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RADIOLOGY & ULTRASOUND 8-26

- Focus on prenatal ultrasound techniques
- PET/MRI leads hybrid imaging
- Imaging's role in CRC liver metastases



LAB & POCT 28-34

- CRISPR system embeds images in DNA
- Simplified mass spectrometry for bioanalysis
- MicroRNA supports testicular cancer detection



We have impact on value!

The movement to Value-Based Healthcare gives no value to diagnostic processes, including Radiology. ESR aims to establish a more holistic approach to help Europe's single-payer systems shift to a new economic model. John Braszy reports

The organizers behind Value-Based Healthcare (VBH) are gaining ground in an effort to transition public and private payers toward value-based reimbursement.

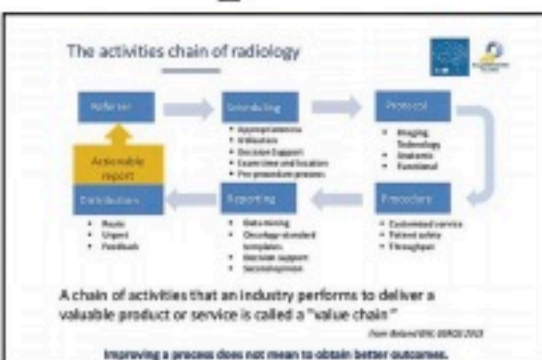
To date, the International Consortium for Health Outcomes Measurement (ICHOM) has published 21 sets of standards covering almost half of what it defines as the global disease burden.

Some European health care groups have experimented with this approach with mixed results, notably the Karolinska University Hospital in Sweden.

VBH started in the United States as a response to ineffective models introduced by payers to manage costs of healthcare services, such as fee-for-service or capitated payment approaches.

Incredibly, VBH does not include diagnostic processes, focusing instead on therapeutic outcomes. Value is defined by treatment without considering the multi-disciplinary evaluation of the patient that in the first instance determines the patient's pathway for care.

'It's still early days,' said Professor Lorenzo Derchi, who is chair of the Value-Based Imaging Working Group of the European Society of Radiology (ESR) and the ESR's First Vice-President. 'Value-Based Healthcare is an economic approach that is interesting, but not the only possible approach. The initiators of this movement come from the Harvard School of Economics, not the medical school,' he told European Hospital during our recent interview. 'It does not consider the whole spectrum of care, a holistic



approach to the patient. With this model, radiology is not considered for its role in providing guidance for the therapy, nor for following up on the treatment to fine-tune and adapt that treatment.

'Radiology adds impact, more than what is being called value, which is only a calculation of outcome versus cost.'

'It's not easy to value the impact of diagnosis,' he pointed out. 'It becomes easier for calculations if the diagnosis is taken for granted. It's not clear if ICHOM did not consider diagnostics, or if they considered it but found it too difficult to measure as a value.'

In September the ESR published a Concept Paper On Value-Based Radiology in the Society's journal, Insights into Imaging, seeking to contribute to the discussion on this critical issue and to move it to the next level by asserting that a correct diagnosis is the first outcome that matters to patients.

European governments are facing difficulties in managing their national health systems, just as the American private payer systems. And the ESR paper points out that short-term cost-cutting solutions, and austerity measures that have been the first reaction, have already

reached their limit and are now negatively affecting the quality of healthcare, creating a vicious circle of increased demands on healthcare and a need for greater spending.

'It's like low-cost airline companies,' Derchi compared. 'They work for a while, then low-cost risks becoming a low-value service.'

After publishing the paper, he has taken to the podium at national radiology congresses to increase awareness of this issue, and to start a dialogue that ESR can bring to all involved stakeholders.

'As radiologists we have a long tradition of measuring and assessing our chain of work from the request of the referring physician to the report, to measure each step,' he said. 'Yet VBH sees these as processes and not as outcomes. What we need to do is define that the endpoint of these processes (the final diagnosis) is an outcome. And we need to ask how we can fit this intermediate outcome into the Value-Based Health Care framework.'

'Metrics to measure radiologists' impact on patient outcomes become a key step to take the discussion to the next level, to demonstrate whether the diagnosis is correct and actionable, that it is relevant and

useful to the episode of care.

'I use the term impact rather than the word value here, because this is the main problem in the ICHOM framework, where value means outcome versus cost,' said Derchi. 'They calculate cost and outcomes starting only at the moment when the patient comes to therapy. The impact of the imaging process, or of the other diagnostic methodologies, such as lab tests, biopsies and even the pathology report, needs to be considered not only as a cost but also as something that's key to the subsequent outcome, affecting what will be done in the treatment process.'

The ESR Concept Paper On Value-Based Radiology sets out five key factors in determining appropriate metrics for what it defines as Value-Based Radiology (VBR).

- Appropriateness of requests
- Attention to radiation protection measures
- Characteristics of the reports, whether they are correct, complete, understandable, structured and properly used
- Relationships between patients and radiology personnel
- Continuous professional education, research and innovation

VBR creates an opportunity to shift from volume-based calculations to a value-based practice of radiology that puts more emphasis on the relation between quality and outcomes. 'We are doctors in medicine. We are neither photographers, nor operators running machines and pushing buttons. We inspect what is coming from the machines to integrate this information into the clinical picture of the patient to develop the diagnosis. It is our medical knowledge that gives these images significance,' he emphasized.

'If you measure only volume, then time is squeezed, the time for the examination is tight, cutting the time for reading and interpreting



Professor Lorenzo Derchi heads Emergency Radiology at San Martino Hospital at University Hospital Genoa in Italy. He also chairs the Value-Based Imaging Working Group of the European Society of Radiology (ESR) and is the ESR's First Vice-President.

and for communicating the report. There is no longer time to discuss the findings with the referring physician, to be sure they are understood, and how they may change the opinion on how to treat.'

'There are two perspectives,' Derchi concluded. 'One is economic, and if we are to be measured, we want to be able to show that we have impact on value. The other is an opportunity to discuss this topic, to create a moment for rethinking how we can achieve acknowledgment of our efforts for the quality in our work.'



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New tech secures mobile IT for roving medics

Healthcare goes out and about

New technology being deployed across the NHS in central England is helping to deliver more secure mobile systems for healthcare professionals, Mark Nicholls reports

The partnership between Toshiba and the Birmingham CrossCity Clinical Commissioning Group (CCG) is bringing the work of health and social care organisations closer together.

One of the initiatives planned for the Birmingham area is the introduction of Toshiba Mobile Zero Client (TMZC) to its laptops, which as a result have no hard drive and no local operating system or memory. Instead, they utilise the health system's existing virtual platforms to access and process information.

Clare Hope, Head of Digital for Birmingham and Solihull Clinical Commissioning Groups, explained that, with the CCG moving the local data and applications that healthcare professionals use to the cloud - and giving them access to it through the cloud using virtual platforms - the CCG is breaking down the 'silos' structure between health and social care organisations to create a more connected digital ecosystem.

This gives practitioners a faster, more holistic view of a patient's history and personal information and is also more secure at a time when health systems have been among organisations vulnerable to cyber attacks over the last couple of years.

'Our patients don't see the bound-

aries between these organisations,' Hope pointed out. They expect a joined-up service where their personal information follows them to each appointment - allowing seamless healthcare.

Because the devices are mobile, we're giving our workforce the tools they need to meet the increasing demand for a more flexible healthcare service.

Patients will see a reduction in time spent in and between appointments, as diagnostic information will be more readily available. Instead of waiting for records to be shared between practices - the information will follow the patient, enabling quicker and better-informed diagnosis.

With healthcare professionals increasingly working from the field, the CCG believes the TMZC solution

will enable them to access needed information wherever they are, and simultaneously record patient information records with up to date statistics when they are being seen.

Another advantage is that, because no information is stored on the laptops once they are turned off, healthcare providers can share mobile devices and still have access to all the information and applications they need through the virtualised desktop. Additional security features allow the device to remotely be de-stowed and reduce the risk of sensitive data being misplaced in the field should it be lost or stolen.

A challenge IT departments face in supporting a mobile workforce is securing the sensitive and personal information across multiple devices and a widening network, which can mean investing in expensive



Mobile equipment such as a laptop, is substantial to meet the flourishing demand for a more flexible healthcare service and support healthcare professionals increasingly working out in the field



David Sims is Toshiba's Solution Sales Specialist. With over 22 years' experience in telecommunications, he specialises in mobility, IOT/M2M and security solutions. Prior to employment at Toshiba, he had held senior roles in the telecommunications industry.

Mobile Device Management solutions (MDM). 'However, because data is virtually stored when using zero client solutions, sophisticated security packages are unnecessary because it can all easily be managed in the cloud,' added Hope.

Toshiba and the CCG have worked closely to identify a solution that not only helps create a more connected digital ecosystem, but also supports its increasing need for more mobile and flexible working practices. Following a successful user acceptance test, the technology will be rolled out across the CCG area - which covers a million health and social care patients over a large urban environment.

A future development, he said, could be wearable devices used to monitor individuals away from hospitals to collect information about their health.

David Sims, Solutions Sales Specialist with Toshiba, said the company is also helping to explore how Internet of Things (IoT) can transform wellness care in the Birmingham area, and how 'the huge volume of data that devices such as



Clare Hope is Head of Digital for the Birmingham and Solihull Clinical Commissioning Group, and is also the Digital Workstream lead for the Sustainability and Transformation Plan within the region. Within the industry he was a developer, before moving to the NHS, having led a number of projects from large scale Virtualisation, to smaller innovations into the use of technology to support healthcare, his current focus is on the use of cognitive computing and personalised healthcare.

wearables can be utilised for proactive healthcare.'

Challenges in mobile healthcare

Last year healthcare was the fifth most targeted industry in cyber-attacks,' Sims pointed out. At the same time healthcare staff are increasingly operating from the field, a trend that IT departments must support to ensure sensitive patient and business critical data is kept secure. However, mobile working practices bring with it an increased risk of sensitive data being lost or stolen.

TMZC safeguards the technology by storing data away from the device, making it only accessible through its existing cloud-based virtual desktop infrastructure solution.

'This removes the threat of malware being stored on devices,' Sims added, 'as well as mitigating concerns about data being compromised should a device be lost or stolen.'

In 2013 over 480,000 TB cases resisted all antibiotics

Facing the front line in the AMR battle

'Nurses have a distinctive and crucial role in the development and implementation of sound health policy,' according to Annette Kennedy, President of the International Council of Nurses, which represents 135 National Nurses Associations and around 17 million nurses worldwide. 'The reason,' she adds, 'is the unique role and relationship nurses play in healthcare provision to patients, carers, families and the community.' Here the nurse/midwife outlines their value in combating antimicrobial resistance (AMR).

One key policy aim for the International Council of Nurses (ICN) is antimicrobial resistance (AMR). AMR threatens

the effective prevention and treatment of an ever-increasing range of infectious diseases caused by bacteria, parasites,

viruses and fungi. It is an increasingly serious threat to global public health that requires action across all government sectors and society (Bief World Economic Forum, 2015).

Its impact is at multiple levels - individual, systems, economies and trade.

Patients with infections caused by drug-resistant bacteria are generally at increased risk of worse clinical outcomes and death, and consume more healthcare resources than patients infected with the same bacteria that are not resistant.

Today, new resistance mechanisms emerge and spread globally. According to The World Health Organization (WHO), AMR is responsible for 25,000 deaths in Europe annually, 36,000 thousand per year in Thailand, and over 25,000 in the USA. In 2013, over 480,000 tubercular (TB) cases were resistant to all forms of antibiotic treatment.

AMR financial and physical costs

It is estimated that the direct costs of AMR in the USA are up to US\$20 billion per year and up to US\$35 billion per year for indirect cost. A February 2015 AMR review projected that, by

2050, it would cause over 10 million deaths globally per year and result in a cumulative cost of US\$800 million, roughly the same as removing the UK economy from global output each year.

Take educational action

As the primary contact with patients, families and communities, nurses can have the greatest effect on public and patient education to improve health literacy. A WHO multi-country survey showed that 64% of those surveyed believed that antibiotics are good for illnesses such as cold and flu, and about one third believed they should stop taking antibiotics when they feel better. As patient advocates, nurses can help patients to understand their diagnosis and make the best decisions about their health.

Their role is also crucial in supporting and strengthening infection prevention and control (IPC) policies and practices; supporting patients' adherence to antimicrobial treatment and correct use of antibiotics; and promoting vaccination. Both health professionals and patients need more education, and better understanding that infections take time to heal, and build up natural resistance.

With other health professionals, nurses' local knowledge can inform decisions regarding antimicrobial therapy, and enhance the multidisciplinary approach to antimicrobial management.

Prevention and control

Nurses also have a role in infec-

tion prevention and control, ensuring responsible use of treatments, monitoring and evaluating them, and reporting AMR events.

Our continuing education on this topic is critical. We are key to surveillance and monitoring of patients' health as consistent patient carers.

At the 68th World Health Assembly in May 2015, the World Health Assembly endorsed a global action plan to tackle antimicrobial resistance - including antibiotic resistance - the most urgent drug resistance trend. This identified five main objectives:

1. Improve awareness and understanding of AMR
2. Strengthen knowledge through surveillance and research
3. Reduce incidence of infection through sanitation, hygiene and infection prevention
4. Optimise use of antimicrobial agents
5. Develop the economic case for sustainable investment that consider the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines and other interventions.

Increase health literacy

As nurses have a clear role in meeting these objectives, we must continually advocate for greater health literacy and increased immunisation.

We must keep abreast of AMR trends and also act as role models in our healthcare settings and homes. We need to ensure we ourselves fight the myths on immunisation and are discerning with our colleagues on

Medical Lighting System

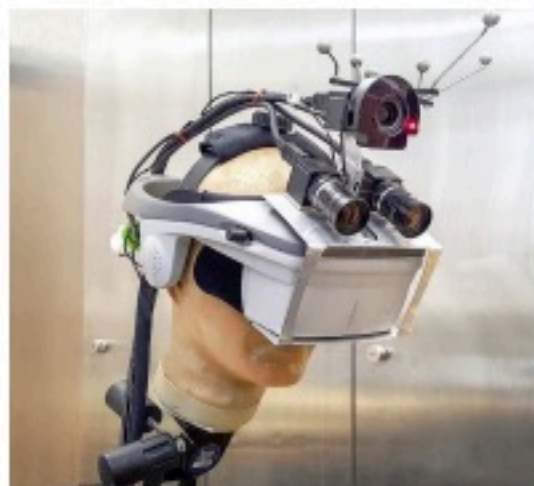
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Augmented Reality in the operating theatre

Virtual data merges with a real body



Head-mounted displays used to develop prototypes for medical AR systems. Both head-mounted displays have been developed in Munich – but are not conceived for use in the operating theatre (too many cables, too heavy)

Report: Anja Behringer

Medical Augmented Reality (AR) assistance systems overlay information onto a surgeon's field of view. This technology is complex and expensive. Therefore, the procedure must offer a big advantage compared to conventional treatment and diagnostic methods to qualify for standard use. The objective is a system that shows a surgeon a 3-D image of inside the body plus instruments used during surgery – and not on an additional screen but with a direct view of the patient.

For the system to improve matters it must be easy to use, show relevant information and be easy to integrate into established workflow. Computer scientists merge existing and processed data with camera images of the real environment.

The team, which with the help of AR lowers radiation exposure for patients by factor 40, has proved its value for some years. The challenges that medical technicians still faced three years ago, such as problems with imaging, reliable and precise tracking or issues around data preparation and visualisation have considerably reduced. Real-time imaging and visualisation are now so refined that AR systems can be utilised for an increasing number of applications.

During our interview, Dr Ulrich Eck, Senior Research Scientist for Computer Aided Medical Procedures

and Augmented Reality at the Department of Informatics, Technical University of Munich, discussed some future applications.

'Minimally invasive procedures use endoscopes for imaging,' he began. 'The surgeon mainly operates with the help of images transmitted by the endoscope. As the image data is acquired and visualised electronically this type of platform is particularly suitable for the visualisation of additional information, such as pre-operative image data (CT/MRI/PET), or intra-operative image data (US/OCT).

Data glasses for use in the operating theatre

'Planning data can also be visualised for interventions. One particular challenge is the provision of relevant information for the surgeon for every step, at just the right time. The AR system must automatically detect in which phase the current procedure is.'

The use of data glasses during surgery is an interesting concept, but there are still some unanswered questions, such as issues of ergonomics and sterilisation. The integration of data glasses also changes workflows – similar to the use of navigation systems. Effort and result must have a meaningful ratio, and it's not obvious which interventions are most suitable for this.

'In summary, there are currently no data glasses/HMD for use in the operating theatre which, along with

technical criteria, such as screen resolution and contrast, system latency, precision and quality of visualisation, also meet the requirements for ergonomics (light, removable, comfortable, no cables) and operating theatre specific requirements (sterilisable, reusable, robust, cost efficient). The development of an HMD suitable for the operating theatre needs close cooperation between manufacturers of data glasses, researchers in augmented reality and medical experts. The first studies in this area are currently being carried out.'

Asked for which application we can expect the early implementation in the operating theatre at a reasonable cost, Eck spoke of medical devices

manufacturers who 'now have the first devices in their range which integrate the concept of the camera-augmented C-arm (CamC) developed in our department, into their products'.

X-ray images projected onto the patient's body

'CamC is intended to help surgeons work faster, with more precision and with reduced radiation exposure for patients and staff.

'In future, we can expect augmented reality enhancements of products for specific types of application, such as in neuro-surgery.

The idea of projecting a patient's X-ray images onto their body during surgery makes sense even to lay



In 2012, Ulrich Eck, PhD began his Computer and Information Science studies at the University of South Australia. After gaining his PhD in 2016, for his thesis 'Precision Co-Location of Haptic Devices in Visuo-Haptic Augmented Reality', he became a Senior Research Scientist at the Technical University of Munich. He manages research in the NARVIS laboratory at the Chair for Computer Aided Medical Procedures. His research interests include medical augmented reality, medical simulation, haptic simulators, computer vision and human-computer interaction.

people. Eck explains the complexity: 'An X-ray image projects a 3-D space (the body) onto a 2-D plane. When an X-ray image is projected onto the body the spatial correlation between image content and visualisation is no longer accurate, because it results in the impression that the information is located on the user's skin. Only when the projector projects from the perspective of the X-ray source and the user views the patient from this direction is all the information of an X-ray image visualised correctly. This is the idea that our CamC-system is based on, albeit with a screen and not a projector.'

Detailed 3-D reconstruction of the respective body region (static or dynamic) is an essential prerequisite for the correct projection of X-ray images onto the body. Only then can the image be projected without distortion.

'In simple cases,' Eck concludes, 'projection of an X-ray image onto a body part, such as a flat hand, offers added value as the spatial correlation between the surface of the hand and the image corresponds well enough. We believe that, in most other cases, this type of projection does not deliver any noteworthy advantage.'

Gaining a uniform, homogeneous and shadowless illumination

Adaptable universal

Lighting up during diagnostics, minor surgery and other needs in ARE, intensive care, the recovery room, and more, the Saled 15 has universal value. ACEM, its maker, reports that the model provides excellent light intensity, IR-free light beam, colour temperature (CCT) of 4,500°K, colour rendering index (CRI) of 95, low power consumption and long life.

'The high technological level combined with the use of high-powered LEDs allow Saled15 to have a very linear yield and a negligible performance decay for its entire life duration,' the firm adds.

'Thanks to the high efficiency achieved, Saled15 has a light intensity of 65,000 Lux (85,000 Lux with 'Boost' function) and a low power consumption (10W).

The round shape also makes it handy and functional both in use and more, the firm adds.

The 3-Sense touch panel controls all lamp functions from on/off to light intensity adjustment, para-

selection (SEL), boosted brightness and, Acem adds, the new SEL function allows the selection of single parts of the light beam and the activation of the desired LEDs in a sequential way according to the requirements and needs.'

The brightness boost brings maximum light intensity in case of a wide light field; this approximate 20% increase deactivates automatically after five minutes.

'Acem is an Italian specialist in the design and manufacture of medical devices, surgical lamps for medical use, surgeries and operating rooms, etc.

The company's flagship is LED (Light Emitting Diode) technology used to produce its lamps.

'Acem product will be on display at MEDICA 2017, being held in Düsseldorf from 13-16 November, Hall 16 Stand E 31.

The Saled15 has a light intensity of 65,000 Lux (85,000 Lux with 'Boost' function)



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