge from site to site. For example, we can develop new imaging protocols or optimisations of techniques at one site and then transfer these skills to other clinical services at other sites. We get access to lots of different hospitals and approaches, different vendors' machines, and different clinical specialisms within Trusts. It's good for the medical physics team in terms of the wide experience we can gain and is ultimately beneficial for all the clinical departments we work with.

What do you see as the main challenges facing imaging in the UK?

The immediate challenge is the ongoing change in the National Health Service structure. Everyone is waiting to see how they settle out, particularly with the change to the Any Qualified Providers scheme, whereby imaging services will be available from a range of approved providers. The other main ongoing challenges are influenced by best utilisation and availability of imaging equipment. Fundamentally in the UK we are limited in that we don't have enough imaging resources to meet demands. If we look at the proportion of CT and MR scanners per population head across Europe, we are disappointingly low down the league

table. I think this lack of facilities has forced the UK to take a lead in terms of modernisation and options for best utilisation of imaging resources. Most sites are already moving towards seven day working and are having to look at evening and weekend working. It is absolutely appropriate to get the most out of our resources, but the risk is that it is not sustainable or safe to work at 100% capacity. The pressures are so great in terms of targets, and so much has been achieved in terms of shortening the period from referral to scan for example. As technology continues to advance with resulting patient benefit, demand will continue to grow. Without an increase in the actual establishment of imaging equipment, the quality and patient care will suffer if we don't address the actual infrastructure of imaging services.

.....

“without an increase in the actual establishment of imaging equipment, the quality and patient care will suffer if we don't address the actual infrastructure of imaging services”

.....

As a manager, what are the main management challenges you experience in your working life?

I probably have an unusual job in relation to management. I have two roles. One is management of a team that delivers a medical physics service. This involves the same issues everyone has in terms of managing people, finances, service delivery, set against a background of operating with reduced budgets and mounting financial pressures. We are in a specialist environment; we have contracts from National Health Service (NHS) provider to NHS provider. That doesn't mean we're not exposed to a marketplace, and as we

have a contract with a hospital, they want to reduce their costs and that drives pressures on us.

The other form of management for me is unusual. It's all about the network. My team works out within other hospitals, and effectively we try to network and become part of that team. That's where we get the best relationship. If we sit at our desks or on the phone people will ask us the important questions, but they don't ask what they perceive as less important, and some of those questions can lead to very radical developments. We therefore position ourselves as a regular member of their team, visiting on particular days, and as a result we work with and try to affect change within groups for which we have no formal line management responsibility. I would never say that we are

managing radiographers or radiologists, but we influence them and are working with them so we are trying to control a process within an organisation that is not our employer. How you do that? It requires a collaborative approach, and we can only do that if we meet people regularly. We can't do that remotely and that's what we've had to develop to make the service successful. It's one of the most rewarding parts of the job. We have to be an effective part of a team and engineer the necessary collaborations to achieve our objectives. We get the pleasant experience of visiting many different departments and working with lots of different people. ■

Further information

British Institute of Radiology website
<http://www.bir.org.uk>

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HEALTHCARE SERVICES IN CYPRUS

IN TRANSITION TO A NATIONAL HEALTH SYSTEM



Author

Mamas Theodorou, PhD

*Associate Professor
in Health Policy and Planning
Open University of Cyprus*

Introduction

Cyprus, a European Union (EU) and Eurozone country, is an island republic covering an area of 9,250 square kilometres in the eastern Mediterranean Sea with a population of 840,407 in the government-controlled area in 2011 (Statistical Service website, 2013). Over the past decade, the country has enjoyed economic growth and increasing prosperity, mainly due to growth in service industries, such as banking, shipping and tourism. Real gross domestic product (GDP) has been growing at an average annual rate of almost 4 percent since 1995, compared to less than 2 percent growth in the Euro zone. Unemployment has historically been low at about 3 percent, but gradually increased to 16.2 percent in December 2013 as a result of the global financial crisis (Eurostat, 2013).

Life expectancy at birth is 77.9 years for males and 82.4 years for females (Statistical Service, 2011). The leading causes of death are diseases of the circulatory system and malignant neoplasms. The most common cancer in women is breast cancer with an age-standardised incidence rate of 73 per 100,000 population; the most frequent cancer in men is prostate cancer. There is a low prevalence of HIV infection and high levels of immunisation coverage. Although the population is relatively young in comparison with other EU countries, Cyprus' ageing population poses significant challenges to its already strained health system.

Organisation and Governance

The health system consists of two parallel and separate delivery entities: public and private. The public system is highly centralised, and almost everything regarding planning, organisation,

administration, and regulation is the responsibility of the Ministry of Health (MoH). It is exclusively financed by the state budget, with services provided through a network of hospitals and health centres directly controlled by the MoH. Public providers have the status of civil servants and are salaried employees. The private system is financed mostly by out-of-pocket payments and to some degree by voluntary health insurance (VHI). It largely consists of independent providers, and facilities are often physician-owned or private companies with doctors usually as shareholders. Other minor healthcare delivery sub-systems include the Workers' Union schemes, which mostly provide primary care services, and the schemes offered by semi-state organisations such as the Cyprus Telecommunication Authority (ATHK) and the Electricity Authority of Cyprus (AHK). The first mostly have their own network of providers, while the second use private providers. Other public health programmes are administered by a number of other Ministries and agencies, such as the Ministry of Education and Culture, the Ministry of Agriculture, the Police, and several non-governmental organisations (NGOs).

In terms of regulation of providers, personnel, pharmaceuticals and medical devices, Cyprus is almost fully in line with corresponding EU directives, which have been incorporated into national legislation. Despite this legislation, in the private sector there are difficulties controlling and regulating areas such as the development of health facilities, high cost medical technology, staffing and human resource development and quality of services. Additionally, patient empowerment remains an important issue, and there have been positive steps with the enactment of the Safeguarding and Protection of the Patients' Rights Law in 2004.

Financing

Cyprus devotes a low share of its financial resources to healthcare. According to National Health Accounts data, total healthcare expenditures (THE) in Cyprus in 2010 accounted for 6.0 percent of GDP, with 41.5 percent of healthcare expenditures government funded and 58.5 percent privately funded. Out-of-pocket payments are the dominant private source of healthcare expenditures and Cyprus has one of Europe's highest proportions of healthcare spending by households.

The MoH is responsible for collecting tax revenues, which are allocated at the beginning of the year to the different ministries through annual budgets. The final MoH budget is approved by the government, after a budget creation process that involves numerous stakeholders. The MoH is exclusively responsible for the implementation of the budget and no public provider is able to spend beyond approved amounts. All health professionals in the public sector have civil servant status and their payment is on a salary basis.

The public system does not secure universal coverage. It is estimated that only 80 percent of the population has the right of access to the public health system free of charge, while the rest of the population must pay according to fee schedules set by the MoH to use public services. The legal basis for entitlement to public services is Cypriot or EU citizenship and proof of having earned below a certain level of income, although for some groups, free of charge coverage is granted without proof of income or other criteria. A fairly high share of the population is also entitled to health services funded either by workers unions' or semi-state organisations. VHI provides coverage to more than 20 percent of the population through

group or individual schemes.

The services provided by the public system include primary care, specialists' services, diagnostic tests and paramedical services, emergency services, hospital care, pharmaceutical care, dental care, rehabilitation, and home care. Cost sharing measures in the form of co-payments have been imposed from the August 2013, in selected outpatient services of the public sector in order to control irrational utilisation. No data are yet available for the consequences of co-payments on access.

Physical and Human Resources

Physical and human resources are split between government hospitals and healthcare centres, and private hospitals, clinics and polyclinics. The majority of physicians, dentists, and pharmacists work in the private sector, whereas the majority of nurses are employed in the public sector. Over the last decade the majority of newly qualified physicians have pursued careers in non-primary care specialties. As a result there has been a decrease of 20 percent in the number of GPs from 1995 to 2000.

Because the annual MoH budget includes a specific allocation for each public hospital according to required needs, there are no incentives for cost-awareness, quality assurance and efficient use of available resources. The pluralistic health system has resulted in a lack of adequate resource distribution and utilisation between the public and private sectors. Indicatively, Cyprus has a very high number of CTs and MRIs as compared with the OECD country average, with most of these CTs and MRIs concentrated in the private sector. Moreover, the healthcare system is characterised by under-utilisation of information technology and the lack of a universal electronic medical record system to facilitate data mining, coordination and continuity of care and quality improvement.

There has been a continued increase

in the number of graduating nurses as a result of new nursing training programmes at four local universities (one public and three private). A relative increase in the supply of physicians and pharmacists is also expected as local universities have recently initiated their first medical and pharmacy programmes; a national workforce capacity plan for health workers is needed to ensure these new workers are able to find employment. Moreover, Continuing Professional Development (CPD) and revalidation of qualifications issues need to be addressed in order to ensure medical competency, quality of care, and patient safety.

Provision of Services

The public system has a large network of providers throughout the country. This network operates alongside that of the private sector, which offers primarily ambulatory care and to some extent hospital care, although data and documentation regarding the private sector is sparse. The link between secondary care and the social care system is informal, the latter being mostly the responsibility of the Ministry of Labour and Social Security.

The fragmentation of the health system, with little continuity of care and poor communication between doctors and other healthcare providers within and between the private and public sectors, is a major weakness, which leads to inefficiencies in both sectors, duplication of services, and underutilisation in the private sector. Within the public sector there are problems related to organisation and coverage since there is no referral system. There are also difficulties accessing some services due to long waiting times. Access for specific groups, such as immigrants, is problematic while there is limited coverage in dental care, since orthodontics and fixed prosthetics are not provided by the public sector, long term care, rehabilitation care, and palliative care, of which the last two are mostly provided by NGOs and the charitable sector. Additionally, there is an issue of affordability, especially for

the above mentioned services, since patients in many cases bear the cost for care. The affordability issue is evident not only from high private expenditure as a percentage of total health expenditure, but also from a Eurobarometer survey (Eurobarometer, 2007).

Assessment of the Current Health System

The current health system has many deficiencies. The fact that the public system does not provide universal coverage and approximately 20 percent of Cypriots must pay out of pocket to access the public health system, or must purchase healthcare from the private sector, demonstrates that the health system does not guarantee financial protection for the entire population. Empirical evidence shows that the health system is disproportionately funded by low and middle income households, as indirect taxes constitute 50 percent of state budget revenues. Nevertheless, the public health system primarily provides services to low income households. Other problems that have been identified include the uncontrolled deployment and use of high cost medical technology in the private sector, long waiting times in the public sector, uninsured illegal immigrants, and other shortages or inefficiencies in fields of care including rehabilitation, long term and palliative care.

Surveys reveal that a high percentage of citizens hold a favourable opinion about the availability and accessibility of the system, despite long waiting lists. There are also contradictory findings from population based surveys on quality and safety. In terms of outcomes, although barriers to access for some groups lead to unmet needs, generally Cypriots are in good health compared to the populations of other EU countries. However, this is in jeopardy as risk factors such as obesity and smoking may have a negative impact on the future health status of the population.

There is room for improvement in efficiency, transparency, quality, and

accountability. Additional patient empowerment and citizen participation in decision making, better hospital management and governance, and better control of biomedical technology deployment and use, are some of the priorities to improve performance.

The Transition to a National Health System

The lack of a national health system of universal coverage in Cyprus is a major issue of discussion and basic goal for the government and the health policy for more than twenty years. Accession to the EU led to many reforms in the health system, particularly in terms of policy, regulation, and the provision of services. With the re-launch of the Lisbon Strategy in 2005, the EU and its Member States committed themselves to a new partnership and to undertake reforms in a coordinated manner. Within this framework, in 2006 the government issued its “Strategic Plan for 2007–2013” which highlighted reforms of the organisational and financial structures of the health system as priorities (MoH, 2006).

Prior to EU accession, the Parliament passed Law 89(1) 2001 “for the introduction of a General Health Insurance System (GHIS),” which called for a new health system based on the principles of solidarity, justice and universality. However, the kick-off date of the GHIS has been repeatedly postponed for three main reasons: a) government concerns over costs b) the negative impact of the financial crisis on the fiscal revenues, and c) the time consuming tender procedures associated with the introduction of the new system (Cyprus National Reform Programme, 2011). At this time, while there have been many discussions and policy papers written, the only tangible progress has been the creation of the Health Insurance Organization (HIO), which has been appointed as the body responsible for implementation of the new system.

In 2007, the HIO introduced thematic

work teams. The teams have created policy papers and documents that describe the basic principles of operation of the new health system. Specifically, these documents describe the current system and highlight challenges for the transition to the new health system, including how healthcare service providers will interact with and be compensated under the new system. These documents form the basis of negotiations with stakeholders (Cyprus National Reform Programme, 2011). In addition, HIO has designed the operational processes in the context of the new IT system, while reorganisation and restructuring of the public health care sector and the MoH, along with decentralisation of health services remained key priorities.

The introduction of the GHIS is by far the most important health reform in Cyprus. It will be based on contributions (employers, employees, pensioners), and will provide universal coverage. In general, the new system is expected to:

- Encourage competition between and among providers in both the public and private sectors
- Encourage a primary care driven referral system by paying GPs based on capitation and performance indicators; specialists will be paid on a fee-for-service basis under a global budget by specialty.
- Remunerate inpatient care using DRGs.
- Improve the performance of healthcare provision, by:
 - (i) decentralising managerial responsibilities from the MoH to public hospitals, whereby the MoH will gradually be transformed to a policy-making body regulating public and private sector providers;
 - (ii) reforming the financial management system through the introduction of modern cost accounting systems;
 - (iii) establishing rules and regulations to ensure minimal standards for quality of health services;
 - (iv) promoting greater continuity of care for patients through the development of a robust GP system.

Despite the general agreement of the new government and the political parties that the sooner the GHIS is implemented the better, predictions about when the GHIS will be implemented were futile until recently. However in May 2012, the European Commission issued a Council Recommendation which stated that Cyprus should “...complete and implement the national healthcare system without delay, on the basis of a roadmap, which should ensure its financial sustainability while providing universal coverage” (European Commission, 2012). This led the Cypriot Cabinet in June to reaffirm its commitment to the reform. Despite the deep economic crisis, Troika (the tripartite committee led by the European Commission with the European Central Bank and the International Monetary Fund) has also agreed to the implementation of the GHIS, (MoU, 2013). Both the Council’s recommendation and Troika’s agreement gives a new impetus and support to the implementation of the GHS, which is now expected to come into effect at the beginning of 2016. The proposed reform is an ambitious effort to offer universal access and resolve the imbalance between the public and private sectors. The past experiences of other countries provide valuable lessons which can help to ensure that the GHIS is implemented successfully (Cylus et al, 2013).

Conclusion

Although cost concerns were one of the reasons for previous delays of the GHIS, the current economic crisis provides an opportunity in some respects. As a result of lower household incomes during the current crisis, the use of the private health sector has decreased, while the public sector has experienced an increase in demand. This has led not only to a renewed appetite for reform to target the already overloaded public sector, but also for more willingness on the part of the private sector to accept change due to decreases in revenues, as the reform is likely to lead to increased

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private sector utilisation, albeit likely at lower reimbursement prices than under the current system. Concerns over potential high costs associated with reform implementation are also no longer considered to be valid due in part to a private financing initiative to install and operate the new integrated information system.

Accession to the EU led to many reforms in the health system, particularly in terms of policy, regulation, and the provision of services. Major

challenges include reducing the rising costs of healthcare, addressing inequalities in access to healthcare services, and improving the quality and financing of the health system. Reforms in these areas will help to maintain the progress achieved in controlling communicable diseases, to reduce the incidence of chronic diseases, and to maintain the environment in a way that safeguards the quality of life.

While this opportunity for reforming the health system should not be neglected,

key lessons from other countries should be taken into account. Efforts must be made to ensure that the financial needs of the GHIS do not adversely affect growth in a vulnerable economic climate.

Public and private providers competing for patients must be able to compete under a balanced incentive structure. Learning from the experiences of other countries will help Cyprus to better meet challenges of the reform process. ■

MEDICAL TOURISM IN CYPRUS

CHALLENGES AND PROSPECTS

Abstract

The main objectives of this study were the investigation of the current state of affairs and perspectives pertaining to medical tourism in Cyprus, the identification of associated problems and weaknesses and the formulation of proposals for a sustainable further development of medical tourism by experts with specialized knowledge on the subject. The study was conducted using the Delphi method in two rounds (Goodman, 1987), which is characterized by anonymity and structured questionnaires with

controlled feedback. The data are collected through repeated rounds and the results of the previous rounds are fed back by the researcher in the form of statistical outcomes until the best possible degree of consensus between the participating experts is achieved (McKenna, 1994). The group usually comprises experts that reflect the state of the art and contemporary knowledge on the subject under investigation. A total of 23 people participated in this study, coming from different areas of the health and medical tourism sectors of Cyprus. The findings of the present study

revealed a high degree of consensus ($\geq 75\%$) in most of the questions answered by the experts. The promotion of medical tourism, the accreditation of medical facilities, the quality of the associated services, the generation of incentives and the active participation of the government through public-private ventures are among the proposals put forward for the development of medical tourism in Cyprus. Based on the results we conclude that medical tourism in Cyprus has the potential for further development and establishment as a sustainable lever for economic growth. ■



Authors

Marios Georgiou

Medical Laboratory Technician,
Karaiskaki Foundation,
MSc in Health Services Management

Mamas Theodorou, PhD

Associate Professor
in Health Policy and Planning
Open University of Cyprus

Cyprus Statistics

Total population	865,900
Gross national income per capita (PPP international \$)	26,110
Life expectancy at birth m/f (years)	79/84
Probability of dying under five (per 1000 live births)	3.5
Probability of dying between 15 and 60 years m/f (per 1000 population)	79/38
Total expenditure on health per capita (Intl \$, 2011)	2,221
Total expenditure on health as % of GDP (2011)	7.3
Number of hospital beds (public sector General Hospitals)	2,988
Number of doctors	2,553
Persons per hospital bed	284

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www.ecio.org

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May 6-8

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www.conhit.de

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icr2014.org

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www.euroson2014.org

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Congress 2014, Dubai, UAE,
www.arabpediatriccongress.com

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