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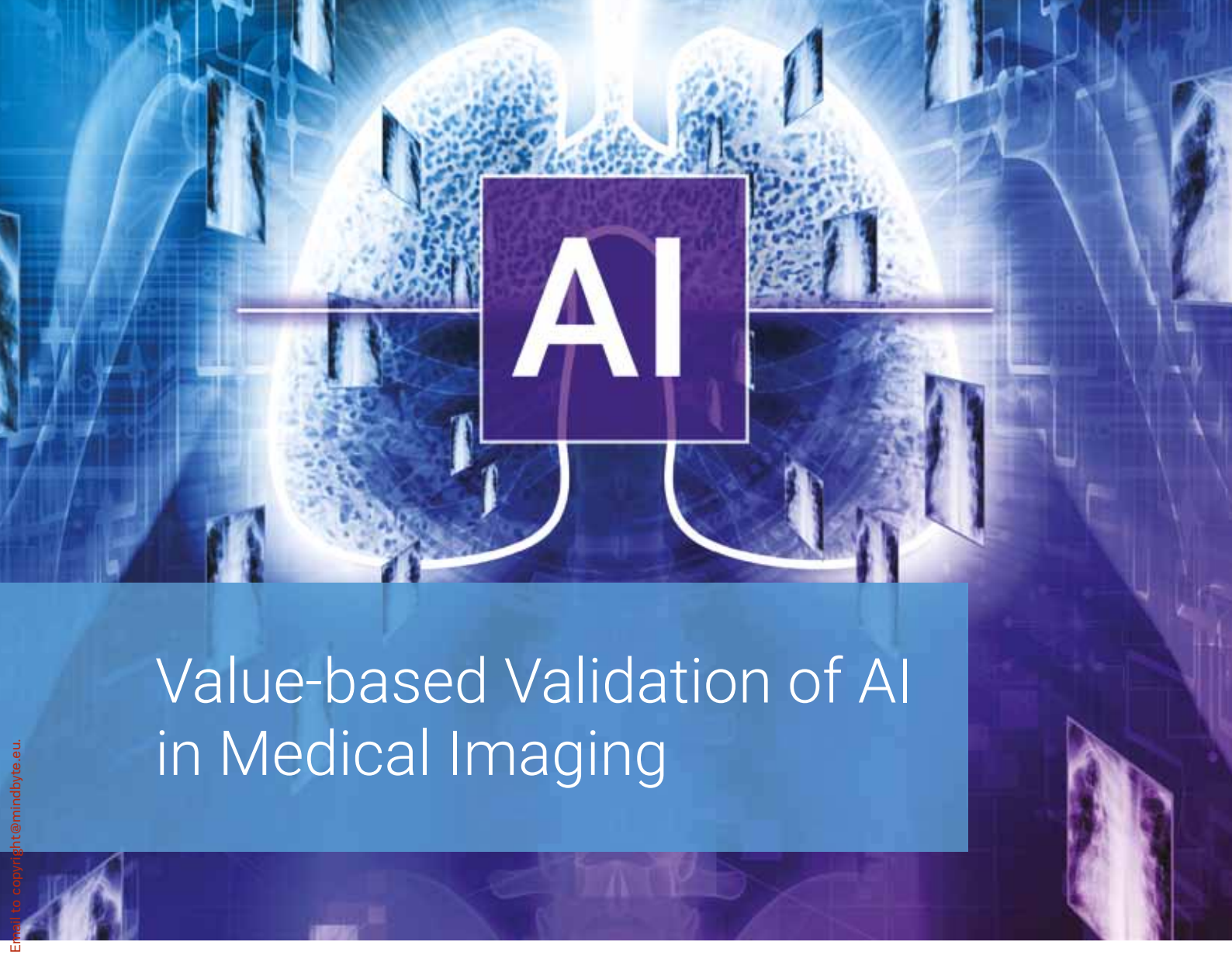
Emerging Markets



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Expanding precision medicine

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Emerging markets

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The financial crisis was a blessing for our health systems. It forced European policymakers and politicians to take more decisive action on key issues. It became clear that healthcare is not only about money (I strongly believe that there is still a potential of up to 30% in gains/savings) but about sincere structural problems in our foundations, and our unwillingness to free healthcare from political influence.

Payers are not able to execute their power to drive change. Steady underfunding of health services has no political consequences.

Under urgent pressure to meet the needs of growing populations, it seems that healthcare leaders in emerging markets are much more open to technological change, implementing innovations in processes and procedures at a game-changing rate. This puts Europe into the corner of those focusing on their well-acquired rights instead of adapting novel market processes.

Our cover story explores lessons for healthcare from Africa, Asia and South America. Alliar's innovative business model enables patients in remote locations across Brazil to access standardised, high-quality exams. Two thousand kilometres from São Paolo, patients can get an MRI scan while the machine is operated remotely by expert technicians, demonstrating the impact technology can make. Fernando Terni and Carlos Araujo show the opportunities that modern technology brings.

Insurance literacy is the key impetus to catalysing demand among poor communities. David Dror takes a look at innovations in voluntary micro health insurance to finance universal health coverage.

The Intercare group in South Africa has created integrated practice units, which are multidisciplinary, co-located and focused teams of healthcare professionals. Primary care and wellness centres, dedicated units for sub-acute care and rehabilitation, as well as ambulatory day surgery centres, are key components of the Intercare Group's patient-centred healthcare model, reports Hendrik Hanekom.

Editorial Board member Chris McCahan then focuses on another angle for emerging market healthcare: the use of managed equipment services (MES) as an innovative way of tackling the problem of wasted medical equipment stock. The successful example he introduces us to is in sub-Saharan Africa. Seventy percent of hospital equipment in sub-Saharan Africa stands idle and MES could change all that.

Joelle Mumley and Amit Thakker discuss Africa's prime role in healthcare tech, with the continent leading the way in cutting-edge drone use. The African healthcare context is uniquely placed to adopt and benefit from drone technology, they say, and the sector can learn from this on an international scale.

Divyesh Mundra then takes readers on a journey through India's National Health Protection Mission. Effective implementation of Ayushman Bharat will largely depend on ensuring that the package of services prioritised under the National Health Protection Scheme is based on community needs, evidence-based, well governed and inclusive.

You will read as well about amazing winning practices, management matters and more.

Enjoy this issue! Gain some useful insights and inspiration towards playing a part in moving international healthcare in a positive direction. Feel the same? Share your thoughts and join the discussion by emailing me at **cm@healthmanagement.org**. ■

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What do you think?

Under urgent pressure to meet the needs of growing populations, health-care leaders in Asia, Africa and South America are embracing technological change and implementing innovations in processes and procedures at a game-changing rate. Innovation is happening in surprising places - and we would like to hear from you. Share your ideas and thoughts on innovation in emerging markets by emailing us at **edito@healthmanagement.org**

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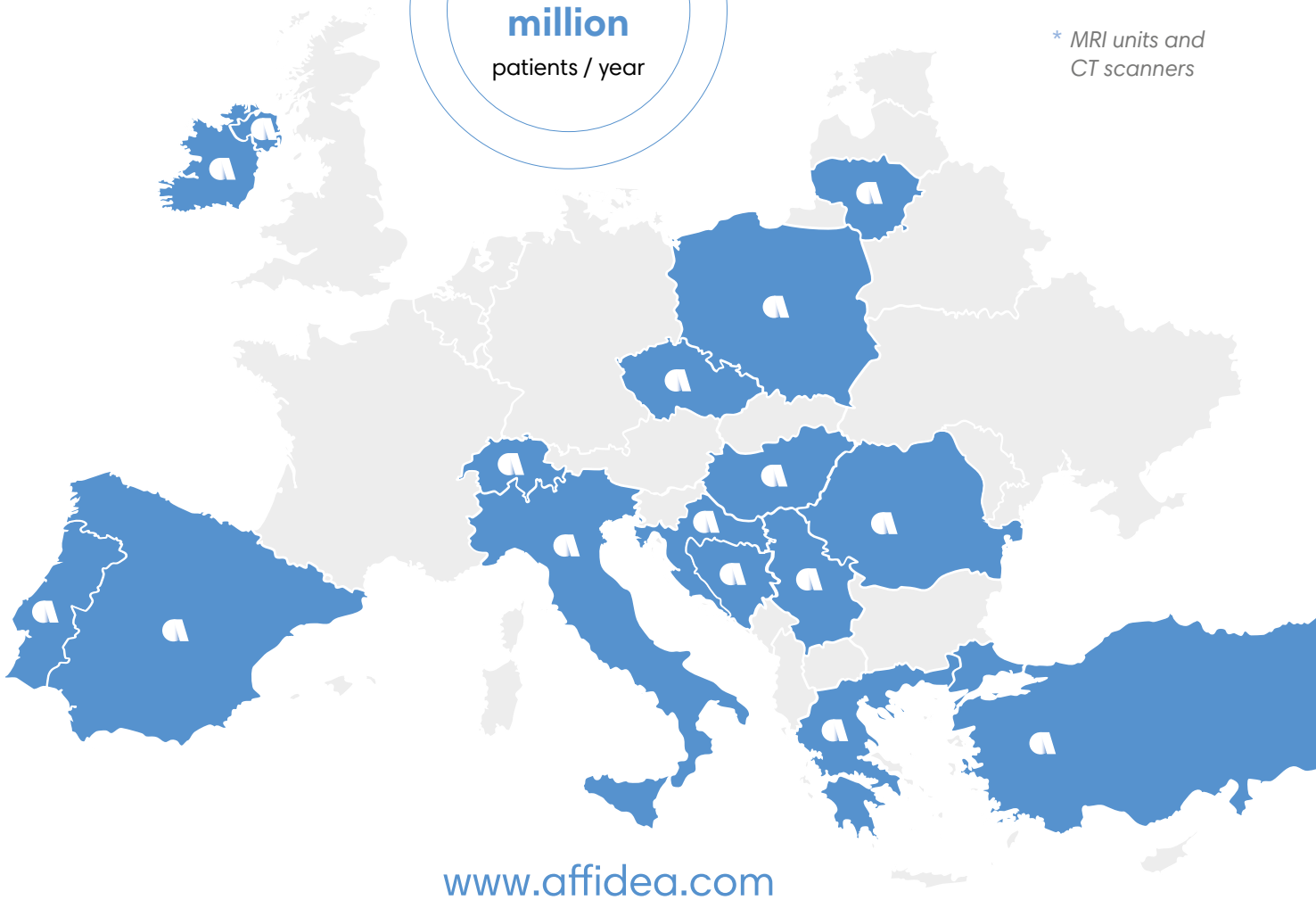

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Healthcare Business International 2018

The new global healthcare landscape

HBI 2018 focused on problems around building capacity, reaching out to new customers and deploying new solutions around digital health and artificial intelligence.

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Healthcare Business International's annual conference is the only CEO-level event focused on private healthcare services, bringing together providers, investors and payors from across Europe and emerging markets to examine the industry's future. The 2018 event, held in London on 10-11 April, hosted over 620 delegates from more than 50 countries. HBI 2018 gave a clear view of the new healthcare landscape across the world.

This year, the event focused on problems around building capacity, reaching out to new customers and deploying new solutions around digital health and artificial intelligence (AI). A selection from the presentations by expert speakers from all parts of the world is included below.

Challenges of the Southeast Asian healthcare market

The Asian healthcare market is desperately in need of good providers, but the operating environment remains challenging, according to the expert panel at HBI 2018.

"Asian streets and healthcare markets are not paved with gold, and the region is incredibly hard to work in," said Thalia Georgiou, head of healthcare at Hong Kong-based consultancy firm Asia Care Group, adding that opportunities in the region are hampered by challenges that include rising operating costs, lack of regulation, and corruption and fraud.

Rising healthcare costs and PPP

With rising healthcare costs in Southeast Asia, there is a significant need for affordable care options, giving rise to public-private partnership (PPP) opportunities.

Dr. Jeremy Low, chief marketing officer of Thailand hospital group Thonburi, which also manages three public general hospitals in Thailand, saw PPPs being used to manage cost: "Healthcare costs are increasing in this part of the world. Some of the regions realise they are not very effective in managing healthcare. The main challenge is culture—it takes some time for the public sector to accept a third-party private operator is there to be efficient.

"In medical technology, there is lots of bandwagon effect. If one party has this machine, others want it too, that drives up the cost. And salaries of doctors and nurses are increasing quite dramatically, and that's because of a shortage in the workforce."

He added that telemedicine has been slow to take off in Asia, as many patients still prefer to see a doctor face-to-face, clarifying: "After the consultation they will seek a second opinion, this is where they will use telemedicine."

Lack of regulation

"A lack of standardisation, reporting or national clinical guidelines result in significant variations in care outcomes," Georgiou said.

As a result of this lack of regulation, many private healthcare operators are also incentivising services rather than delivering efficient targeted care, according to Christian Ward, director of group healthcare of insurer AIA.

"Sometimes access is not an issue, some of the markets are still very focused on occupancy. In island states like Hong Kong and Singapore, there is a plethora of primary care services which are relatively cheap. Lots of providers have set themselves up incentivising services," he said.

Georgiou also cited the example of the average length of hospital stay for hip fractures in Hong Kong as being five times longer than in the U.S.

Corruption, fraud and due diligence

Despite the challenges, there are business opportunities for foreign healthcare providers in Asia due to the growing population, demand and increasing willingness to pay. However, Georgiou warned

> THE ONLY CEO-LEVEL EVENT FOCUSED ON PRIVATE HEALTHCARE SERVICES

the importance of due diligence prior to making the investment.

"Half of our work is with big companies, household name companies who come to Asia presuming there's growth, but whose assets are not performing. It's really important to sound out the market. If you are on the cusp of deciding whether to go into Asia, a willingness to pay is a healthy indicator (which you have to look for)."

According to Asia Care Group's analysis, the willingness to pay for healthcare in Southeast Asia has increased by 10-25% in 2017, compared to the previous year.

Georgiou also warned that corruption and fraud could easily account for 10-30% profit loss, so installing good reporting and management systems are vital.

Problems with investing in MENA

The biggest problem with investing in healthcare in the Middle East and North Africa (MENA) isn't returning capital—it's raising it in the first place. But it's not the only problem. Dr. Helmut Schuehsler, chairman and managing partner for TVM Capital in Dubai and Munich, shared his thoughts about it at HBI 2018. He identified several problems:

Do-it-yourself mentality

He explained: "Raising capital for a Middle East-focused strategy today is hugely difficult. A lot of the local investors are very often family offices, other than the sovereign wealth funds which are huge and for whom we are way too small.

"They are usually diversified businesses, and if they want to invest in the Middle East they do it

themselves. And if they want to invest in healthcare, they do it themselves."

Schuehsler explained these groups build hospitals on land that is often donated by the government, or a sheikh.

He added: "There's very little money from the inside because people don't want to give me money as a private equity manager to manage it without an influence over what we do, and I think outside the Middle East, you can imagine what everyone is saying when it comes to investing there.

"You are lucky if you get an interview—if people actually listen to your story—whatever they watch, Fox or the BBC or whatever, is so bad about the Middle East that people's propensity to listen to you is very small."

Geography

Another problem in the Middle East is that it's such an ill-defined area that people don't know where to put it, he says.

"Investment teams in our field think in geographic terms. We're not in Asia (for the Asian team), we're not in Africa, in Europe, not North America or Europe. It's a no man's land in the middle."

Change

The region is going through tremendous change at the moment, which is also a problem, said Schuehsler, adding: "The speed of development is tremendous. Determining where the opportunity is has changed dramatically. I'd argue 10 years ago, long term post-acute care, was a huge opportunity because there was no long-term care in all of the Middle East and we had fast-growing businesses.

"Five to seven years later, that success has been noticed by other people and you have a wave of others coming into the market so that opportunity is gone. I think people coming into that market in the next two to four years will have a very hard time. "

Regulation

Schuehsler said: "Regulators change their minds, especially in Abu Dhabi which is a great market by anybody's standard. You have to deal with a lot of change in terms of how the regulator looks at the world, because we've gone back and forth between being invited to invest in certain sub-sectors—and at the same time being under tremendous cost pressure, which I understand, because of healthcare inflation."

Opportunity

Despite all this, Schuehsler believed there to be tremendous opportunity in the region, especially with Vision 2030 in Saudi Arabia, the plan to reduce the country's dependence on oil and develop public sector services like health.

He explained: "It's not only way the biggest market in the Gulf Cooperation Council (GCC) region, but a development where you hold your breath and ask, 'am I brave enough and is the time right to raise a fund to go into Saudi healthcare?'"

"At some point you have to make a decision. When everyone comes, it's too late. Do we deploy big time and put all our resources into Saudi Arabia? For anybody who is in the investment business, that's the biggest question."

> "DIFFICULT TO BECOME A MAJOR PRIVATE PLAYER WITHOUT COSYING UP TO THE GOVERNMENTS IN EMERGING MARKETS"

Abdul Hamid Oubeisi, CEO of Abu Dhabi and Dubai-based National Reference Laboratory, also saw opportunity in the region.

He explained: "There are great opportunities in outsourcing. Governments are interested, whether in PPP, or privatisation. The UAE Ministry of Health, for example, recently outsourced their entire diagnostics. We also hear they are looking at the hospital operator market.

"In Saudi Arabia, it is taking a bit longer, but we see PPPs coming. There are a lot of opportunities where providers like us could bring productivity and efficiency."

Want to enter Africa and other emerging markets? Make friends with government first

Conversations with delegates at HBI 2018 highlighted that a heavy focus on PPPs by some of the major healthcare actors in Africa is proving to be the right approach in countries where governments hold a lot of sway.

Dr. Amit Thakker, chairman of the board at Africa Healthcare Federation, has an almost activist-level presence in conversations around private healthcare in Africa, travelling the continent to preach the benefits of private-public-partnerships at numerous meetings springing up across the region. It's easy to

dismiss the public-focused approach for being slow to yield results and lacking in vision.

But delegates agreed the approach is the right one. "Yes, working the government is slow but you need to make those connections. Become friendly with the key stakeholders and then you can talk to the private sector partners," one said.

The implication was that it is difficult to become a major private player without cosying up to the governments in emerging markets, in Africa and beyond, where the regulatory environment and official bodies' oversight play second fiddle to relationships. If you want planning permission or an operating licence, let alone public contracts, it isn't enough for your organisation to just tick the official boxes.

Using AI and big data for outpatient transformation

How can artificial intelligence (AI) and big data be used to transform outpatient services? Healthcare Business International spoke to tech expert Mark Ebbens, senior partner at GE Healthcare Business International, to find out.

The starting point, says Ebbens, is identifying the problems: "In most outpatient settings, you face the same challenges, how quickly people go through the system (throughput), low clinic capacity, the ratio between new visits and follow-up visits, and how do you manage the fact the doctors in the outpatient clinics are the ones you want in surgery, or seeing patients on ward rounds. There's always a balance between planned and unplanned care. Outpatients tends to suffer. You can speed it up or slow it down.

"The only thing that really drives performance in outpatients is when people get beaten up for performance times—so in the UK it's the 18 week referral time— however, I'd say the way they hit targets is highly inefficient. Everywhere booking and scheduling of outpatient appointments is done non-intelligently."

There's currently very little analytics being applied. The question to ask is this: "How do you defrag that hard disk so the empty white space is filled up more efficiently?"

Ebbens explains: "There are algorithms that can optimise theatre and outpatient schedules. It takes more planning than it would to schedule the Premier League's games. You're looking at physician preference, specialty, the days he likes to work, available slots, the size of the waiting list, the sequence in which you manage the waiting list as some people who wait may become urgent during the process, and another 15 constraints—and these are fed into an optimising tool.

"The biggest constraint is consultant job plans. They'll say "I'm not doing it". It's an issue in the UK but it's even bigger elsewhere where they will say "You're not paying me to do that" —in the US for example".

The savings can be substantial. "Even if you capture 25% or 20% of that potential, it's 20% better than it is now. And that's 20% of your time back."

"AI and big data can help maximise your limited resource. We did a bit of tracking where we put radio-frequency identification (RFID) tags on patients, doctors, and around an outpatient clinic and we watched where they went. They didn't like it. We got to measure actual face-to-face time between patient and doctor.

"That's real-time data but you can't make decisions in real time for something that's scheduled. Unlike managing an emergency department where you are trying to think on your feet, this is about learning from planning mistakes and optimising and that's something AI is good at.

"The real power of AI is spotting patterns you wouldn't see yourself—it compares variables and normal outcomes. It can even spot patterns for individual employees. A nurse might underperform in cold weather after a public holiday.

"Outpatients should be an easy to solve problem digitally. Why hasn't anyone solved it? You've got to get doctors and patients to change their behaviour."

Another way to do this is to keep patients informed of something as simple as waiting times. He explains: "Take Humber River Hospital in Canada. They publish their data live—if you've got an appointment, they can tell you that you will be waiting two hours—so you can go grab a coffee or whatever and come back later. It improves the experience, perception of choice and alleviates crowding. It is like electronic signs at bus stops telling you when the bus is going to arrive." ■

Mark Ebbens's presentation at HBI 2018 is available at **https://iii.hm/jp8**

Healthcare Business International 2018. Going for growth. Conference agenda. Available from **https://iii.hm/jpa**

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The future of healthcare

Turning challenges into opportunities

Providing value-based care will be one of the driving forces in the future as highlighted by Siemens Healthineers professionals Dr. Ghada Trotabas, Dr. Arthur Kaindl, and Dr. Jonathan Darer at Healthcare Business International (HBI) 2018.

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The biggest challenge facing healthcare is the need to improve value for patients. Healthcare systems today are struggling with rising costs and varying quality. Most diagnoses and treatment protocols are designed for typical patients. Delivery of care is fragmented and is merely focused on volume. Healthcare is yet to leverage the full potential of data, and the patient experience journey remains in its infancy.

At Healthcare Business International (HBI) 2018, top executives from Siemens Healthineers shared their thoughts about the future of healthcare and how healthcare could meet these challenges by enabling healthcare providers to increase value.

Discussions were around the topics of expanding precision medicine, transforming care delivery, improving patient experience and digitalising healthcare, led by panelists from Siemens Healthineers—Dr. Ghada Trotabas, Dr. Arthur Kaindl, and Dr. Jonathan Darer.

Expanding precision medicine

Healthcare will see an increased focus on medicine that is more precise and affordable. This will require more efficient integration of relevant patient data, leading to precise diagnostics. By tailoring therapy on the basis of the disease and specific patient characteristics, healthcare providers can give the right treatment to the right patient at the right time. The more precise the treatment, the better patient outcomes will be. Improved patient outcomes will translate into improved value.

The term "precision medicine" is widely used today, but implementing it will require a greater focus on health data integration and the use of computational tools and IT interfaces to provide precise medical care. As Dr. Jonathan Darer, Clinical Consultant at Siemens Healthineers pointed out, the most effective way to deliver high-quality care to patients, especially those with multiple chronic diseases, is to focus on three things:

- Mastering the flow of data across all stakeholders to let people know what's happening to patients
- Having a different care model to help patients navigate the complex healthcare system wherever they go
- Engaging patients and families as active members of the care team.

Precision medicine can only become a real-world option if health data is properly integrated. Diagnostics and treatment decisions based on this integrated data are what could ultimately ensure value-based care and patient-centred therapy.

Transforming care delivery

As we work on improving value, we need to make certain that the care delivery model ensures positive patient outcomes without an increase in costs. This will require consolidation. The new care delivery model will need to optimise clinical operations and automate standardised workflows. Inefficiencies present within our healthcare delivery system often affect patient care. Not only do these inefficiencies increase costs, but they also negatively impact patient outcomes. Healthcare legislation is another factor that affects the efficiency of healthcare delivery. The future of healthcare can be much improved if our healthcare system focused more on optimising workflows, using clinical decision support software to streamline operations and creating the right infrastructure to ensure effective delivery of care.

By transforming care delivery, we can help improve patient access to healthcare services and make these services more affordable for the patients. That is the most efficient way of improving value. As Dr. Darer explained: "Value-based care delivery will enable healthcare professionals to better identify high-risk patients, identify patient needs with precision and connect patients to resources."

Improving patient experience

The new healthcare model will view patients as consumers. And, like most consumers, patients will also demand value from healthcare service providers. They will have expectations, and they will want the right to choose and the right to make their own decisions. The future of healthcare will thus see a more informed patient, a patient who will demand better outcomes.

Healthcare providers can provide this value and improve patient outcomes by ensuring accurate and well-informed diagnoses, optimal treatment planning, a more supportive clinical work environment, greater transparency, continuity of care, improved patient support and connected care. Dealing with physician burnout, improving coordination and ensuring high-quality communication are additional elements that can play a critical role in providing value-based care to patients. The important thing here is to improve the fundamental structure of the healthcare system to optimise personalised treatment and patient outcomes.

> “WE NEED TO MAKE CERTAIN THAT THE CARE DELIVERY MODEL ENSURES POSITIVE PATIENT OUTCOMES WITHOUT INCREASED COSTS”

A more informed patient will also be more engaged when it comes to their healthcare and treatment decisions. In other words, patients will be in a position to influence their own outcomes, and this will require greater patient engagement. When you engage patients, and when healthcare providers include them in key discussions and treatment decisions, this can have a significant impact on patient outcome. This is one area where healthcare really needs to do more work, as engaging with patients and families is still something most healthcare providers struggle with. The quality of care that is delivered to the patient can be enhanced by engaging with these patients and building an actual patient-doctor relationship with them.

Digitalising healthcare

Finally, digitilisation will be the new face of healthcare in the future. Artificial intelligence will become an integral part of future healthcare solutions; healthcare data will be more effectively used with the help of new and improved digital tools, and the digital revolution will change the very nature of care delivery and treatment of disease.

The healthcare industry today is faced with the challenge of improving value. It is dealing with ageing populations, increased prevalence of chronic diseases and increased healthcare spending. There is the added pressure to deliver better and more improved care without increasing costs. The only way to provide all this is by digitalising healthcare.

Digital technologies can help the healthcare industry meet the needs of patients and providers. They can do so by:

- Improving access for both patients and providers to healthcare delivery
- Enabling remote monitoring of patients
- Giving patients ownership of their health and wellness
- Increasing accuracy, standardisation and efficiency in care delivery
- Facilitating seamless communication within the healthcare system
- Leveraging artificial intelligence to better integrate and analyse healthcare data

Dr. Arthur Kaindl, General Manager, Digital Health Services at Siemens Healthineers further pointed out that digitalisation of healthcare can help create loyalty between the patient and the provider in the healthcare system. And it is this very goal that companies like Siemens Healthineers hope to achieve by providing the most relevant digital ecosystems in the market. The ultimate goal is to bring all the stakeholders together and provide the most suitable digital solutions so that healthcare providers can reap the benefits of digitalisation and use this digital transformation to create better patient loyalty.

In the end, digitalisation, personalised treatment, and a better delivery care model will improve the patient experience. This improved patient experience will increase patient loyalty and make them the ultimate winner of digitalising healthcare.

Conclusion

The healthcare industry is dealing with rising costs and demands for improved quality of care. The ultimate goal is to improve patient value, and the only way the healthcare industry will achieve this is by digitalising healthcare, leveraging artificial intelligence and by better using healthcare data for more effective diagnoses and treatment. These four strategies can go a long way towards transforming healthcare and help this industry accept and embrace the digital revolution. ■

Smart hospital ethics

Starting the dialogue

With the advent of smart hospitals, the digital future of clinical medicine calls for a new ethical framework.

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Fact: *whether you like digital medicine or not—it is already here. Also true: facts do not hold normative power—the presence of breathtaking technological progress **A** is by no means a pro-ethical argument to use **A**. Artificial intelligence (AI) emerges, medicine transforms, and then clinics, as a core part of the health system, change step-by-step. But when it comes to digital health, Peter "Spiderman" Parker's Uncle Ben was right: "With great power comes great responsibility". Digital health ethics are discussed widely among academics and practitioners as well as in legal and economic realms. Legislators and nongovernmental organisations (NGOs) are paying attention to the debates. For example, the World Medical Association issued the Declaration of Taipei on ethical considerations regarding health databases and biobanks (2002/2016), and the German Ethics Council has discussed the ethics of big data and health (ethikrat.org/themen/forschung-und-technik/big-data). Hospital ethics committees are starting to reflect on digital transformation issues. The idea of patient experience at the very heart of the digital revolution in the clinical sector can be viewed under the economic paradigm fostering the 'patient=client' approach or the ethical paradigm nurturing the 'patient=duty for welfare' approach. Or both? When it comes to the smart hospital trend, deep integration of digital technologies into cure, care and management is—as a matter of fact—irreversible, and—as a matter of values—a very important and wide ocean of ethical issues to address. This importance extends to doctors, researchers, students, patients, nurses, digital experts, management, founders, industry professionals and many others in all areas of medicine, management, healthcare and hospitals, as well as other industries—and, last but not least, to the general public. Time to sketch some possible elements and fields of action toward smart hospital ethics.*

In the long history of medicine, there has never been a period of such profound innovations as radical as digital transformation. Digital medicine is not an entirely gradual development, but changes medicine at its core. At the same time, the habits of most social contexts change, becoming more digital, and attitudes towards and handling of prevention, health, disease and cure change as well. Consequently, doctors, nursing stuff and management/administration staff adjust their relationship to patients (and themselves). Hospitals nowadays have to operate digitally, and target patient-oriented clinical services more consistently, including potentially positive results for patients as well as medical staff.

Why do we need smart hospital ethics?

The vigour of technical developments is steadily growing also in the hospital sector. A surgery robot is already almost retro. Understandably this increases society's request for a certain degree of responsibility in this process. An example is the highly relevant debate over data protection. If hospitals are seen as seas of data in the future that medically and economically have a lot to offer, the legal question over data rights and the corresponding obligation of handling data appropriately quickly arises.

The introduction of the electronic patient record is, when thought through to the end, a rich source of new challenges, such as the possibility of amalgamating patient data and gaining new insights. *Who owns these insights, who should obtain them and why, who might apply them and for what?* As with all legal considerations, the basic problem is that these are normatively bound to a specific time and location and therefore not universally valid. Just as the investment sector hedges legal options, for example, to save taxes or reduce liability risks, so must imaginably different data protection cultures be weighted.

In a state under the rule of law we can justifiably hope that there is a major intersection between positive statutory and ethical standards. Nonetheless, first this intersection will never be complete and second, the rule of law and digital products are intangible. In addition, actual law and consequently

real jurisdiction are lagging far behind technological development. This highlights the need for early and consistent reflection on the gap between facts and the ethically desirable. Technology assessments are needed to investigate developments in the digital realm of medicine and provide substantial insights and decision-making support in clinics and elsewhere.

The overall smart hospital system comprises many individual units, topics, players and processes of high complexity that lead to specific questions that in the analogue world were unable to evolve. Although many conceivable questions and prospective responses developed already in specific contexts relating to digital medicine, the overall view is of particular importance, because the smart hospital is a huge internal (doctors, nursing staff, management/administration, scientists, etc.) and external (patients, referrers, etc.) change process where an adequate basis of shared values can provide orientation.

> “THERE ARE A MULTITUDE OF SPECIFIC APPLICATION QUESTIONS ABOUT NEW DIGITAL MEDICINE, ALONG WITH COMPLETELY NEW ETHICAL QUESTIONS”

Possible heuristic questions

Table 1 includes example questions that are by no means exhaustive. They are designed to inspire us with new questions, stimulate hypotheses or invite criticism. An ethical view of hospitals is nothing new and is often the essential base of religiously-inspired establishments such as Christian hospitals. However, digitalisation generates a new material aspect that requires ethical considerations—if it is in fact true that for a reasonable moral conclusion normative (at least one) and descriptive premises need to be intertwined.

There are a multitude of specific application questions about new digital medicine, along with completely new questions. It is, for example, conceivable to transfer the well-known trolley experiment (an old but very helpful thought experiment developed by Philippa Foot in 1967 - **trolleydilemma.com**), which asks important ethical questions on decision theory and ethics, into the clinical area. How can and should AI decide, when a choice has to be made between two alternatives, when careful balance is required and the situation is complicated because the relevant values have equal weight? Assume there is only one special autonomous surgery robot and two patients who, based on human judgment, need the same surgery: an old and a young man. Without

Table 1. Example questions of smart hospital ethics

Example questions on smart hospital ethics	
Micro level: Patients Doctors Nursing Staff Management/Admin. Scientists	What responsibility do: patients/doctors/nursing staff/management and administration/scientists in a smart hospital have, and to whom?
Meso level: Hospitals Payers Industry	Is it, from the patient’s view, ethically acceptable to assess medical-digital innovations only in the context of one’s own, prospective cure? For what purpose is which kind of use of which patient data ethically acceptable? Is the legal and economically efficient use of digitalisation primarily for cost effects desirable? Is it desirable to outsource responsibilities of doctors and nursing staff to the digital system, and if so, to what extent? Can smart hospitals, in market terms, lead to “cure privileges” for financially strong patients? What responsibility cannot be assumed digitally by the patient? How can cooperation between medical care and science guarantee common values? What nursing activities can responsibly be delegated to technical systems like robots? How can patients and employees support the “humanum” in the conditions created by digital transformation? Is it morally acceptable when hospitals (co-) develop every marketable and technically feasible and legal medical innovation and then bring them to market? Can increased patient experience or “patient outcome” be legitimately seen as having an ethical purpose or economic goal – or both (if the latter, in what proportion of each)? How can digital change in the hospital be responsibly moulded for the staff? Are existing financial structures appropriately developed for responsible digital transformation? In cases of university hospitals that teach and conduct research: How should new ethical aspects of digitalisation in medicine be seen in the research context, and what function should they have in medical training, such as in the study modules?
Macro level: Law, Social discourse	Which regulatory systems are desirable? Which legal standards make sense ethically? Is there sufficiently broad social discourse on ethical issues of the smart hospital?
Theoretical reasoning and basic questions for concrete moral norms	What ethics are appropriate for a smart hospital on the aforementioned issues - is a normative foundation necessary and/or available (normative level)? Do we agree about reality, ie facts according to digital transformation in hospitals (descriptive level)?

surgery the chances of survival are extremely low. An operation is needed immediately. *An algorithm statistically evaluates the situation, and its choice might differ from the human's. Why? Is that legitimate?*

A real-world example is the genome testing company Nebula Genomics set up by Harvard professor George Church to address the B2C2B market for genetic data via blockchain, with no middlemen needed for private persons to market their DNA data. Human genome sequencing costs decreased dramatically from $ 100,000,000 in 2001 to under $1,000 today (Grishin et al. 2018). In principle, smart hospitals could develop and offer similar services or cooperate with innovative game changers. *What ethical questions arise when hospitals start to become game changers in the digital realm?*

To face these and other conceivable scenarios it is necessary to ask theoretical 'raison d'être' questions, given that individual ethics for every problem do not exist.

Hospitals' responsibility for critical reflection and development

Over the past 30 years, many different hospital ethics committees were initiated in many developed countries, not least to consider questions and answers on technological development in the medical sector. Tasks include regular and also internal consulting, concrete assessment of specific medical and nursing situations as well as training. Their institutional embedding ranges from real control and decision functions to purely advisory tasks.

Mostly, the critical success factor is institutional independence and whether ethics committee members remain silent. It makes sense, particularly in a new field like digital transformation in a hospital, to establish a new initiative alongside the existing ethics bodies, to focus completely on the new questions and offer solutions in the smart hospital context.

Engaging with the new ethics

An example of appropriate engagement with a new ethical body accompanying digital reorientation is the Universitätsmedizin Essen (Essen University Hospital). As a smart hospital, the Universitätsmedizin Essen does not follow the usual procedure of primarily using the digitalisation strategy to enhance efficiency and economy, but as a principal opportunity to improve patient care and unburden staff from tedious and time-consuming administrative tasks, and to innovatively increase quality in order to better take care of patients with value-driven empathy, a human core competence that cannot be expected from algorithms. It is the focus on humanity that transforms a digitally oriented hospital into a smart hospital. If teaching and research join forces in a smart medical school with the same ambition, this can be regarded as smart university medicine. The Universitätsmedizin Essen is on its way to becoming the 'Smart University Medicine Essen'.

> "IT IS THE FOCUS ON HUMANITY THAT TRANSFORMS A DIGITALLY-ORIENTED HOSPITAL INTO A SMART HOSPITAL"

Successful change from a hospital of the present to a smart hospital of the future is not only a technological question, but encompasses internal and external cultural change. This includes the mindset and behaviour of all hospital personnel. The challenge is to set aside one's own needs and focus on patients without any reservation; in particular, being aware of the changes to one's profession—even reputation. Already the doctor is no longer the exclusive knowledge bearer and decision-maker on whether people live or die. Doctors have the chance to use the benefits of digitalisation to intensify their real strength: trustful and empathic care of their patients. Thus, patients experience warm, individual and digital medicine. Doctors, nurses, managers and administrators will have more time and digital resources for their professional expertise to agilely, healthily and successfully act in terms of patient care, teaching and research and more. The technical staff of the smart hospital will have more time to provide good advice and to answer individual questions.

This change also affects patients, whose positive experience is at the heart of the smart hospital. Strengthening patients' personal competence, focusing on the cooperative interaction between doctors and patients from both directions, healing medically instead of industrially is what it is all about. On the patient side, it aims to reduce the conflict between the desire for safety and need for self-determination. This offers the opportunity for the general public to benefit more from high-end medicine. A new digital maturity is becoming conceivable and livable for patients in the smart hospital: more

self-responsibility, more transparency, more cybersecurity, and most of all more quality care within the context of patient outcome.

A smart hospital does not produce health. It generates honest, empathic, first-class and highly professional basic conditions for recovery, and as a partner of patients it individually designs their prevention plan and aftercare. This relationship between scalability and individualisation can only be achieved via digital transformation: an economically successful hospital with individualised top medicine can hardly be viewed otherwise. Dignity is not a marketable product, but without digitally transformed scarcity management and innovative medicine it is in constant institutional conflict with markets and competition.

Conclusions

The path to a smart hospital with more hospitality, a sense of wellbeing, trust and warmth for patients and staff with patient-centric attitudes can only be successful if the broad topic areas of the fundamentally connected ethical aspects are closely integrated into this massive change process. *Thus, what can (feasibility), want (emotions), and shall (ethics) we welcome?*

Hospitals of the future will successfully endure when the opportunities of digitalisation are closely oriented to patient needs and not economic success, which will anyway result from a successful reorganisation process.

Without ethical reflections, the above-mentioned stances of the Universitätsmedizin Essen regarding their own digital transformation are hardly justifiable. An economic bottleneck, legally secured, would not render digitalisation unworkable. But maybe in the sense of what has been outlined above: because in that context success can only mean success for patients and staff that on a purely economic-legal basis is harder to achieve and impossible to legitimise. Even though in this case the Universitätsmedizin Essen is not a profit-oriented but a state-owned organisation. Considering that the U.S. healthcare company Kaiser Permanente has annual sales in 2016 almost equal to the state of Luxembourg (Siegel 2016) and the German private hospital group Helios manages more than 30,000 beds, it indicates what direction the journey is headed in. It is remarkable, to define digitalisation also as, but not only or even primarily, a returns driver.

Critical ethical reflections on different dimensions of the smart hospital are important. Ethics must not come too late but should guide technological, legal and economical perspectives; the speed of technological development is, to some extent, breathtaking.

The smart hospital Ethics Ellipse has been initiated from the Management Board of the Universitätsmedizin Essen to develop scientific, clinical and industrial proposals and recommendations and to support the Universitätsmedizin Essen in further implementation of the smart hospital. Against the background of plausible expectation for a diversity of questions, sharing multiple perspectives seems appropriate (**Figure 2**). Cooperation will guarantee solid development of medicine, economy and ethics that, first and foremost, has one goal: to optimally address the needs of patients. ■

Figure 2. Case Smart Hospital Ethics Ellipse Essen (Germany)

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Healthcare demands are growing and evolving – so must we

Healthcare companies must evolve to help providers face the challenge of an ageing and growing population suffering from the increased incidence and diversity of chronic disease.

We are experiencing a paradigm shift in the demand and definition for value-based healthcare, and it is no secret that this has resulted from the daunting task that healthcare providers face—doing more with less resource. To deliver value today and in the future, it is of the utmost importance that healthcare companies are equipped to collaborate with health systems, helping them deliver the highest standard of care within evidence-based, cost-effective frameworks.

How value should be defined is the question on everyone's lips with value-based healthcare departing from the traditional fee-for-service approach. At Johnson & Johnson Medical Devices Companies (JJMDC), we believe this shift provides an opportunity to unite all clinical and non-clinical stakeholders, manage population health, and partner with hospitals to help improve outcomes, control costs, and enhance patient satisfaction.

Each hospital is unique and exhibits specific strengths and areas for improvements, which is why JJMDC offers CareAdvantage, a value-based, holistic approach to working with healthcare providers. Offering customised, co-created solutions that address challenges within multiple arenas, these solutions are built upon our belief that solving always starts with listening.

One example of this approach is the integration of CareAdvantage at the UK's Wrightington Hospital in 2017. This resulted in an overall improvement in surgical utilisation from 46% to 50% (equating to an average efficiency increase of 19.6 minutes). These savings could then be reinvested into expanding access to treatment. Results from this partnership were presented at International Society for Pharmacoeconomics and Outcomes Research (ISPOR) 2016.

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Collaboration and investment are essential to bring forth value-based care, but we know this cannot be limited solely to innovative digital technologies. JJMDC is therefore also evolving our most valuable asset—our people. This investment has increased internal training delivery by 80% in 2017 versus 2016, and a migration of our best and brightest means partners can access all our knowledge and expertise via CareAdvantage.

Other recent investments have included our October 2017 acquisition of Surgical Process Institute (SPI)—bringing innovative software solutions that minimise clinical variability in patient care—optimising patient outcomes and driving economic efficiency. The following month saw the launch of the J&J Institute, which brings together our professional education offerings within all our networks. All of these expand CareAdvantage value delivery with embedded training.

I am in no doubt that the definition of value-based healthcare will continue to evolve. However, to live up to today's definition, all healthcare companies must embrace a shared commitment to support the delivery of high-quality, sustainable healthcare now, and into the future. ■

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Distributing a life source in Africa

Lifebank has developed crucial infrastructure in Nigeria, enabling the efficient transportation and storage of blood, saving thousands of lives. HealthManagement editor Marianna Keen spoke to CEO and founder Temie Giwa-Tubosun about her journey.

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To what degree has the blood shortage in Nigeria been tackled so far, due to the work of LifeBank?
It's a very small degree to be perfectly honest. It's such an endemic problem that it would be such a difficult thing to say that we solved the problem in two years. We've saved about 4,000 people from dying. I don't think we've solved the problem significantly, but we're on our way to solving it. We have the determination that can solve it. And now we need to figure out the skills set in Nigeria, and get the investment we need to do that.

Have you reached your goal so far?
Absolutely. We set out to prove that you could build a business that is valuable, that solves this problem. We feel very confident that we've met our goals.

How does the LifeBank process work? How have you made use of innovative technology?
It starts with the people who have the blood—the blood banks. When they get to work in the morning, they list their products with us, so that gives us an inventory of how many units of blood are available in parts of our community. We have a map and database that has a list of all the blood that is available in the parts of our community—very simple. Then we deploy this information into the hands of the hospitals who need the blood. Whenever any hospital needs blood, they contact LifeBank, and we get them the blood they need. They can contact us, either via a phone call—we have a 24/7 call centre—or they can use our web app. It is a very simple app; it just requests certain things from the person requesting the blood. As from the beginning of March, hospitals are now also able to connect with us using an Unstructured Supplementary Service Data (USSD) platform. This USSD platform allows people who don't have an internet connection to still communicate with one another, using the mobile phone network. So hospitals and clinics can still make purchases using USSD.

After the hospital has made its order, we deliver the blood to the hospital in 45 minutes or less, and we maintain the condition of the products we move by using a WHO recommended cold chain. Our hospitals pay about 8 dollars for our services. Some hospitals pay a little more, and some hospitals pay a little bit less, but it averages out to about 8 dollars per unit of product.

How vital is LifeBank in providing an effective supply chain?
We're essentially a distribution company that distributes these products to the people who need it, in the right conditions and on time. The first thing we do is we connect blood banks to blood donors. People who are interested in becoming blood donors can register on a different app that we run, and it connects them to blood banks. Then, after blood banks have collected, stored and tested the blood, we connect them to the hospitals. So we are basically the conduit that was missing before, we connect everybody in this blood chain and make sure that patients, at the end of the day, get the blood they need.

In what other healthcare areas do you think technology, smart logistics, and big data can be applied to deliver a seamless health supply-chain system across Africa?
I think it could be very useful in various sectors of healthcare. I think this kind of distribution could be helpful with vaccines, organs, oxygen and medical samples. I think it could be really interesting with things like drugs and supplies, such as insulin, anti-venom, anti-rabies, basically anything that patients need and anything that hospitals generally don't like to stock in the hospital. I think our innovation can be absolutely useful for things like that.

> IF YOU WANT TO DISTRIBUTE ANYTHING ACROSS THE CONTINENT, OR IN ANY DEVELOPING COUNTRY, YOU BASICALLY HAVE TO CREATE YOUR OWN INFRASTRUCTURE

Will LifeBank branch out from the distribution of blood to organs and other essentials for hospitals?

We're already working on it! We are going to launch new operations in a few months. We want to move vaccines, organs and oxygen, and basically anything that hospitals need that they cannot find.

Is the goal for the LifeBank enterprise to be eventually deployed across Africa?

We would like to. Our big, ambitious goal is to be in every village and every last mile in Africa, and to be able to distribute these essential medical products to every single hospital on the continent. That's our big goal and we're working towards it.

Why do you believe social enterprises such as LifeBank are so important to healthcare in Nigeria and in other countries?

That's a very good question. I have a strong belief in businesses. I think businesses can help to solve unique and major problems in Africa, and in the developing world in general. I think the businesses that have a social niche can be absolutely the best way to solve a lot of these problems that we've been dealing with for so long. I think that having a business model ensures longevity. It allows you to continue solving this problem over time. It allows you to completely focus on the problem and deliver value to the people who need the value the most. And the reward you get for delivering value is money, and that money allows you to be sustainable, to sustain your ambition. I feel very strongly that businesses with social impact can be a significant way of solving an endemic and entrenched problem, especially problems around infrastructure, and that includes infrastructure within healthcare.

How have you and your team encouraged people to donate blood, and what methods will you use to continue to do so in the future?

I don't think we have actually encouraged people to do this, as I think people always wanted to give blood, but they just didn't know how. If you talk to most people in Nigeria, and you tell them how many people are dying in Nigeria every year because they have no blood, and you tell them they have the power to change that, I think most people are really interested to solve the problem. The problem in the past

has been giving them the right tools, the right places, so they can go and actually give the blood. I think that's what we've been able to do very well.

What are the biggest organisational and managerial challenges you have faced within LifeBank?

Building infrastructure in a community that has no infrastructure and no history of infrastructure. I think it's actually very difficult.

One story I found interesting was from Jeff Bezos, Amazon CEO. He recently spoke about when he started Amazon.com and said that when he got his first order, he just took it to his local post office and his local post office was able to get it to where it was needed. I just thought that was so fascinating. There's such a thing in Nigeria where if you want to open a bookshop, if you want to distribute blood, if you want to distribute anything—in fact it's the same across the continent and in any developing country—you basically have to create your own infrastructure, your own distribution system. When we launched, we originally wanted to be just an app, and not a distribution company or a logistics company, but we realised we just couldn't move away from a distribution and supply chain. And that's how we came to where we are. I think that's the biggest challenge. And if you know logistics, then you know it's actually quite difficult to build, especially on the African continent. One of the challenges we have is to find enough capital—capital that will allow us to grow in a way that is sustainable.

What is your leadership style and what advice do you have for other leaders and managers? Any advice specifically targeted at female leaders?

I think women lead differently to men. I think my style is more collegial. Although I'm trying to make it a little bit less so, just to have a good balance between structure and getting along. I think my leadership style is more collegial and not autocratic in any way. The good thing about that is that it allows employees to take responsibility. I'm not giving anyone orders, I give them responsibilities, and I hold them accountable for the responsibilities I give them. I think that's absolutely important, and an interesting way to lead, in preference to shouting or telling people exactly what to do. I think it's important to allow people to rise to the occasion, to give them additional responsibility, and to allow them to grow into the jobs they have. So that's been my big leadership style.

I think, generally, women tend to be like that, and I don't think there's anything wrong with that. I don't think women should emulate other people's, or the other gender's, leadership style. I think we should have our own way of leading, and I think we should understand that there are good parts about running a more collegial, more open and more diffused leadership system, instead of having it always top down where the CEO tells everybody what to do. I think sometimes we women feel like we have to learn and pretend to be men at work, but I don't think that's necessary. I think the world would be a better place and people would be treated very well and very kindly. I think the most important thing is that women should understand their own leadership style and make sure they are looking at their blind spots. If, let's say, you're very collegial, make sure that as you're being collegial, as you're allowing your staff to take responsibility for parts of the business, you also make sure you hold them responsible for those parts. And if you're more autocratic, then also ensure that you're creating a structure in which the people you're leading can also learn and grow in their jobs. I think you should own whatever leadership style you have.

What factors make LifeBank successful?

I think the biggest reason for that is that we had no money. When we launched, we launched literally with $35,000, and we made that last for two years. And because we had no money, everyone had to be super committed to the customers we had. We had to make sure that we were servicing them very well. We had to make sure we were focused on giving the best service we could to them. So that lack of money created a hyper focus on customer service, but also on excellence. We had to make sure that the little money we had went a long way. So that is what I think has made LifeBank so awesome—that hyper focus on our customers, and the fact that we are very excellent at discipline in terms of our operations.

How many people do you have working within LifeBank, and how many do you hope to expand this to?

We currently have about 22 staff, and in the next few years we're going to expand to about 50 people. ■

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Strategic product approval for health companies and regulators

Streamlining regulation for better healthcare outcomes

Rationalising product registration approval by health companies and government regulatory agencies to facilitate improved disease diagnosis and care of patients by healthcare practitioners.

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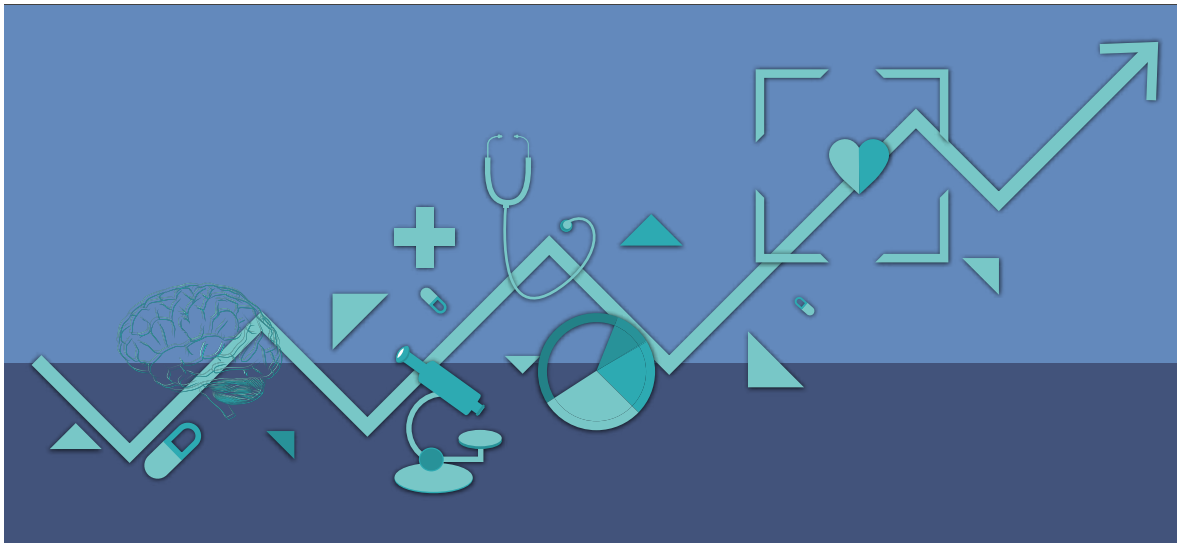

In every aspect of life, being strategic is very important. This is a common word used mainly by businesses with an underlying perception of the effect on their bottom line. Rarely do health companies focus on being strategic with their product registration in conjunction with the regulatory agencies. The reason? Each group generally believes the more products the better. My focus in this article is on how being strategic can be beneficial to health companies, regulators, healthcare practitioners/professionals and ultimately patients or consumers.

First, let us understand what exactly it means to be strategic. In simple terms, dictionaries define strategy as the art of planning and directing actions or policy designed to achieve a major or overall aim. One describes strategy as the art and science of planning and marshalling resources for their most efficient and effective use (Business Dictionary 2018). This is different from being tactical, which is a short-term action to move from one milestone to another in the direction of an overall goal. The focus here is strategic product development, registration and approval as a long-term exercise for the ultimate benefit of the patient or consumer.

What happened to health companies with specialty or specific focus health products? Why does one company think they have to satisfy several disease areas at the same time? Why do healthcare practitioners have to be burdened with the need to make informed treatment choices from so many varieties, mostly purporting to achieve similar patient benefits, when they should spend more time in accurate disease diagnosis for the patient? Health companies can better help healthcare professionals and ultimately the patient by being experts in key disease indication areas. A case in point is the study

of unmet needs in infectious disease management which shows that despite dramatic advances in diagnostic technologies, many patients with suspected infections receive empiric antimicrobial therapy rather than appropriate therapy dictated by the rapid identification of the infectious agent. The result is overuse of our small inventory of effective antimicrobials, whose numbers continue to dwindle due to increasing levels of antimicrobial resistance (Caliendo et al. 2013). Companies are able to dedicate more resources and time to addressing all the grey areas of a particular disease, finding curative and not necessarily only preventive or palliative treatments, or medicines for diseases that improve the quality of life of patients.

> “WHY DOES ONE COMPANY THINK THEY HAVE TO SATISFY SEVERAL DISEASE AREAS AT THE SAME TIME?”

Health regulators also have a major role to play in product registration approvals as applications are submitted by companies. They all have databases and while robustness may vary from one regulatory agency to another, the aim is the same: to track products being registered versus companies and disease indications. They should be able to create a ceiling in the registration of similar products by different companies, working with the individual countries’ government health statistics departments to determine population needs for such medicines. A good example of this is the National Agency for Food and Drug Administration and Control in Nigeria (Federal Government of Nigeria 2018). Working with healthcare professionals, it came up with a list of fourteen drug products for which the country already has more than enough capacity, leading to a ban on further importation by another government group, the Custom. This will encourage healthcare companies to research other disease areas, develop more effective medications, and help reduce the disease burden in the population. The regulators also benefit by appropriate redeployment of their material and human resources to other areas of their jobs that also impact the health of the population they serve, such as enforcement of registered details by these healthcare companies.

There are also a lot of benefits for the healthcare companies. One of these is brand rationalisation and optimisation. A quote aptly explains this: “Firms must invest in creating their own value systems rather than applying generic approaches implicitly derived from a non-applicable value system” (Opeyemi 2014). For companies who take the time to review their inventory list versus operating cost, they have discovered that they gain more competitive advantage with rationalised product inventory management focused on areas of strength and their business mission or vision. A number of books and case studies have been published by the *Harvard Business Review* on supply chain complexity management and how it affects all aspects of the company. This also helps companies create uncontested market space that makes the competition irrelevant.

The proverb that states “The sky is wide enough for all the birds to fly without running into one another’’ surmises the benefit of specificity. The health industry and regulatory agencies are encouraged to focus strategically on development and approval of disease- and patient-specific medications, to help reduce and proactively manage disease burdens in their countries. ■

KEY POINTS

- ✓ Strategic product development, registration and approval benefits the overall wellbeing of the patients
- ✓ Government agencies collaborating in regulating product approvals is beneficial to healthcare
- ✓ The impact of regulation on healthcare companies is positive

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Lessons for healthcare from emerging markets

Can the vision of emerging markets transfer to developed countries for better healthcare?

From the mobile banking revolution and use of healthcare drones in Africa to production-line surgery in India, emerging markets embrace tech innovation with speed and boldness that developed markets only dream of. The reasons are many including a lack of infrastructure and regulations, factors that lend themselves to finding solutions and thinking outside the box. Technology developed in regions like Europe and North America has spawned opportunities in healthcare around the globe. Now is it time for developed markets to learn from emerging markets? We asked three healthcare experts to reflect on the question: "Does production-line surgery have potential in developed healthcare markets?"

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"The development of what is called production-line surgery in countries where resources are very limited is of great interest, but production-line surgery has already been developing in wealthy countries too.

There has been a concerted effort to reduce duration of stay and then to make as many operations day case operations as is thought to be possible. This is called increasing productivity but it is important to remember that productivity is different from efficiency. Productivity is measured by relating the resources used to the outputs, for example numbers of operations or surgeon or operating theatres whereas efficiency relates outcome to resources, for example the percentage of people having an operation whose health improved significantly related to the resources used. This is obviously very important in every country because need and demand will increase faster than resources. However the key issue is now value. It does not make sense to carry out operations of low value even if they are carried out efficiently and productively. Doing the wrong things at less cost is not high value healthcare.

But what is high value surgery? Well that depends upon a number of factors and the population level. It depends on factors such as:

- How much resource is being used for surgery

> "PRODUCTION-LINE SURGERY HAS ALREADY BEEN DEVELOPING IN WEALTHY COUNTRIES TOO"

and could that resource be used better for medical treatment or prevention?

- Are the people who would benefit most from surgery being operated on or, even in a tax based system, are wealthier people having more operations than deprived sections of the population?

Some interventions where there is limited evidence of cost-effectiveness, for example shoulder, surgery and knee arthroscopy, have increased in wealthy countries in the last decade but this is not necessarily high value use of resources when the alternative use of resources is taken into account.

Even interventions where there is strong evidence of effectiveness, for example hip replacement, knee replacement and cataract surgery may start to yield a poor return in investment if numbers treated significantly increase and therefore if the operation is offered to people who are less severely affected. For such people the benefits of the operation are less than they are for people who are very severely affected, the type of people treated when the operation was introduced, but the probability and magnitude of harm is constant. Therefore the balance of benefit to harm is significantly different for people who are mildly affected compared to those who are severely affected.

This means that even hip replacement, the operation voted the number one operation in the 20th century, may not give good value to either individuals or populations if too many operations are carried out in a particular population."

"Emerging markets will be a catalyst for disrupting how surgical care is delivered more affordably in developed markets.

Hospital systems in India, like Narayana Healthcare, have already demonstrated the value of 'production-line surgery' to enable more surgeons to perform more surgeries more effectively. Their flagship hospital has over 5, 000 beds, sees thousands of patients a day, and performs over 30 cardiac procedures a day. They achieve this because of their team-based approach to surgical care, where top surgeons, recognising the practical limitations of an individual surgeon, have transitioned their role from 'super-hero' to 'team coach'. Focus is placed on team training, supply chain, and strategic partnerships with equipment and technology suppliers.

This production-line surgery approach is borne out of necessity, as there are simply too many underserved patients to take a traditional approach to surgical workflow and patient care. But greater volume doesn't necessarily mean lower quality results. On the contrary, procedure volume has enabled surgeons to become highly skilled and foster continuous improvement - Narayana's clinical outcomes rival and exceed some of the best hospitals in the U.S.

Other hospital groups in India like Apollo, Fortis, and Aarvind Eye Institute have similar models of high quality, affordable care driven by patient volume and creative business models. In a slightly

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> "TOP SURGEONS, RECOGNISING THE PRACTICAL LIMITATIONS OF AN INDIVIDUAL SURGEON, HAVE TRANSITIONED THEIR ROLE FROM 'SUPER-HERO' TO 'TEAM COACH'"

different model, Columbia Asia, a hospital group in Southeast Asia known as the 'McDonald's of hospitals', has optimised each of their 30 hospitals to be around 100 beds, following a manufacturing model of replicating an operation unit with amazing cost-efficiency.

Production-line surgery has the ability to democratise surgical care in developed markets such as United States or the EU. With ever increasing cost of surgical care without similar increases and clinical outcomes, a production-line surgery approach could have great benefit for high-volume procedures such as total knee replacement or cataract surgery. More complex surgical cases (ie oncology or neurosurgery) don't need production surgery in practice but the foundational philosophies of mentorship, team training, strategic partnerships, and data enabled decision-making will still provide great benefit to improving outcomes and patient satisfaction while reducing overall cost of care."

"Healthcare must be safe, good quality and good value for the money. In many ways the National Health Service (NHS) in England is relatively safe, good quality and, compared to many other western societies, it is very good value for the money. However, demand is increasing, people are living longer and longer and cost of providing good healthcare is increasing. So even the NHS has to find a way of reducing costs. This is where production-line surgery has huge potential.

The phrase production-line surgery itself is not accurate. What we are talking about is a large volume of elective surgical work done at a very low cost. This concept originated in Russia and has now taken over in India, for example, at the Narayana Heath and Aravind Eye Hospitals. Each day, nearly 700 cataract surgeries are completed at these facilities and well-trained, low-paid staff undertake most of the procedure. The surgeon executes only the most delicate aspect of the surgery. The safety and quality of care are maintained by excellent support for staff, good teamwork and regular feedback to personnel. IT is used to make sure procedures are done quickly and effectively and results are analysed regularly and shared with the team.

The volume of surgery means the hospital is able to negotiate the cost of consumable goods. This reduces the cost of procedures. Nearly 60 to 70 percent of NHS costs are salaries and if low-paid staff carry out most of the procedures safely, this would reduce personnel costs significantly.

Today, the NHS is finding it difficult to cope with increasing demand and during winter many elective surgeries are cancelled. The waiting lists are growing in various parts of the country and the demand is increasing. Cost of care will also increase.

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> "THE PHRASE PRODUCTION-LINE SURGERY ITSELF IS NOT ACCURATE. IT'S A LARGE VOLUME OF ELECTIVE SURGICAL WORK DONE AT LOW COST"

The NHS has to find alternative ways of reducing costs and increasing productivity without compromising quality and safety. This needs a team of good doctors, nurses, managers and other staff to work together and staff must be trained very well. The procedure should also be piloted in one or two elective hospitals. I have absolutely no doubt that this can save millions of which the NHS can invest in social care, community care, primary care, digital transformation and another areas where NHS desperately needs investment." ■

Alliar: Innovations for a country of continental dimensions

Alliar's innovative business model and IT systems mean that patients in remote locations have access to standardised, high-quality exams in any of its patient centres across Brazil.

Intro: Parauapebas

Parauapebas is a small town located in north Brazil, next to the Amazon rainforest. It sits 2,000 km away from São Paulo, the country's largest city and the headquarters for Alliar Médicos à Frente ("*Alliar Physicians Ahead*",) a leading Brazilian diagnostics imaging company. Despite the distance, Parauapebas' inhabitants are served daily by Brazil's top radiologists and MRI technicians. The concept is simple: patients are positioned on their local MRI by a nurse, the machine is remotely operated by specialised technicians, who are sitting in a command centre located across the country, and the images are uploaded to the cloud, allowing Alliar's radiologists to write their reports wherever they may be. The benefits are threefold:

1. patients in remote locations gain access to the country's best professionals
2. Alliar is able to offer standardised, high-quality exams in any of its patient centres; and
3. operating costs are reduced, as "command-centre" technicians are able to simultaneously operate as many as 3 MRI machines.

This unique model—the world's first of its kind—came to life as a result of a daily challenge faced by Alliar: to provide quality diagnostics in a country of continental dimensions.

Business model

Alliar was formed in 2011, with the merger of four regional leaders in diagnostic imaging. Backed by a local private equity fund, the company set out to build a nationwide presence by acquiring local, radiologist-owned companies in key cities. The founders of the acquired companies became Alliar shareholders and were kept in charge of daily operations, while their brands were leveraged to open new patient centres in nearby cities. During this initial cycle, which concluded by early 2014, Alliar completed 20 acquisitions throughout Brazil, an intense phase of mergers, acquisitions and integration with a focus on building up a robust IT platform and capturing the low-hanging synergies. At the end of this cycle, despite being very robust, Alliar's imaging-focused, geographically-decentralised model lacked the capability to fully capture all potential synergies.

From mid-2014 until the end of 2017 the company went through its second cycle, which shifted focus towards a fully integrated, cloud-based IT platform. During this cycle, the company also implemented several managerial tools, such as zero-based budgeting, lean manufacturing and balanced scorecard. Relevant synergies were captured from the centralisation of 12 call centres (previously located in different cities) into just one contact centre and from economies of scale, mainly in procurement, maintenance and personnel costs.

At this point the full potential of the business model became evident. By combining centralised processes and a strong local presence, supervised by each company's founders, Alliar was able to offer the friendly and warm services of small business, while delivering the financials expected of a large company.

Technology as an enabler

To successfully run more than 120 patient centres spread throughout Brazil, Alliar relies heavily on information technology. In spite of having conducted 25 acquisitions, there is no legacy—all the company's centres run on four commercial-based systems: a cloud-based RIS (radiological information system), a single PACS (picture archiving and communication system), a nationwide ERP (enterprise resource

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Alliar provides diagnostic imaging to public hospitals in the State of Bahia in a public-private partnership

Operational data control panel at Alliar HQ

planning system) and a contact-centre system. Technology has been ingrained into the company's DNA since day one—operating under a fully integrated IT platform is what has allowed Alliar to develop innovative approaches to common industry problems.

MRI remote command centre

By 2013, due to the lack of expert technicians, it was not possible to run specific protocols in all of our sites during all commercial hours. For instance, if a patient with a heart condition contacted the Parauapebas service centre for a heart MRI, availability was limited to the timeslots in which an expert technician was on site to run the exam. After implementation of the remote command centre, Alliar is able to offer any

> "PATIENTS IN REMOTE LOCATIONS GAIN ACCESS TO THE COUNTRY'S BEST PROFESSIONALS"

type of exam anywhere, anytime. An interesting side benefit is the cost savings derived from the project. Modern MRIs are able to run by themselves most of the time, just like an aeroplane flying on autopilot. For that reason, Alliar's expert technicians operate up to three MRIs simultaneously, reducing the number of required technicians. Finally, with the command centre the quality of the exams has increased to a point where the number of times a patient has to come back to redo an exam has decreased more than 50%. As of today, Alliar remotely operates more than 120 MRIs and is starting to implement the same model for its CT scans.

Contact centre

On a regular day, Alliar receives more than 30,000 contacts through different platforms (phone, web or mobile app). This is the beginning of the patient's journey, as the contact centre agent has to match the patient's desired schedule with the availability of

the chosen service centres. With all contacts going through a centralised operation, Alliar employs a sophisticated algorithm to maximise the capacity utilisation of its machines. Such a platform is also evolving to use AI/ machine learning to enhance the patient's experience. The company expects to reduce by 50% the interaction time between patients and agents, drastically reducing errors and costs, while also improving its net promoter score.

Patient experience

AI and algorithms are also being used at the reception and production areas of Alliar's service centres, leading to less waiting time for patients. Real-time tracking allows the São Paulo-based management team to monitor what is happening in each and every patient centre. From how long a certain patient is waiting, to the net promoter score attributed by someone who has just concluded their exams, no information is overlooked. At the company's headquarters, large flat screen TVs display operational data, going as far as highlighting whether specific doctors or health plan operators are requesting fewer or more exams than expected.

Serving the less privileged

Brazil's public healthcare sector assists individuals who do not have access to private services. It covers 75% of the population but runs on a budget roughly the same size as the private sector's. In partnership with the government of the State of Bahia (north-east region), Alliar has established the country's first public-private partnership (PPP) focused on diagnostic imaging. Under the PPP agreement, worth over US$300 million, Alliar is responsible for upgrading facilities, installing new equipment and running the diagnostic imaging centres of 11 public hospitals over a period of 11.5 years. When compared to the previous state-run centres, the PPP delivers more exams, with incomparable quality and at a lower cost to the taxpayers. This successful partnership is the subject of a 2016 case study by the World Bank's International Finance Corporation (2016), and demonstrates that technology-based, for-profit healthcare companies can have a profound impact on the life of underprivileged citizens.

New possibilities

As it further develops the command centre technology for MRI and CT scans, Alliar continues to push the boundaries of its business. The company has just started a new division focused on remotely operating machines for third-party companies. This service is geared towards hospitals and smaller patient centres, where idle equipment makes it expensive to employ full-time technicians. The offering also includes outsourcing of the exams' reports to Alliar radiologists and their storage on the company's cloud platform. By subcontracting core activities, clients are effectively engaging in a new kind of business: imaging lab-to-lab. If this is indeed the future, you could soon find an Alliar-operated MRI close to your home—wherever you may live.

2018 onwards: Alliar's third cycle

By leveraging the full potential of its IT systems, Alliar has been able to gain scale, improve productivity and reduce costs, becoming competitive not only in the private market but also in the underserved public sector. Glancing to the future, with heavy usage of AI, the company sees interesting opportunities, such as its command centre being further automated (technicians only overseeing the quality of the exams), agents at the contact centre no longer talking to patients (unless specific situations occur), and medical doctors concentrating their effort on further understanding rare diseases, leaving routine cases to the machines' AI. Altogether, these initiatives should keep Alliar on the leading edge, making Brazil's diagnostics imaging sector as innovative as any other in the world. ■

KEY POINTS

- ✓ Alliar is a leading Brazilian diagnostics imaging company
- ✓ Alliar offers standardised, high-quality exams in its patient centres across Brazil, with innovative use of technology and increasing use of AI and algorithms
- ✓ Alliar remotely operates more than 120 MRIs and is starting to implement the same model for its CT scans
- ✓ Alliar has established Brazil's first public-private partnership to provide diagnostic imaging in 11 public hospitals in the State of Bahia

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Financing micro health insurance

Theory, methods and evidence

A look at innovations in harnessing voluntary and contributory micro health insurance to finance universal health coverage in the informal sector.

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Everybody spends money on healthcare; some people pay negligible amounts, and others pay exorbitant and impoverishing sums. In a perfect world, everyone should have protection against the excessive costs, and this is what health insurance (HI) can do. However, accomplishing this goal is a tall order, financially and administratively. The more extensive the HI coverage, the higher the challenge to succeed, particularly when the HI should ideally cover the entire population.

Providing meaningful HI coverage to the entire population is possible only when the benefits package can compensate all needs. As the insured population increases, its requirements become more variable and complex. A broad "birth-to-death" standard benefits package may perhaps cover all needs (at high cost), or it may even go further and include benefits that most insured persons would never enjoy. So, we assume that the majority of the world population would consider such a package simultaneously unaffordable and unattractive, notably because its premium would tally with data of frequency and severity of risks that do not apply in most locations. This issue can plague any scheme—government-run or private. Most plans in low- and middle-income countries (LMIC) face this paradigm, obliging them to consider partial benefits packages.

People in low-income and informal settings

However, designing partial packages raises the essential questions of what to include and what to keep out, which data to use for pricing, and who

should take those decisions. For most people in low-income and informal settings (small-scale, self-employed activities, typically unrecorded, unregistered and conducted without proper recognition from the authorities), the answer is clear: have a say on what you pay. In fact, they want extensive discussions among family, friends and peers, ie the people most involved in household spending decisions. They want to be reasonably sure that the money spent will generate some welfare gains. However, welfare gains can be assessed only retrospectively at the end of the period of insurance, whereas the premium must be paid at the beginning of the period, prospectively. So, decisions cannot emerge from actual results, but from a discussion of transactional aspects, such as: can they trust the insurance agency? Can they trust the process to be transparent and fair? Such confidence building conversations must take place before attempting to sell insurance in the informal sector. They include explanations of the business process of insurance, agreement within the target group on an estimate of willingness-to-pay (WTP), and preparing for an assessment of risks to be protected by conducting the baseline study. Unfortunately, these essential discussions are often sidestepped, presumably to save time and money. These shortcuts have led to low insurance uptake in the informal sector.

The usual order of things to achieve high enrolments is first to develop context-relevant innovative health benefits packages, preceded by the preparatory steps mentioned. Since the poor seek welfare gains through affiliation with family, friends, and others in their reference group, confidence-building steps should occur in that context. The name given to the local context is "community-based health insurance" (CBHI) or "micro health insurance."

Micro health insurance

This brief introduction explains why micro HI is not merely a characteristic of the product (cheap insurance with low-risk cover) or the target clientele (poor people) but a different business model of protection in which the locus of decisions is at the "micro" stratum of society, namely local communities. Placing decisions at the micro level will bring the message of HI to where the majority of the population in most LMICs lives and works. The actors in the microinsurance space need to agree to this sequence of actions, since large sections of the community in rural and informal settings are not familiar with HI, and are unlikely to buy an unknown product from an unknown agent. Following the course of action described here would be a useful strategy to reach the majority, without reliance on LMIC governments requiring individuals to enrol ("mandating") or subsidising premiums, or providing universal HI.

> "SUCCESS IN CATALYSING DEMAND FOR HI IN THE INFORMAL SECTOR DEPENDS ON ENCOURAGING GROUP DIALOGUE"

Three core issues to address

Against this backdrop, my book, *Financing micro health insurance: theory, methods, and evidence*, addresses three core issues about financing voluntary and contributory HI for resource-poor and rural groups in LMICs. First, the underlying rationale for engaging in insurance literacy is to catalyse demand for voluntary and contributory HI among illiterate and innumerate persons. Secondly, it is important to render the business process of insurance simple so that local communities can learn it and own it (ie launch, administer and govern the scheme after receiving appropriate training). The actions to achieve this involve developing simplified methods for risk assessment to price and underwrite hazards, set up the administrative tasks and ensure proper governance of the micro HI schemes. The third issue involves formulating a compelling business case of affordable-, financially sustainable- and operationally-scalable micro HI. This book coherently compiles research outcomes of studies conducted by the author in collaboration with others (health economists, development economists, actuaries, medical professionals, mathematical modellers, and social scientists) to provide a comprehensive perspective on the development and implementation of health microinsurance.

Defining conditions that catalyse demand

A review of the demand for micro HI suggests that conventional economic theory does not adequately explain financial behaviour in the informal sector and

the context of poverty and informality. Thus a new approach is needed to define the conditions that catalyse demand for HI in the informal sector (Dror and Firth 2014). The alternative theory of demand proposed is based on relevant and workable assumptions of the role of groups in financial decisions in the informal sector. It also considers the influence of local governance arrangements on enhancing trust in the system, which is a necessary—but not sufficient—condition for the establishment of an HI market. An empirical follow-up study does not uphold the null hypothesis that demand is an individual decision. It examines factors which catalyse demand for community-based micro HI schemes and confirms the assumption that success in catalysing demand for HI in the informal sector depends on encouraging group dialogue (Dror et al. 2018).

> “DESIGNING PARTIAL PACKAGES RAISES THE QUESTIONS OF WHAT TO INCLUDE, WHICH DATA TO USE FOR PRICING, AND WHO SHOULD TAKE THOSE DECISIONS”

A systematic review and meta-analysis of the literature on factors affecting uptake of CBHI in LMICs included 18 qualitative studies (Dror et al. 2016a). The systematic review identified nine significant factors as enablers for uptake: knowledge and understanding of insurance principles and CBHI, quality of healthcare, trust, benefits package, CBHI scheme rules, cultural beliefs, affordability, distance to health facility, and legal and policy framework.

The socioeconomic status of households, education, age, and female household heads also affect enrolment positively. There is empirical evidence that awareness campaigns conducted for CBHI members enhance understanding of HI among the target population.

The evidence also suggests that CBHI encourages both early healthcare seeking (Dror et al. 2005) and a higher practice of preventive healthcare measures (Panda et al. 2015a). The authors verified that the increased utilisation by the insured was not due to adverse selection.

Willingness to pay

After establishing the micro HI framework, community members discuss the benefits package with premiums and choose the package that best captures their priorities and willingness to pay (WTP) level. By definition WTP is the maximum amount people are willing to spend to acquire a service. A review of 20 papers describing 14 experimental field studies on eliciting WTP for health insurance among low-income persons in developing countries concluded that there was no “gold standard” method to quantify the expected WTP in different settings (Dror and Koren 2012). The most common practice was conducting household surveys to elicit information. However, these surveys are expensive and time-consuming, so naturally, there is an interest to find faster and cheaper alternative ways to estimate WTP. Binnendijk et al. (2013) suggested that it is possible to determine the WTP level based on each community’s food expenditures (based on Engel’s law), with a reasonable approximation of WTP in the studied locations at around 4.5 percent of food expenditures. Nosratnejad et al. (2016) proposed determining WTP as a percentage of GDP per capita (GDPPC). GDPPC is readily available in most countries. WTP for HI among rural households in LMICs was just below 2 percent of the GDPPC per household per year.

The business case for micro health insurance

Another methodological issue has been to estimate the frequency of risks by studying healthcare utilisation (as a proxy for morbidity). Binnendijk et al. (2012) proposed a quick and cheap intervention to estimate morbidity and healthcare utilisation locally, known as “illness mapping.”

Since affordability is a crucial factor in catalysing demand for microinsurance, medical and health insurance (MHI) units persistently face the challenge of keeping premiums low enough to be perceived as affordable by the target population, yet high enough to ensure sufficient income to keep the micro insurance unit (MIU) solvent. Dror et al. (2018a) devised a prototype scheme, based on empirical data collected from two CBHI plans, to evaluate the Business Case for micro HI. The business model examined required the MHI plan to be able to maintain all its payments (administration, claims and loan repayments) at 99.9 percent confidence. The additional condition examined was that the medical health insurer (MHI) would pay interest rates on commercial loans taken to fill its

capital requirements. The study demonstrated that MHIs could repay loans with commercially competitive interest. Considering that the MHIs could meet investors' legitimate expectations (loan repayment with interest) and members' interests (full payment of their claims every year and growth of their organisation's capital assets), the authors conclude that there is a compelling business case for operating voluntary and contributory micro HI. Governments could encourage the outreach of micro HI by creating an enabling regulatory framework allowing MHIs to borrow funds.

Impact of microinsurance on welfare gains

Various studies have delved into the positive impact of microinsurance on welfare gains of the insured households. Dror et al. (2016) demonstrated that the studied MHI schemes improved insured households' access to healthcare (by reducing self-medication); enhanced financial protection (reduced hardship financing and increased economic mobility); and improved equality of access between richer and poorer households. These indicators of impact after only two years of operation would presumably be better after a more extended period of being insured.

The possibility of microinsurance being financially sustainable and operationally scalable without subsidies infuses new investment opportunities, which have yet to be explored. In 1963 Kenneth Arrow (1963) recognised that

> *the loss due to illness is only partially the cost of medical care. It also consists of discomfort and loss of productive time during the illness, and, in more serious cases, death or prolonged deprivation of normal function. From the point of view of the welfare economics of uncertainty, both losses are risks against which individuals would like to insure. The nonexistence of suitable insurance policies for either risk implies a loss of welfare.*

Decades later, governments of LMICs are formally committed to promoting universal health coverage. However, actual health coverage is very far from satisfactory. The declared intention of governments is to reach their objective by using a blend of tools for healthcare financing, notably microinsurance schemes. The conditions whereby insurance providers would both compensate for welfare loss and add welfare gains to the insured that do not claim anything from their HI is a distant dream. This book provides policy guidelines to harness micro HI in the effort to finance universal health coverage. ■

KEY POINTS

- ✓ Insurance literacy is the key impetus to catalysing demand among poor communities
- ✓ Active involvement of community members in the business processes fosters acceptance of insurance, trust in the scheme and higher willingness to pay
- ✓ Microinsurance has the potential to be financially sustainable and operationally scalable without subsidies or government mandating

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Integrated, risk-based care for South Africa

Intercare Group focuses on value and innovation

Primary care and wellness centres, dedicated units for sub-acute care and rehabilitation, as well as ambulatory day surgery centres, are key components of the Intercare Group's healthcare model in South Africa.

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The patient-centred organisation structures its services around the health status and needs of a patient and not merely the traditional levels of care. It represents a transition from the outdated traditional hospi- and provider-centric model, offering consumers accessibility and convenience through the location of their facilities, extended operating hours, high-quality clinical care, and reduced costs amid an escalating disease burden. The Intercare Group is an example of what is possible when one is profoundly committed to change and willing to invest, collaborate and partner to make that change a reality.

Achieving value in healthcare

When it comes to the question of value in healthcare, for us it's about achieving the best outcomes at the lowest cost. We focus on outcomes that matter to patients, and I think our focus on integration and the consumer has assisted us in realising this vision. We combine the very best healthcare professionals with state-of-the-art facilities and equipment to deliver high-quality clinical care and maximise the experience of our patients. We have made value an overarching strategy for the Intercare Group, which informs everything we do. From its inception 16 years ago, the business has been built in a stepwise fashion, consistently building upon and expanding our services and expertise in a conscious journey towards becoming a value-based healthcare organisation.

Making healthcare accessible on a primary care level

Traditional primary care practices in South Africa are often stand-alone, with few associated services or attractions for patients. In addition, they generally only house general practitioners and a patient needs to travel to several different locations to access other healthcare services, whether this is pathology, radiology, pharmacy or other medical providers. Another characteristic is relatively limited operating hours, with practices often being closed over weekends or public holidays. This was largely symbolic of the doctor-centric nature of the healthcare system.

From the outset, we recognised that accessibility and convenience were important for patients and was something that we needed to place at the centre of our care delivery model. We achieved this in a number of ways. A report from PriceWaterhouseCoopers in 1999 highlighted that consumers want healthcare in retail spaces. We adopted this approach and our first medical centre was situated in a shopping centre, associated with a large retail pharmacy. Property owners and developers were initially resistant to the idea, because they didn't understand the value of healthcare being based in these areas. However, creating the right partnerships helped us through this and once they understood the model, they began to actively seek out our medical centres to form anchors in their retail environment.

In addition to its physical positioning, we implemented extended operating times, including being open on weekends and public holidays. We also wanted to reduce the physical fragmentation in the location of medical services and brought a multitude of primary care services under one roof in a multi-disciplinary medical home. In our centres, patients can access general practitioners, dentists, radiology, pathology, physiotherapists, psychologists, dieticians, optometrists, audiologists and also a pharmacy.

More recently, we have made significant investments in optimising how our patients can access our services, developing online booking capabilities and setting up a call centre dedicated to making bookings and coordinating the care of our patients. Currently, telemedicine and out-of-facility care are forming major parts of our strategy.

Comprehensive, risk-based care delivery models

Any population can be classified into four general categories based on their health status and as such be represented on a pyramid. The majority of individuals, forming the base of the pyramid, will be healthy, with only episodic health events such as infections or injury. The next level is those who are at risk of developing chronic diseases due to certain risk factors, usually related to lifestyle. Further up the pyramid are patients who are living with one or more chronic disease, but who are relatively well. The tip of the pyramid is composed of individuals who are really struggling with their health, usually suffering from multiple illnesses and who have to interact frequently with the healthcare system due to complications of their conditions. The top two tiers in this pyramid make up only 10-15% of the population, but account for around 50% of the total healthcare spend.

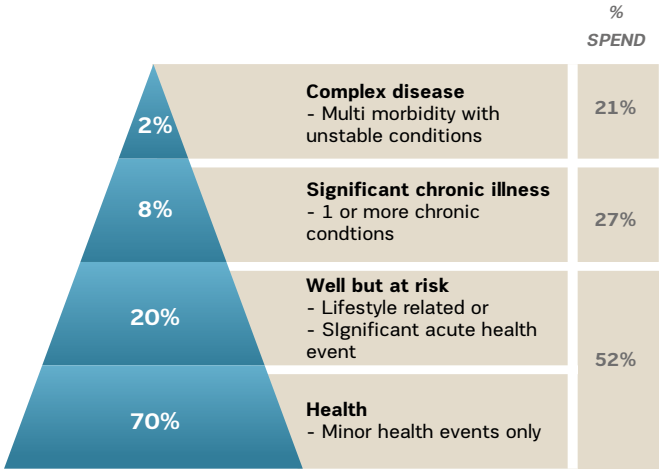
Traditionally, healthcare systems and organisations structure their offering around levels of care, but the Intercare Group model is based on providing care to patients according to their health needs, in terms of where they are in the health continuum. This is why we consider our primary care and day hospitals to be on the same level, as they care for patients that are mostly well with only episodic healthcare needs. Our sub-acute and rehabilitation hospitals and primary care centres are positioned on the higher level, as they both deal with chronically ill patients with complex and ongoing medical needs.

The overall aim however, irrespective of the facility type, is to prevent individuals from moving up the pyramid, and to try and bring those more ill patients down a level.

Servicing the base of the pyramid - Wellness, primary care and day hospitals

Our primary care centres place a significant emphasis on preventative services through, for example, the promotion of appropriate vaccination programmes and the provision of lifestyle advice. They also focus a huge amount of their attention on screening and early detection, including cervical, breast and prostate cancer, HIV and diabetes, hypertension and dyslipidaemia. Indeed, Intercare outperforms the national average for almost 90% of the primary care screening and prevention metrics used in the country.

We also work very closely with Discovery Vitality, an incentive-based behaviour modification programme aimed at making people healthier. Here we partner with



Source: DHMS

Health profile segmentation

them to develop and operate Wellness Centres, which are able to offer comprehensive screening and prevention benefits to their members under one roof.

The ultimate aim of our work in this space is to ensure that individuals do not move up the health pyramid by addressing risk factors and preventing the development of chronic conditions.

Day hospitals represent a cost-effective alternative to surgery conducted in acute settings. The proportion of eligible surgeries performed as same-day cases in South Africa is very low, sometimes two to three times lower than in other countries. We realised early on that entering this market was aligned with our strategy of reducing costs while maintaining quality, as well as structuring our care delivery model as an outpatient based one.

Supporting patients with complex needs

The rising burden of chronic diseases together with ageing populations are resulting in a significant increase in the number of patients with multiple comorbidities and complications. The current healthcare system with its fragmented, fee-for-service model is unable to deliver the care these patients need, in the way that they need them.

We believe that with the right approach, many of these patients can still be effectively managed at a primary care level, and we do so through several programmes with leading health insurers. I think that our success has been through our creation and use of Integrated Practice Units, which are multi-disciplinary, co-located and focused teams of healthcare professionals. In this way, we have achieved much success in reducing ER visits, unnecessary out-of-hospital specialist visits and preventable hospital admissions.

Our sub-acute and rehabilitation hospitals also focus on patients with complex medical needs. These include

patients who have suffered strokes or other forms of brain injury, spinal cord injuries, severe motor vehicle accidents or require post-operative rehabilitation to help ensure maximum restoration of mobility and quality of life. In order to achieve this, we have set up multi-disciplinary teams typically composed of a general practitioner, nurse, case manager, physiotherapist, speech therapist, occupational therapist, psychologist, dietician and importantly, a social worker. These professionals come together frequently as a team to discuss each case, and also conduct meetings with the patient's family or caregivers. They also work very closely with the health insurer and are integrated in terms of data exchange between the two. Intercare was the first group to develop a programme with Discovery Health on utilising this model of care to reduce admissions following discharge. Readmissions were reduced by 33% and preventable admissions by 50%.

Ensuring high-quality clinical care

Clinical quality and outcomes are obviously key elements of value in healthcare and it has always been important to us to ensure that these elements are of the highest possible standard. We have achieved this in several ways.

Before founding the group and opening our first medical centre in 2002, I was Chief Executive Officer of the South African Medical Association for over a decade. This gave me insight into the standards and quality of primary care in South Africa, and allowed me to select and approach the doctors that I knew were top-class. Since then we have continued to carefully select the healthcare professionals we wish to bring into our operations.

We also believe that passion and expertise are a powerful combination and usually produce the best outcomes and quality of care. As such, we invest in programmes to upskill our doctors and nurses in a field of their interest to create "primary care specialists". Not only do we see improved outcomes with such an approach, but these practitioners usually deliver care at a lower cost, as well as with more confidence and awareness of evidence-based guidelines. They tend to order fewer tests, refer less and prescribe the optimal medical interventions the first time. We have run very successful disease management programmes on this basis, including for major depression and diabetes mellitus.

Internal peer review is also important and we are introducing such a model within the group. Each one of our medical practices has one of their own doctors trained as a peer reviewer, and they in turn work with a higher level review committee in the group to assess and improve their quality and cost profiling. The practice level peer-reviewers then take back the recommendations and actions to their fellow doctors in the practice. We also work very closely with several large health insurers in South Africa on profiling programmes and pay-for-performance remuneration structures.

Achieving integration

Because of the breadth of the group's service offering, including primary care centres and two types of hospitals, and the number of different types of medical services housed within them, we ran the risk of just replicating the fragmentation seen in the South African healthcare system in general. We needed to find ways of bringing them together for the benefit of our patients and the health insurers and large corporates which we serve.

In response to this, we decided to create a separate entity within the group, called Intercare Salubrity. Intercare Salubrity is a risk management company and helps

to aggregate demand by insurers, wellness companies and corporates for providers, and to aggregate supply by consolidating the offerings of multiple different facilities and professionals for those requiring healthcare services. Importantly, the care delivered within this system is fully coordinated, essentially presenting a single integrated healthcare system in which patients can have their health managed.

Salubrity also helps to coordinate and integrate patient care and flow between our facilities. For example, many of the patients admitted to our sub-acute and rehabilitation facilities post stroke have uncontrolled chronic conditions such as hypertension and diabetes. Following the completion of their rehabilitation programme, these patients are discharged from the sub-acute hospital into disease management programmes operated in our primary care centres. This helps to ensure their primary conditions are better managed and helps to prevent readmissions.

Leading doctors through the turmoil

In our business review, we came across a quote from Toby Cosgrove, then CEO of Cleveland Clinic. He said: "To help physicians move beyond grief and anger about what they might be losing as the healthcare system remodels, leaders must shift the conversation to something different—something positive, noble and important" (quoted in Moriates et al. 2015).

We have found that the challenge is not to convince doctors of the principle of fixing healthcare, but rather to get them comfortable with the uncertainties in a system that is still figuring itself out. Future expectations of health insurers, patients and reimbursement generate the most concern.

It is about changing the message from one about challenges and shortcomings (poor quality and rising costs) to one of opportunities (better outcomes and reimbursement that rewards good care over volumes).

Intercare has worked hard in this space, constantly engaging with clinical leadership within the organisation and doctors on the ground and is now setting up various structures to support doctors in buying in to the required changes.

Strategic collaboration and partnerships

Strategic partnerships are very important in breaking down the siloed structure of the healthcare system sometimes characterised by defensive self-interest, mistrust and a scarcity mentality. One of the most strained relationships traditionally has been between providers and health insurers. Intercare has largely led the way in changing how healthcare providers interact and work with insurers in South Africa. Anuschka Coovadia, head of healthcare for Africa at KPMG said at Davos in 2015: "Innovative provider-payer partnerships are emerging on our healthcare landscape. These new models are built on the fundamental principles of providing the right care, at the right cost, to the right patient in the right environment." She said an excellent example of this is the partnership between Intercare and the leading health insurer in South Africa, Discovery Health. Intercare and Discovery have co-designed, implemented and managed several successful healthcare programmes, which have benefited both provider and insurer but most importantly, the patient.

Often, strategic partnerships are also valuable in facilitating integration and aligning incentives. Intercare also works with leading providers in other areas of our healthcare industry, including pathology, imaging, pharmacy, pharmaceuticals and medical technology, to set up programmes and systems which are able to deliver true value for patients.

Future of healthcare

I think most readers will be familiar with the future trends in healthcare – consumerisation, decentralisation, digitisation, AI, and increased focus and accountability for value and so on. We believe that the future is here, but not here entirely. We are operating in an interesting and challenging, intermediary state, an ice cube that is standing in a puddle of its own water, neither completely ice nor completely water. It is a challenging time, as the demands of the new system pull at the structures and capacities of the old.

The lightbulb was an incredible technological advancement, but its impact would have been dependant on widespread electrical supply to all households. In the healthcare space artificial intelligence and various technologies will only realise their full potential when mindsets, data systems, funding models and legislation allow them too.

As a group, we are standing up and taking on the challenge of being a leader in this change, despite the difficulties that it presents and the investments which are often required. ■

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Managed equipment services can be boon for emerging market health

Solving the waste issue of unused equipment in African hospitals

Managed Equipment Services (MES) is an innovative way of tackling the problem of wasted medical equipment stock in sub-Saharan Africa.

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In healthcare, the private sector is increasingly working with governments to address the needs of health systems. This collaboration can take many different forms, from simple public sector outsourcing of services to the private sector to more complex Public Private Partnerships (PPP) that can be used to build major health infrastructure, as has been done in Turkey for example. Public private collaborations can take many forms. An interesting model becoming more popular is Managed Equipment Services (MES), where manufacturers of medical equipment (private sector) bring 'total equipment solutions' to their clients.

With MES, the manufacturers don't just sell the equipment, they also agree to service it by concluding multi-year contracts that bind them to uphold service and performance standards and to train hospital staff to use and maintain the equipment. They may also put in place an IT system that monitors how the equipment is being used which, over time, will result in better planning for equipment purchases. When constructed correctly, the MES company agrees to share the risk with their customer, the health service provider.

At present, manufacturers of medical equipment tend to come from advanced economies in Asia, Europe, and the United States. Given the high levels of R&D and capital expenditure involved in this line of business, they mostly are large, well-established companies. Global leaders, amongst others, include Philips (Netherlands), Siemens (Germany), General Electric (USA), Toshiba (Japan), Varian (USA), and Althea (UK). Increasingly we are seeing affordable equipment also being developed and sold by innovative companies from emerging markets such

as India (eg Esteem) and China (eg Mindray) that are competing both on price and quality.

Unfortunately, a lot of medical equipment in public hospitals in emerging markets sits idle —as much as 70 percent in sub-Saharan Africa, according to one WHO estimate—due to inappropriate procurement, lack of training on how to use the equipment, lack of maintenance, or failure to repair.

Imagine a scenario, for example, where a hospital, in a major upgrade of diagnostics equipment, spends about a million dollars on the newest, most hi-tech Magnetic Resonance Imaging (MRI) machine. After installing, the MRI works well...for about a month...at which point it breaks down. The hospital management then discovers that no staff member has the technical skills to repair it and/or the hospital lacks the proper spare parts to do so. They contact the manufacturer, which eventually agrees to dispatch a technician, who is usually based in a different country or continent, to inspect and make the necessary repairs.

> "WITH MES, THE MANUFACTURERS DON'T JUST SELL EQUIPMENT, THEY ALSO AGREE TO SERVICE AND TRAIN HOSPITAL STAFF TO USE AND MAINTAIN IT"

The whole process takes a long time, and involves a lot of back-and-forth to confirm the terms and conditions of the repair job. For example, the spare part may need to be imported from afar. Meanwhile, no MRIs can be performed. Both provider and patient lose out in this scenario.

For developing economies, it may be more cost efficient to conclude MES contracts instead of making singular purchases. The MES procurement model offers the potential to have a positive impact in under-resourced settings. For example, MES can lead to better planning through a heightened focus on ordering equipment that meets a population's actual healthcare needs and ensuring there is an adequate supply of trained medical personnel to use the equipment. MES thus offers the potential to make cost savings by having agreed protocols for maintenance and repairs.

In emerging markets, Kenya is an interesting test case for MES worth watching. As part of Kenya's comprehensive overhaul of its public healthcare system, the government contracted with GE Healthcare (radiology), Philips (ICU), Mindray (theatre equipment), Esteem (surgical theatre central services), and Bellco (dialysis) to modernise hospital equipment, including in intensive care, renal, and radiology units. The overhaul encompassed 98 public facilities spread across Kenya's 47 counties. To eliminate the costs that middlemen sales agents can add, the government contracted directly with the original manufacturers of the equipment both to supply the equipment and for servicing and training requirements.

IFC, the arm of the World Bank that advises and invests in the private sectors of emerging markets, has a $2.1 billion active portfolio in healthcare, a mix of debt and equity dispersed through more than 100 projects around the world. In all this work we take a health systems perspective and strive to support projects that maximise outcomes while minimising costs for the system. We believe that when planned correctly, MES can be an effective method to deliver high quality, cutting-edge equipment to emerging market hospitals in a more cost-efficient way.

As with most such private sector solutions in healthcare, the real challenge is integrating them with what is a much more complex overall health system of people, processes, and information. This requires a strong planning and oversight function. As demand for healthcare in emerging markets grows rapidly, MES will be part of the menu of private sector solutions available to governments that, hopefully, will raise the bar in terms of the quality, affordability, and accessibility of healthcare.■

KEY POINTS

- ✓ In healthcare, the private and public sectors are increasingly working together.
- ✓ In the MES model, manufacturers of medical equipment provide total equipment solutions to their clients
- ✓ Up to 70 percent of hospital equipment in sub-Saharan Africa stands idle
- ✓ For developing economies MES contracts are more cost efficient than single purchases
- ✓ MES can be an effective, cost-efficient method of delivering high-quality, cutting-edge equipment to emerging markets

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Africa leading way in healthcare tech

The continent is ahead of the game in cutting-edge drone use

The African healthcare context is uniquely placed to adopt and benefit from drone technology.

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In the past decade, the possible use of drone technology in various sectors of the economy has become increasingly likely. As with most new technologies, drones are seen as a double-edged sword. Their most high-profile use has been in a military context, which often couches the discussion around this technology in some level of controversy and fear. Additionally, drones have posed challenges in the area of air traffic control and safety, as well as personal privacy. However, drones also offer exciting, cost-effective opportunities for advancement, especially in the area of transport and supply chains. Considering the specific challenges facing the healthcare sector, especially in Africa, drones provide a potential solution to many of the sector's primary challenges. Whatever the feelings around drone technology, its advancement is now inevitable and must be taken very seriously. The African health sector is uniquely placed to capitalise on the strengths and mitigate the drawbacks of this new technology.

Africa's recent history has shown an ability to adopt technologies quickly and effectively, especially when compared with Europe, the United States and other more established economies. There are many reasons for this, but primarily because of less developed infrastructure and less restrictive regulations. Cellphones were adopted rapidly throughout Africa in the late 1990s and early 2000s, partially because landline phones were so ineffective. Because of the widespread use of cellphones, limited financial regulation, and the fact that a large percentage of the population was unbanked, there was then fertile ground for M-pesa and the start of the mobile banking revolution. The U.S. and Europe have been markedly behind Africa in both of these developments and are still in the process of catching up. This open environment puts the continent in an ideal position to adopt innovative technologies that often get bogged down by bureaucracy and regulation in other areas of the world.

> "THE OPEN ENVIRONMENT IN THE AFRICAN CONTINENT HELPS IT ADOPT INNOVATIVE TECHNOLOGIES OFTEN STALLED BY BUREAUCRACY AND REGULATION ELSEWHERE"

Additionally, the challenges that Africa faces in the area of transportation infrastructure and the difficulty of providing quality healthcare to the most rural population, makes drone technology a perfect opportunity to skip aspects of the costly and time-consuming efforts of building roads and airports and makes the transportation of life-saving goods a possible reality in the very near future. One of the primary issues facing the healthcare sector in Africa today is the rural-urban divide. Whereas Nairobi, Johannesburg and Lagos may have state-of-the-art health facilities, the populations in rural and hard-to-reach areas often have trouble meeting their most basic healthcare needs. Poor road infrastructure means there is a significant need for alternative delivery systems. The delivery of products is, of course, only one aspect of healthcare service delivery and is ineffective without the technical and

diagnostic expertise of qualified medical practitioners. Combined with telemedicine, made possible through the mobile phone technology that already exists, drone technology could be revolutionary.

Although not yet mainstream or widespread, there are already efforts to make use of drones a reality in healthcare in Africa. Zipline is a company based out of California in the United States, working primarily in Rwanda, and is the most well-known example of drone technology use in healthcare to date (**zipline.com**). Their Rwanda programme began in October 2016 and has grown to deliver more than 20 percent of all the nation's blood supply outside of Kigali. The organisation tells story after story of life-saving deliveries that would not have been possible without the use of their drones. Their work has also radically changed the structure of the country's medical supply chain. The use of drone technology ensures that hospitals always have enough blood and minimises wastage due to the reduced transport time.

The blood delivery that Zipline offers has made a huge impact in Rwanda, but the use of drones should by no means be limited to that specific niche. In fact, Zipline plans on expanding into Tanzania with a programme that is set to deliver blood transfusion supplies, HIV medications, antimalarials, antibiotics, surgical supplies and much more. Drones have the potential to transport life saving supplies, not only in emergency situations, but also on a regular basis, providing a cheaper transport alternative to the established supply chain systems.

As with any new technology, however, the health sector must also be aware of the potential unintended negative consequences. The same reasons that make Africa the perfect place to carry out new and exciting innovations are also open doors for potential harm. Although at times redundant and bureaucratic, there are reasons that the regulations in Europe and the U.S. are in place and, if Africa is to move forward with implementing this kind of technology into the healthcare system, a balance must be reached. Government bodies and the private sector on the national, regional and continental levels should work together to form policy that neither stifles innovation nor is reckless in its implementation. The Africa Healthcare Federation (AHF), a continent-wide federation of the private health sector, established in 2016, offers an opportunity for this type of dialogue and partnership formation. The annual Africa Health Business Symposium, being held this year in Johannesburg in October, provides a platform for experts in the field to discuss these issues, alongside their public sector partners, to come up with the most effective solutions to the health sector's most pressing problems.

Drone technology is here and available. Despite the risks that every new technology presents, there are many more benefits it can offer in combination with telemedicine, that will drastically improve healthcare service delivery. The African continent is the perfect setting to explore this technology, not only because it is open to innovation, but also because it has the most to gain. The rural-urban divide, transportation challenges, and financial constraints make delivering quality healthcare to the entire population a daunting task. It will only be possible by cooperating on the national, regional, and continental levels to capitalise on the opportunities that drone technology provides and implementing it in a creative and responsible manner. ■

KEY POINTS

- ✓ There is significant fear and suspicion around the topic of drones
- ✓ Africa has shown that it has the ability to quickly and effectively adopt new technologies
- ✓ Because of the unique challenges facing the African health sector, drones could have an immense impact on improving health outcomes
- ✓ National, regional, and continental policies need to be put in place that find a balance between stifling innovation and allowing reckless implementation

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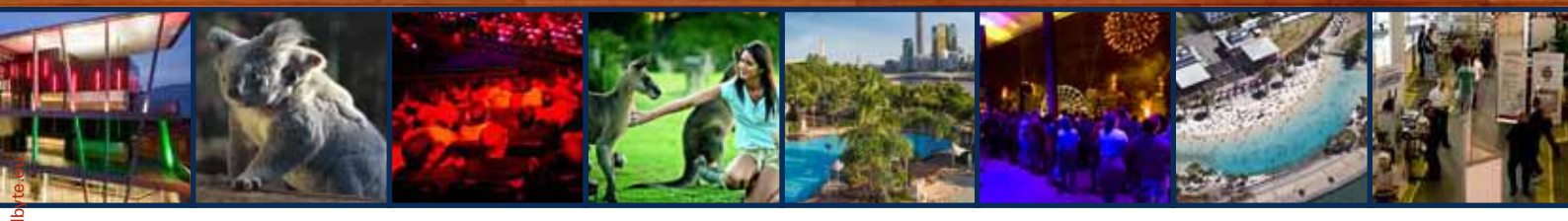

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Ayushman Bharat - India's National Health Protection Mission

Effective implementation of Ayushman Bharat - India's National Health Protection Mission (AB-NHPM) will largely depend on ensuring that the package of services prioritised under the National Health Protection Scheme is based on community needs, evidence-based, well governed and inclusive.

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There is arguably no aspect of social policy more complex or controversial in today's world than how a country goes about assuring health for its people. Major challenges facing the Indian public healthcare system are the sheer complexity of financing and managing preventive, promotive, curative and rehabilitative care; of proactively addressing the social determinants of health; of assuring quality in the public sector; of harnessing the initiative and resources of the private sector while ensuring effective regulatory systems; and of ensuring equity of access to services across social and economic divides.

Since the Union Budget 2018 announcement on the Ayushman Bharat-National Health Protection Mission (AB-NHPM), valuable viewpoints, evidence and analysis have come up containing a mix of admiration and scepticism. As a result, the NHPM has been labelled many things—visionary, populist, pro-private insurance market, scaled-up version of old schemes, pre-election gimmick and more. The most important question that remains in the minds of health economists is how will publicly funded health insurance cover a population ten times that of Obamacare with less than a hundredth of a budget and still reduce out-of-pocket expenditure of patients.

Current status of health financing including health insurance in India

Public health expenditure in India (total of central and state governments) remained constant at approximately 1.3% of gross domestic product (GDP) between 2008 and 2015 and increased marginally to 1.4% in 2016-17. Including the private sector, total health expenditure as a percentage of GDP is estimated at 3.9%. In 2018-19, the Ministry of Health and Family Welfare received an allocation of Rs. 54,600 crore. The National Health Mission received the highest allocation at Rs.30,130 crore and constituted 55% of the total allocation. According to the National Family Health Survey 4 (2015-16) (Ministry of Health and Family Welfare 2017), only 29% of households in India have one member covered under any health insurance scheme, be it public or private (20% women and 23% men). The top five states according to coverage are Andhra Pradesh (75%), Chhattisgarh (69%), Telangana (66%), Tamil Nadu (64%) and Tripura (58%).

In-patient hospitalisation expenditure in India has increased nearly 300% during the last ten years (National Sample Survey Office 2015). Household health expenditures include out-of-pocket expenditures (OOPE) (95%) and insurance (5%). According to the National Health Accounts (2014-15), total OOPE is 3.02 lakh crore. The highest OOPE is made towards purchasing medicines—1.30 lakh crores. (43%), followed by private hospitals—86,189 crores (28%).

OOPE is typically financed by household revenues (71%). Rural households primarily depended on their 'household income/savings' (68%) and on 'borrowings' (25%) while urban households relied much more on their 'income/saving' (75%) for financing expenditure on hospitalisations and on (18%) borrowings (National Sample Survey Office 2015). OOPE in India is over 60%, which leads to nearly 6 million families getting into poverty due to catastrophic health expenditures.

AB-NHPM salient features

- There are basically two pillars of AB-NHPM. One is the strengthening of primary healthcare by converting sub-centres into Health and Wellness Centres and second is the National Health

Protection Scheme (NHPS) for the vulnerable 40% of the Indian population (10.74 crore families) based on the Socio-Economic Caste Census database.

- NHPS will have a defined benefit cover of Rs.5 lakh per family per year covering 1,347 treatments. The beneficiaries can avail benefits in both public and empanelled private hospitals. AB-NHPM will subsume the ongoing centrally sponsored health insurance schemes- Rashtriya Swasthya Bima Yojana (RSBY) and the Senior Citizen Health Insurance Scheme.
- Total expenditure will depend on actual market-determined premium paid in States/Union Territories (UTs) where AB-NHPM will be implemented through insurance companies. In States/UTs where the scheme will be implemented in Trust/Society mode, the central share of funds will be provided based on actual expenditure or premium ceiling (whichever is lower) in the predetermined ratio.

AB-NHPM objectives

1. Reduce out-of-pocket expenditure (OOPE)
2. Increase access to quality health and medications

Institutional structure

The Government of India will set up three bodies:

1. National Health Protection Mission Council

Function: provide policy guidance to AB-NHPM.

Composition: co-chaired by Union Health and Family Welfare Minister and Vice-Chairman of National Institution for Transforming India (NITI Aayog).

Members: health ministers of all States/UTs.

2. Ayushman Bharat National Health Protection Mission Governing Board

Function: decision-making body.

Composition: jointly chaired by Secretary (Health and Family Welfare) and Member (Health), NITI Aayog with Financial Advisor, Ministry of Health and Family Welfare (MoHFW), Additional Secretary & Mission Director, Ayushman Bharat National Health Protection Mission, MoHFW (AB-NHPM) and Joint Secretary (AB-NHPM), MoHFW as members.

3. Ayushman Bharat - National Health Protection Mission Agency (AB-NHPMA)

Composition: headed by full-time CEO at the level of Secretary/Additional Secretary to the Government of India.

Function: to manage the AB-NHPM at the operational level in the form of a Society.

4. State Health Agency (SHA)

These will be created in every state of India to implement the scheme. States/UTs can decide to implement the scheme through an insurance company or through a trust.

Six different working groups on processes, information technology, fraud detection and grievances, awareness generation, institutional arrangement and continuum of care were formed in the first meeting of NITI Aayog with MoHFW and State Health secretaries.

Health and wellness centres

Cost-effective health coverage must cover primary care. This is where the second feature of Ayushman Bharat Programme—the creation of 150,000 health and wellness centres across the country—is very significant. The previous government missed the bus when it failed to implement the recommendations of the High-Level Expert Group (HLEG) on Universal Health Coverage (UHC) (Planning Commission of India 2011). However, those recommendations resonate in the National Health Policy 2017, NITI Aayog's three-year action agenda (2017-2020) and Union Budget of 2018 when they mention "Assuring availability of free, comprehensive primary health care services" at sub-centre level. Sub-centres are the first line of contact of citizens to the public health system in India. Yet, even with the talk about strengthening health at the grassroots, overall allocation to the Department of Health and Family Welfare rose by a meagre Rs. 1,250 crore from the revised Budget estimate for 2017-2018, and allocations to the National Health Mission have fallen by more than Rs.600 crore. Our biggest constraint is also an acute shortage of human resources.

Learnings from Rashtriya Swasthya Bima Yojana (RSBY)

RSBY was announced by Prime Minister Manmohan Singh in August 2007. The aim of the scheme was to "improve access of below the poverty line (BPL) families to quality medical care for treatment of diseases involving hospitalisation and surgery through an identified network of healthcare providers" (Rashtriya Swasthya Bima Yojana 2009). The scheme provided for annual coverage of up to Rs. 30,000 per household. The policy covered hospitalisation, daycare treatment and related tests, consultations and medicines as well

Table 1

Historical timeline of Health Insurance in India	
1907	First general insurance company
1952	Employees State Insurance Scheme Implmented (ESI Act 1948)
1954	Central Government Health Scheme
1973	General Insurance Corporation: 4 public insurers – National,New India, Oriental and United India
1999	Establishment of Insurance Regulatory Development Authority 100% Foreign Direct Investment In Health Insurance
2003	Yeshasvini Health Insurance, Karnataka
2007	De-tariffication of insurance
2007	Rajiv Arogyasri Scheme (RAS), Andhra Pradesh
2008	GOI's Rashtriya Swasthya Bima Yojana (RSBY)
2009	Kalaignar, Tamil Nadu
2010	RSBY Plus, Himachal Pradesh and Vajpayee Arogyasri Scheme (VAS), Karnataka

Source: Reddy et al. 2011

as pre- and post-hospitalisation expenses for some 700 medical and surgical conditions and procedures. During 2016-2017, 3.63 crore families were covered under RSBY in 278 districts of the country, and they could access medical treatment across the network of 8,697 empanelled hospitals.

The Situation Analysis document of National Health Policy 2017 mentioned concerns regarding RSBY: "Low awareness among the beneficiaries about the entitlements and on how and when to use the RSBY card. Another concern is related to denial of services by private hospitals for many categories of illnesses and oversupply of some services. Some hospitals, insurance companies and administrators have also resorted to various fraudulent measures, including charging informal payments" (Gupta 2017). Additionally, it notes: "Schemes that are governed and managed by independent bodies have performed better than other schemes that are located in informal cells within existing departments or when managed by insurance companies" (Gupta 2017).

NHPS is different from RSBY in one fundamental way: RSBY was based on enrolment whereas NHPS is an entitlement-based scheme, ie all the identified population sub-groups under NHPS will automatically get covered once the scheme becomes operational. The functions of risk and resource pooling, which is the central role of any insurance company, are almost non-existent in NHPS as the scheme is fully subsidised by the Central and State Government through their budgetary support. The key functions that remain central in NHPS are hospital empanelment and claims settlement.

RSBY provided limited coverage of only Rs. 30,000, usually for secondary care. Though it improved access to healthcare, it did not significantly reduce OOPE as proved in many studies. The NHPS tries to address those concerns by sharply raising the coverage cap, but shares with the RSBY the weakness of not covering outpatient care. which accounts for the largest proportion of OOPE.

"We will give specific QR codes to families entitled to the scheme. QR code or a barcode is a machine-readable optical label that will contain information about the families and their members. These codes will be sent to the beneficiaries' addresses. Learning from RSBY we decided not to issue cards, for saving time as it took more than one year to distribute cards in RSBY," said Preeti Sudan, secretary, Ministry of Health and Family Welfare (Sharma 2018).

Challenges in effective implementation of NHPS

As the National Health Policy 2017 concludes: "A policy is only as good as its implementation" (Sundararaman 2017). Selecting the insurance provider is an extremely complex process. Each step, such as the design of the tender documents, contract and legal agreements, payment terms, penalties for non-compliance, pre-qualification of bidders, transparent and secured e-tendering process, which tenders would be called state-wise or nationally—must be considered carefully. Otherwise, the process would invite unnecessary litigation.

I discuss below the advantages and disadvantages of both the models: Trust and insurance.

Trust model

Key advantages of implementing the scheme through a trust model are:

(a) its not-for-profit orientation
(b) conducting awareness and sensitisation functions using government administrative machinery, especially at district/sub-district level.

Risks of this model are:

(a) weak in-house capacity to perform critical functions that depend on the quality of hired personnel (having requisite skills and competencies)
(b) a weak governance structure that fails to achieve professional conduct and to prevent outside interference. Andhra Pradesh, Telangana, Karnataka and Gujarat are using the trust model.

Table 2. Publicly financed health insurance schemes in India

State	Programme name	Primary care	Secondary care	Tertiary care	Maximum benefit
Maharashtra	Mahatma Jyotiba Phule Jan Arogya Yojana (MJPJAY)	No	No	Yes	Rs. 1,50,000/-
Gujarat	Mukhyamantri Amrutam Yojana (MAJ)	No	Partly	Yes	Rs. 2,00,000/-
Chhattisgarh	Sanjeevani Kosh	No	No	Yes	Rs. 3,00,000/-
Chhattisgarh	Chief Minister Child Heart Protection Scheme	No	No	Yes	Rs. 1,80,000
Kerala	RSBY-CHIS (Comprehensive Health Insurance Scheme)	No	Yes	Yes	Rs. 30,000/- (RSBY)+ 70,000/-
Karnataka	Yeshasvini Co-operative Farmers Healthcare Scheme	No	Yes	Yes	Rs. 2,00,000/-
Andhra Pradesh	RAS (Rajiv Arogya Sri) Community Health Insurance Scheme (CHIS)	No	Yes	Yes	Rs. 2,00,000/-
Tamil Nadu	CM Health Insurance Scheme	No	Yes	Yes	Rs. 1,00,000/-
Himachal Pradesh	RSBY plus	No	No	Yes	Rs. 1,75,000/-
Meghalaya	Megha Health Insurance Scheme (MHIS)	Partial	Yes	Yes	Rs. 1,60,000/-
Assam	Atal Amrit Abhiyan	No	Yes	Yes	RS. 2,00,000/-

Source: National Health Accounts (2014-15)

Insurance model

Some of the main advantages of implementing the scheme through an insurance company are:

(a) its experience of working with third-party administrators (TPAs)
(b) possible scale-up of scheme to cover the non-poor population, which would involve marketing of the scheme and premium collection
(c) better deployment of short-term surpluses to generate better returns on those surpluses.

The risk associated with this model though is in cost-escalation overtime through possible collusion between for-profit entities (insurers, TPAs, and healthcare providers). Maharashtra and Tamil Nadu are currently using the insurance model.

Conclusion

In conclusion, I would like to quote Anil Swarup, Secretary, Ministry of Human Resource Development, "An idea is worth its salt if it is politically acceptable, socially desirable, technologically feasible, financially viable and administratively doable" (Swarup 2017).

In a federal polity with multiple political parties sharing governance, although the Bharatiya Janata Party is currently the ruling party in 21 states, an all-India consensus on the design and implementation of NHPS requires a high level of cooperative federalism, both to make the scheme viable and to ensure portability of coverage across states.

Overall, the effective implementation of AB-NHPM will largely depend on ensuring that the package of services prioritised under NHPS is based on community needs, evidence-based, well governed and inclusive.

As the Government of India has made districts a geographical unit of policymaking through its aspirational districts programme, my recommendations are:

1. Coordination between multiple stakeholders entrusted with the implementation of NHPS needs to be 100 percent. A study conducted in Karnataka (Rajeshkar et al. 2011) showed that the level of organisation was much greater in districts where the district collector took an active interest in implementation and monitoring of RSBY. Every district collector should include AB-NHPM in its monthly review meeting by focusing on access and coverage to the last mile and significant improvement in health outcomes from the last National Family Health Survey (NFHS) (2015-16) (Ministry of Health and Family Welfare 2017).
2. Implementation needs to be accompanied by analysis so that the solutions are found through policy analysis and research embedded into implementation. This calls for strengthening "evidence-to-policy" links. ■

REFERENCES

For full references, please email edito@healthmanagement.org or visit https://iii.hm/jrf

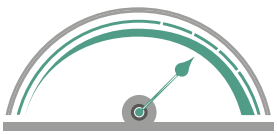
EMERGING MARKETS

EMERGING ECONOMIES – PROJECTIONS AND FORECAST

- BRICS (Brazil, Russia, India, China and South Africa) are among the fastest growing emerging economies in the world
- Emerging markets will dominate the world's top 10 economies in 2050 and will grow twice as fast compared to advanced economies
- Out of the 7 largest economies in the world, six will be emerging economies including China, India, and Indonesia
- By 2050, UK will be down to 10th place, France will be out of the top 10, Italy will be out of the top 20 and Mexico, Turkey and Vietnam will overtake them

Source: https://iii.hm/i26

HEALTHCARE CHALLENGES FOR EMERGING ECONOMIES



- Rising population
- Ageing population
- High patient volumes
- Delivering adequate healthcare to this rapidly growing population

Source: https://iii.hm/i27

HOW EMERGING ECONOMIES CAN MEET THESE CHALLENGES

- Focus on cost-effectiveness and scalability
- Integrate telemedicine in the healthcare mix to meet patient demand
- Prioritise innovation in healthcare technologies, delivery, and business models
- Set up manufacturing partnerships with key pharmaceutical players for improved drug availability and distribution

Source: https://iii.hm/i28

HEALTH 2.0: A NEW HEALTHCARE BUSINESS MODEL FOR EMERGING MARKETS

Emerging markets will need to adopt a new business model to meet their healthcare challenges and opportunities. This new model will rely on:

- Transparent competition within the marketplace
- Individual choice for patients when selecting and purchasing healthcare products and services
- On-demand care delivery through smart care teams, mobile-apps, telehealth, and retailers
- Adoption of new technologies including genomics, big data, and remote monitoring devices
- Person-specific holistic model of health and wellness

Source: https://iii.hm/i29

GROWTH OF MEDICAL IMAGING IN EMERGING MARKETS

- The medical imaging market is predicted to grow by 27% over the next five years
- A major reason for this growth is market expansion in emerging markets
- The ultrasound market is projected to show strong growth in China
- Increased investment in medical imaging is part of China's 2020 Health Plan
- Government investment in healthcare and medical imaging is expected to increase in Russia
- Southeast Asia and Brazil are all committed to improving healthcare in their region

Source: https://iii.hm/i2a

General Data Protection Regulation and healthcare

What could the new data protection law mean for health sector leaders?

The European Union's (EU) General Data Protection Regulation (GDPR) will take effect on 25 May 2018, replacing the 1995 Data Protection Directive. Directly binding and applicable in all EU states, the GDPR aims to protect the data and privacy of the European population by giving control back to citizens and to make the regulatory environment simpler for international business. GDPR was implemented in April 2016 and will be enforced in all EU member states by the end of May 2018. Non-compliance comes at a high price; fines for failure to comply could be as high as €20 million or 4 percent of global turnover. *HealthManagement* spoke to experts in the fields of law, cybersecurity, the patient space and crisis management on how healthcare can prepare for the GDPR and how the regulation will impact on the sector.

Cybersecurity

James Mucklow
Healthcare Expert, PA Consulting Group, London, UK

Healthcare organisations are used to handling sensitive data, but the new EU GDPR introduces fines of up to four percent of revenue or £17m, whichever is the greater, for not meeting the regulations will bring a number of challenges.

Healthcare organisations are responsible for the appropriate management of all personal data storage and processing in both their own organisation and that of their suppliers, who are now jointly liable for any personal data breach. The GDPR leaves the level of appropriate controls up to the organisation to put in place, based upon the level of sensitive personal data held. However, should you encounter a breach, you will need to show that you properly considered the risks and mitigated them through the appropriate controls. For example, does your supply chain meet standards such as the Information Governance Toolkit, ISO27001 and Cyber Essentials Plus?

You must be clear on the legal legitimate basis for holding the data; is it based on legislation or consent? Ideally you should try to focus on holding data on the legal legitimate basis before resorting to the need for consent. If consent is required, you need to make sure

that subjects opt in to you holding and processing their personal data and that you provide them with the ability to opt out at any point. This assumes that you do not have a legal or statutory obligation to retain their personal data.

You can no longer offload the responsibility. A particular area of concern is when data is shared beyond the organisation and/or used beyond direct care. The GDPR says you are jointly liable for any personal data breach. As well as fines from the regulators, you could be subject to civil claims for damages. In addition, the regulators also have the option to suspend your ability to process personal data.

Cybersecurity

Elliot Rose

Digital Trust and Cybersecurity Expert and Member of Management Group, PA Consulting Group, London, UK

The more widely data is shared appropriately, the more valuable it is in the support of patient care. The challenge is, do you have a clear rationale for sharing data or accessing shared data?

The EU GDPR should be seen as an opportunity to review how you handle data and ensure that you have clarity on the processing, storage and sharing of it. The key to doing this is having a systematic approach. You need clear identification of data assets and the governance you have to date. You should have the operational rationale for holding data now and in the future and how it can be enhanced with the right personal data captured. For example, does sharing data promote safer care? Finally, you need a clear view of the basis on which data is processed to enable this.

Ensure you have a plan to be compliant by the end of May. Know what the regulators will be expecting and conduct scenarios to ensure that your plan is realistic and robust. Remediate your risks. Create your inventory analysis, conduct data protection impact assessments and address those areas where you need to take action. Make sure you cover process, people and technology changes that may be required, as well as staff awareness training. Do not forget to conduct the due diligence and changes that will be required across your third parties. Put in place the operating model you will need after May 25. Make sure you have an operating model—and associated tools—which will help you shape all of the things you will need to put in place in order to remain compliant with the GDPR in the most efficient manner.

Cybersecurity

Richard Corbridge

Chief Digital Information Officer, Leeds Teaching Hospital NHS Trust, Leeds, UK

The impact of the General Data Protection Regulation in the public health sector has many different and diverse consequences. The National Health Service (NHS) in the UK is prepared for GDPR perhaps better than many due to the focus brought by elements like the Information Governance tool kit and with the work that NHS Digital and NHS England have done to promote good governance around data over the last decade.

GDPR in many ways gives the health system a more solid basis on which to build governance around data; it certainly provides the organisation-based and much-maligned Information Governance teams with a new platform to promote the need for a renewed focus on data governance. The GDPR also pushes the governance of NHS organisations to discuss the data risks they have at the most senior level and build corporate-level plans with real engagement in actions that need to be undertaken.

The classification of what makes up health data and identification have been added to by GDPR. Again this is useful for health systems as it enables standardised approaches to be created and enables the transferral of information to be controlled in a way that guarantees standardised approaches to data handling.

Privacy Impact Assessments (PIAs) have become common parlance across the health sector over the last three years. GDPR and the system's reaction to these also now place the delivery of PIAs in the public domain increasing transparency and ownership clarity of information risk.

Limiting the security risk and therefore complying with elements of GDPR have now been clarified from a board responsibility in each health organisation throughout the public health system. The 'teeth' of the Data Protection Act have given this a renewed push and the positioning of the Data Protection Officer (DPO) in each organisation has given boards a focal point to rally around.

Legalities

Stewart Duffy
Partner, Healthcare Team, RadcliffesLeBrasseur, London, UK

Organisations with mature information governance systems will find it relatively easy to adapt to the changes that the GDPR introduces. However, many smaller organisations will find the transition more challenging, especially where they have previously invested little time or resources in data protection issues. The enhanced transparency requirements in the GDPR, which include the obligation to specify the lawful grounds relied upon for processing in privacy notices, will require organisations to apply their minds to these issues at the outset rather than relying on post hoc justifications when problems or challenges arise.

Organisations which are used to relying on consent for treatment interventions may struggle to come to grips with the challenges posed by consent as a lawful grounds for processing, particularly the doubt expressed by the Article 29 Working Party about the possibility of consent being freely given, and thus valid, in the context of healthcare provider/patient relationships. Organisations will need to consider the full range of lawful grounds that are available and choose the most appropriate for the processing at issue bearing in mind the heightened requirements which the GDPR applies to consent.

Compliance is a process and it is not too late for organisations to take action. It is important to prioritise. Many organisations processing health data will be required to appoint a Data Protection Officer (DPO) and organisations which have not considered this issue yet will need to address it without further delay. For many organisations the challenge will be to determine whether they are undertaking processing on a 'large scale'. In many cases the correct answer will not be obvious as the examples given in relevant guidance cover only the extreme ends of the spectrum. Organisations which determine that they are not required to appoint a DPO should keep a clear record of their reasoning in case this is called into question.

Organisations also need to map the processing of personal data which they perform and consider the various processing activities in order to determine the lawful basis on which they are relying for that processing. They will need to bear in mind that the lawful grounds relied upon will influence the scope of the data subjects' rights. That mapping exercise will also enable organisations to review their processing activities against the full range of fair processing principles in Article 5 GDPR, and to identify potential changes which better serve those principles. An informed understanding of the organisation's processing activities underpins the preparation of appropriate privacy notices and the application of appropriate organisational and technical security measures.

Organisations will also need to review their internal policies and procedures to ensure that these reflect the revised arrangements, including those for subject access requests. Breach response plans will need to be updated to reflect the requirement for mandatory reporting of breaches where the reporting threshold is met.

The data mapping exercise will also assist organisations in identifying third parties that undertake processing on their behalf. Organisations will need to review their contractual arrangements with processors to ensure that they reflect the requirements in Article 28 GDPR.

Healthcare organisations will need to be mindful that much of the personal data which they process will be special category personal data which attracts enhanced protections. Processing of such data is prohibited unless the processing is necessary for one of purposes identified in the list of exemptions in Article 9(2), which includes the health and social care exemption. Where such an exemption applies the processing will also need to meet one of the lawful grounds in Article 6. Whilst those requirements are necessary for lawful processing, organisations must be mindful that they are not sufficient. Compliance with the fair processing principles in Article 5 is required for all processing. Whilst most organisations operating in the health sector undertake processing with good intentions that must not blind them to the possibility that well-intentioned processing may still breach the Article 5 principles.

Organisations will need to be able to demonstrate their compliance with these principles through appropriate policies and procedures, developed to reflect the particular context in which they operate, and supported by appropriate staff awareness and training. Organisations must continue to address external threats, such as malware and hacking, whilst not forgetting the potential for internal threats, such as rogue employees accessing health data inappropriately.

Patients

Peter Kapitein

Patient advocate, Inspire2Live, The Netherlands

The General Data Protection Regulation (GDPR) does exactly what it says: it protects data. The consequence of this is that the data is much harder to use for the benefit of society and our case for patients.

There is a big difference between citizens and patients. Where citizens might want to protect their data more intensely, patients want it to be used for the benefit of society and if possible for their own. Patients want the data being used by researchers for better treatments and the improvement of quality of life. Most patients don't even want to give permission for it. It's more a matter of "Simply use my data and hurry up".

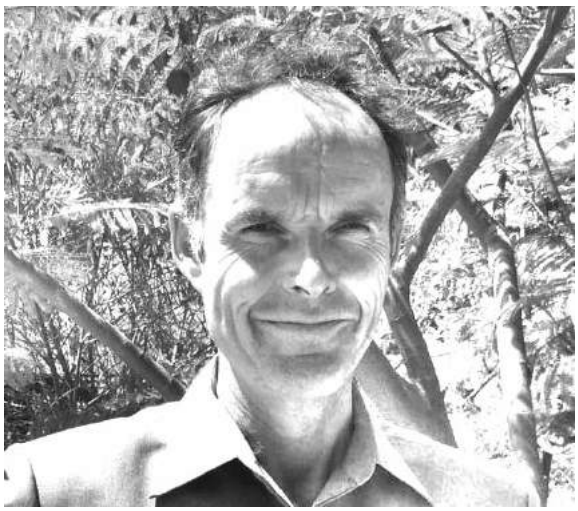
What is seriously lacking in the implementation of GDPR is the comparison of the costs-benefits-risks of the existing situation (without GDPR) where data can be used more easily and the cost-benefit-risk ratio in the new situation (with GDPR). We patients take the risk and pay the bill—with our lives. Therefore, it is simply wrong that politicians and lawyers determine what can and should be done with 'my data'. It is my self-determination that should answer the question about what can be done with my data.

For this reason of self-determination, I refer to an excellent Estonia EU initiative called 'Digital Health Society' and their working group 'Citizen-controlled data governance and data donors' that says: "The patient owns and maintains the data and the data is available for research with an opt out way of working".

Risk and accountability

John Deverell

CEO, Deverell Associates, UK



GDPR will apply to companies processing personal data in the EU, companies offering goods or services to EU residents and companies that monitor the behaviour of EU residents. It is not dependent on the location of the business in question. As a result, people should feel more confident that their personal data is secure. GDPR stipulates that the data 'controller' (senior management of the firm) and the data 'processor' (the department or employee working with the data) have equal accountability. It specifies an "accountability principle". This means that senior managers are required to demonstrate compliance with GDPR and to state their responsibilities for doing so. GDPR outlines seven obligatory requirements for the purpose of safeguarding the security interests of EU citizens; consent, breach notification, right to access, right to be forgotten, data portability, privacy by design and data protection officers. The GDPR continues the trend of the last few years in making senior managers specifically accountable. Gone are the days when managers could legitimately defend themselves by simply and plausibly claiming that they were ignorant of their employees' wrongdoings. Senior managers are now specifically accountable for putting in place the procedures, resources and training to reduce the likelihood of a widening range of adverse events – and for demonstrating that they have done so. While this requires more effort and probably more expenditure on their part, it will – assuming that managers fulfil their responsibilities – increase public and shareholder confidence in business and in the intention to handle risk more effectively. ■

eHealth – transforming healthcare in disruptive times

Where is eHealth in Ireland heading and where could it lead us?

Examining the state of eHealth, its challenges and opportunities at the European Association of Hospital Managers congress in Dublin.

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With digital innovations dramatically transforming every layer of the healthcare landscape, intensive discussions are required to manage the direction that digitalisation takes. With a view on tackling these challenges, the European Association of Hospital Managers (EAHM) held an influential conference on 28–29 March that examined the theme of "eHealth – transforming healthcare in disruptive times". The EAHM Executive Summit 2018, held in Dublin, Ireland brought together leaders from 28 leading hospital management associations in 25 European countries, all with a goal of furthering dialogue and understanding, sharing industry solutions and innovations, while reaching potential and evading threats posed by this digital age.

The why, what and how of digitalisation

The opening of the second day of the EAHM Executive Summit in Dublin was delivered by professor of healthcare management and president of the German Association of Hospital Controlling Prof. Dr. Bjorn Maier. He discussed the idea that digitalisation is not predictable, spanning from consumer-friendly wearables to hospital devices, and expressed that we are largely unprepared for disruption. He spoke about the acceleration of supercycles within our economy—digitalisation being a huge part of this acceleration—and the need for hospital managers to make it their priority to keep up. He approached the question of digitalisation in terms of why, what and how.

The focus on "why" allows us to see the risk-opportunity balance of digitalisation more clearly. A vision of the digitalisation strategy, with identifiable benefits to patients and teams, is instrumental to making this journey successful.

Addressing the "what" of digitalisation allows us to consider our new competitors in the healthcare industry and it is more helpful to view them as friends. This approach will help to uncover new business models, digital treatment and, most of all, refocus on patients, their needs and values.

To deepen the hospital manager's understanding of "what" their hospital's digitalisation should look like, Prof. Maier proposed questions such as whether we should follow the patient's journey end to end and how we can leverage the potential of advanced analytics.

> "COST-EFFECTIVE AND SECURE USE OF ICT TO IMPROVE COMMUNICATION AND COLLABORATION IS THE CURRENT PRIORITY IN EHEALTH IMPLEMENTATION"

Finally, arriving at the "how", the hospital manager will need a road map for digitalisation. It is important to identify the obstacles for change and think about the existing assets available to be leveraged on this digitalisation journey.

The role of Chief Digital Officer (CDO) is the heart and soul of digital transformation, expressed Prof. Maier. This is ideally someone who is a keen innovator with a strategic approach, a coach and a leader or a networker within the rapidly growing digital world. He focused on the importance of thinking of processes rather than departments. Ultimately, the question to be answered is how can IT help us be better and faster in the digital world.

Ireland's eHealth journey

Fran Thompson, programme director for the Strategic e-Health Programme in Ireland, discussed the importance of engagement with digitalisation in terms of the change it brings to end users. He shared a number of success stories he was part of through his work with the Health Service Executive in Ireland, including the implementation of the national imaging solution

"Catherine Barras of DXC Technology focused on the complexity of chronic disease"

Francis Magann

"Bjorn Maier commented digitalisation is not predictable and we are largely unprepared for disruption."

David Cole

NIMIS-PACS. Now scans can be accessed across hospitals and reports are available in 24-48 hours rather than in weeks. One of the key insights he derived from this digitalisation is that a long-term commitment to implementation is needed and a cookie cutter approach does not work.

Another topic Thompson spoke about was The Shared Record Programme that is currently underway in Ireland. He emphasised it isn't just down to the technology changes associated with electronic health records (EHR), but also changes at an organisational level, a change in culture and in associated operational processes, such as those related to pharmacy and discharge.

Through the steps of substitution, augmentation, modification, redefinition, it is possible to impact the patient experience, use resources more efficiently, and increase access and safety.

Key themes impacting on the use and development of eHealth

Elaine Daly of Grant Thornton health practice identified two top challenges of the current healthcare landscape: changing demographics that demand

healthcare reform and rising chronic illness. She expressed sustainability in relation to funding and staff shortages as another key consideration, as is choosing the right eHealth opportunities to drive efficiency and improve patient autonomy. Focusing on eHealth, Ms. Daly identified cost-effective and secure use of ICT to improve communication and collaboration as a priority.

In Ireland, the eHealth journey started off slow, with a budget of only 0.85 percent versus 2-3 percent in peer countries, said Daly. The situation has improved. This can be seen through the presence of a high-tech drug hub that integrates 1,800 pharmacies nationwide as well as an end to end national online medical card system with 1.6 million users. She noted that the focus of eHealth has now started to move towards AI, telemedicine and data analytics.

Finally, she summarised the keys to successful change in eHealth: clear governance and leadership with an identifiable leader, new operating models, project management coordinated with best practice, stakeholder management and workforce up-skilling.

Enabling clinical transformation through a next generation healthcare platform

In keeping with other speakers, Catherine Barras of DXC Technology focused on the complexity of chronic disease, access to convenient services, complex cases requiring high resource utilisation and expensive hospital care rather than better value community care. She presented four different models of digital strategy: agile defender, optimiser, disruptor and composer, and spoke about organisational alignment, starting with key performance indicators (KPIs), followed by culture, process, roles and finally technology as the ingredients of healthcare transformation.

Delivering digital health transformations

Brendan Casey of SwiftQueue spoke about his service as a real-time patient flow management solution. In a UK centre, rather than having 10, 000 patients come to one centre, as would have normally happened, SwiftQueue was able to allow patients to choose to go to another centre, closer to home, to get their bloods done. As well as increasing convenience, it increases the patient's engagement and ownership over their own health.

In terms of the rollout of a digitalisation project, Casey remarked that it can be a complicated operation, but sometimes it can be up and running within three weeks from the hospital first hearing about it.

Understanding the value of location services in a healthcare environment

The smartphone is the centre of gravity with the potential to reduce downtime and enhance patient flow, suggested Simon Wilson of Aruba. His solution uses location services on people's phones to better manage patient flow and match services to patient demand.

Wilson is using what he learnt in the airline, hospitality and retail industries to improve the patient experience. Just like AirBnB allows us to see where we were and when, Aruba's solution allows the patient to note when they were in the hospital and offers insights. The location service based solution can also be used to ease navigation around busy hospitals and tag valuable belongings.

Talking point in discussion

The discussion of the session resulted in a number of interesting points. Firstly, investing in eHealth doesn't always come with an expensive price tag and maximising the assets we already have is the starting point of the eHealth journey. Further to this, deploying innovation incrementally is one of the keys to success, since a coordinated, measured environment will ultimately allow for a better patient experience.

Business intelligence/artificial intelligence

The final session of the summit was opened by Coleman Casey, director of the Health Innovation Hub Ireland. He focused on the importance of listening to what the patient has to say, and cautioned against this pitfall that is becoming increasingly likely with advancing digitalisation. He suggested that patients are often drowned out by the beeping of a myriad of devices, and they are not heard by the clinicians trying to help them.

Delivering transformation through insights

Both patients and providers of care are frustrated by lack of information, suggested Francis Magann of Change Healthcare. Change Healthcare focuses on delivering transformation through insight—its solution matches availability with demand by using analytics. This allows hospital managers to maximise their return on investment for capital items.

Magann highlighted that by removing the manual component of management reports, Change Healthcare can save a significant expense. His experience is that it takes three to four days per month to develop a management report, which when multiplied by the

number of departments and months in the year can be significant.

Standardisation of data is often a key challenge. Above all else, prioritising people and change management over technology itself is necessary for success, said Magann. He explained that developing a culture of change within the organisation is an important result of his work. With regard to innovative processes, he remarked that iterations lead to leaner processes.

Avoiding harm: uncovering opportunities for healthcare transformation

James Ferris of Aptean focused his talk on avoiding harm through effective patient flow. He reiterated the words of the NHS—ten years' worth of muscle ageing occur in ten days of hospital stay for someone over 80 years of age. Aptean's solution aims to reduce the length of stay by reducing the days where patients don't benefit from being in a hospital, eg waiting for a scan. The solution helps decision makers monitor who may be ready for discharge.

IBM Watson Health

The closing session of the EAHM Summit addressed the irreducible conflict between the security of data versus making data available in order to derive insights. Initiated by Prof. Pascal Verdonck, Chairman of the Board of Directors, AZ Maria Middelares Belgium, the session discussed why hospital managers should be cognisant of how exactly they use patient data to make sure it is both helpful in making decisions and safe.

Digitalisation has come in three waves: automation, mobile and artificial intelligence (AI), highlighted Prof. Verdonck. Mobile and AI are genuinely new to hospital managers, with mobile having introduced connected care and having caused significant disruption within the sector.

David Cole, IBM Watson Health innovation lead Europe, added to the discussion, expressing the importance of AI. He conveyed that data is a vital part of eHealth, and even though we have a lot of data, the vast majority of it is unstructured, which is where AI comes in.

Cole discussed that the way that we currently use the term "artificial intelligence" is somewhat inaccurate. What is really being discussed under that name at this time is deep learning, machine learning and neural networks, focused on one domain at the moment, not like the human brain that can move between domains.

Watson AI technology is a cognitive system that learns and reasons, much like we do. It is possible to interact with it using natural language, the same way one would with another human being.

Speaking specifically of Watson Health, Cole illustrated its decision support capability with their oncology solution. It was able to scan through the available literature and patient records and come up with treatment paths. Watson for Oncology could predict what may happen to patients and had a 93 percent concordance with the multidisciplinary team in a study in Manipal hospital, India. This is available through *Annals of Oncology* (Somashekhar et al. 2018).

Watson is able to highlight certain aspects of a patient's medical record if they are relevant. It is also useful for identifying patients who are the most suitable for clinical trials. Cole suggested that in the not too distant future, not using AI or a decision support system will amount to medical negligence.

Speaking of medical records, Cole discussed that the exorbitant amount of time that clinicians have to spend on records is a consequence of the lack of technology in healthcare. This leads to attrition of health professionals because people who go into clinical disciplines want to spend time with patients - not making records. It is therefore vital to put the kind of technology that is available in other industries into healthcare.

Lucy Nugent, President of the Health Management Institute and Deputy CEO of Tallaght Hospital, made some final remarks reminding the audience of hospital managers to focus on patients, thinking not only of the time that they spend with us, but also outside the hospital. ■

KEY POINTS

- ✓ Digital innovation is dramatically transforming every layer of healthcare
- ✓ It is important to identify obstacles to change and leverage existing assets for digitilisation development
- ✓ A change in culture is necessary for acceptance and implementation of digital culture
- ✓ The role of Chief Digital Officer (CDO) is the heart and soul of digital transformation
- ✓ It is important to listen to the patient voice during the digitalisation journey

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Affidea grows in Portugal and expands into teleradiology

Affidea Group is a leading healthcare services provider with over 7500 professionals performing almost 13 million examinations each year. Affidea is recognised for its superior medical technology platform, scale efficiencies, internationally awarded medical excellence and its continued expansion into new ways to create value as an integrator provider for healthcare stakeholders.

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Affidea Group, the leading European provider of diagnostic imaging, outpatient and cancer care services has just announced the successful acquisition of IMI - Imagens Médicas Integradas - an important provider of diagnostic imaging and teleradiology services in Portugal.

The recent acquisition is part of Affidea's strategy to expand its core services of diagnostic imaging while adding new capabilities in teleradiology. This will strengthen the company's position as a healthcare innovator driven by high technology, clinical excellence and results-driven processes.

Commenting on the acquisition, Giuseppe Recchi, Affidea Group CEO, said: "IMI's acquisition in Portugal is an important milestone in Affidea's story of growth, proving our commitment to strengthen our leadership position in advanced diagnostic imaging and our interest in building a digital platform with additional services like teleradiology. Affidea is a company with an ambition for both organic and acquisitive growth. In the last year alone we have added 77 new centres across our European network. Leveraging our core competencies, we will continue to invest in the healthcare industry, expand geographically and create value through digital and data-driven adjacencies. The scale of our network, our digital and hi-tech capabilities as well as our clinical excellence–awarded by international medical and academic institutions–make us the preferred provider for healthcare stakeholders from private healthcare insurers, doctors and patients to the national health service. As a leading medical provider, we aim to improve the healthcare ecosystem and contribute to creating a healthier society having a solid foundation through medical excellence, standardised medical protocols along with an outstanding customer experience in all of our markets".

Through this acquisition, Affidea's European network has grown to 245 centres in Europe, with over 7500 professionals performing almost 13 million examinations and serving more than 6.5 million patients every year.

> "HEALTHCARE INNOVATOR DRIVEN BY HIGH TECHNOLOGY, CLINICAL EXCELLENCE AND RESULTS-DRIVEN PROCESSES"

In Portugal, Affidea has expanded its footprint to 21 centres and added teleradiology services to its portfolio. Thanks to the recent IMI acquisition, Affidea Portugal will provide over 1.4 million examinations per year for patients all over the country.

About Affidea Group

Affidea (**affidea.com**) is the leading European provider of diagnostic imaging, outpatient and cancer care services, operating in 16 countries

across Europe, with a focus on delivering timely, thorough diagnostics and high-quality treatments by working only with state-of-the-art technology and experienced medical professionals. The Affidea Group employs over 7500 professionals and operates over 1300 diagnosis and cancer care modalities with almost 13 million diagnostic examinations every year. Affidea is owned by interests associated with the Bertarelli family which are advised by their business entreprise, Waypoint Capital (**waypointcapital.net**).

About Affidea Portugal

Affidea is a leading provider on the healthcare market in Portugal with 11 stand-alone centres of diagnostic imaging and medical consultations plus 4 clinical laboratories, which cover more than 300 blood collection points. Affidea provides more than 575,000 imaging examinations and 6 million blood analyses results per year for patients all over the country.

About IMI - Imagens Médicas Integradas

IMI-Imagens Médicas Integradas is an important diagnostic imaging provider in Portugal with a history of over 30 years in the local market, operating 4 stand-alone diagnostic imaging centres, including a flagship centre in Lisbon, and managing medical imaging departments for 6 private and public hospitals. Furthermore, IMI provides teleradiology services and operates blood collection points in its stand-alone centres. ■

Further information:
affidea.com
affidea.pt
imi.pt

Does radiology have a bright future?

Do AI and machine learning herald the end of radiology?

Geraldine McGinty

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I could answer in one word: Yes. But *HealthManagement* has given me 700 and I'm delighted to have the opportunity to expand my hypothesis.

I might as well start with the "elephant in the room". How many radiologists cringed when they read President Obama's assertion that "radiologists are losing their jobs to AI" (Remnick 2016). As far as I know, that hasn't happened yet and isn't likely to any time soon. But it's hard to escape the hype and that has some in our community worried. Much worse it has some actively dissuading medical students who are considering a career in radiology. At the American College of Radiology we are not running scared from the power of machine learning and artificial intelligence. On the contrary, we established a Data Science Institute in 2017 (**acrdsi.org**) that is "collaborating with radiology professionals, industry leaders, government agencies, patients and other stakeholders to facilitate the development and implementation of artificial intelligence (AI) applications that will help radiology professionals provide improved medical care." The ACR DSI is developing a framework for implementation of machine learning in the radiological professions that:

- "Defines clinically relevant use cases for the development of AI algorithms in medical imaging, interventional radiology and radiation oncology
- Establishes a methodology and provides tools and metrics for creating algorithm training, testing, and validation data sets around these use cases
- Develops standardised pathways for implementing AI algorithms in clinical practice
- Creates opportunities for monitoring the effectiveness of AI algorithms in clinical practice
- Addresses the regulatory, legal, and ethical issues associated with AI in medical imaging, interventional radiology, and radiation oncology"

To put it a little more colloquially: AI won't replace radiologists but those radiologists who leverage the power of AI may replace those who don't.

So who are those radiologists of the future? I am continually inspired and energised by our @ACRRFS #radres and @ACRYPS communities on Twitter.

Current ACR Resident and Fellow Section Chair elect, Dr. Dan Ortiz, Chief Resident at Eastern Virginia Medical School, and Data Science Institute Advisory Board member Dr. Judy Gichoya, a resident at Indiana University, have launched an online journal club centred on AI (**youtube.com/playlist?list=PLsh1jAUzVC48XbH-YuUz4f-oYfV6mKBQ4**). They've had hundreds sign up and worked through challenging topics with an array of industry stakeholders.

> "INNOVATION AND ADAPTABILITY IS PART OF THE "DNA" OF A RADIOLOGIST"

Our trainees are excited about the potential of leveraging technology to deliver better care to our patients. When I think back to my own choice of radiology as a career, it was exactly that same combination that engaged me. Our trainees are also clear that they want to deliver on the promise of Imaging 3.0 to be visible and valued as part of the healthcare team. My choice to become a breast imager 25 years ago was predicated on the exact same goal. I'm using technology in my daily practice that wasn't even invented when I started my residency and I hope and anticipate that breast imaging will continue to evolve even in my own career timeframe because my goal is the most accurate and high-value care for my patients. Our trainees are the ones who'll deliver those innovations. For example, I am intrigued about how we might better integrate diagnostic information across specialties like pathology and genomics along with imaging data. I'd like to see us recruit the best and the brightest

into radiology and challenge them to achieve goals like that rather than scare students away. Innovation and adaptability is part of the "DNA" of a radiologist.

Our profession's commitment to quality improvement is also a source of great optimism. Radiology led the way with the mammography accreditation programme and we continue to pursue the goals of measuring our performance through use of registries and collaboration with payers like Medicare to develop meaningful metrics to inform value-based payments.

It's no secret that I'm a cheerleader for our profession but I'm also not naïve. No other industry has as many complexities and imminent disruptions as well as embedded barriers to change as healthcare. Our practice as radiologists may look very different in the years to come. But will we still add value? I'm confident that we will. ■

KEY POINTS

- ✓ AI will not make radiologists redundant
- ✓ In the U.S., initiatives such as the ACR Data Science Institute are addressing the implementation of machine learning in radiology
- ✓ Radiologists will continue to add value in healthcare

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Fostering clinical research in imaging departments

Discusses the important roles of radiographers in imaging research, and highlights some essential considerations for establishing a research culture, and fostering clinical research.

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The invitation to write this article followed my participation in a very interesting session at this year's European Congress of Radiology (ECR). This session was developed by the European Society of Radiology (ESR) Research Committee, chaired by Professor Olivier Clément (Paris/FR), and was titled *How to foster clinical research in imaging departments* (**https://iii.hm/jj3**). The session included a presentation from Professor Clément on the results of a recent ESR survey on European research, a presentation from Sabine Mallard on the successful approach to structuring a management unit for imaging research in the Bordeaux region, and Dr. Yan Liu, head of translational research, radiotherapy and imaging with the European Organisation for Research and Treatment of Cancer (EORTC), gave the final presentation in the session on the implementation of quality imaging in multicentre trials, which was followed by a panel discussion with the audience. My contribution to the session was a presentation on the roles of radiographers in research. This contribution was based on my role as President of the European Federation of Radiographer Societies (EFRS), and I am also an active researcher. In this article I will touch on some of the discussion points arising from the ECR session, will discuss the important roles of radiographers in our research, and highlight some essential considerations if we truly want to establish a research culture, and foster clinical research, in our departments.

For us to undertake research of the highest quality there are a multitude of factors which can impact on this. Factors highlighted in the ECR session which can impact both positively and negatively on our research included:

- Access to funding
- Career progression for researchers
- Clinical engagement
- Education and training in research
- Evolving imaging techniques and technologies
- Growing demand for clinical imaging services
- Politics
- Protected research time
- Research capacity
- Research infrastructure
- Research opportunities

Each of these factors can present both challenges and opportunities. Few research groups or research studies can escape the need to consider and engage with any one of these. The academic and clinical environments we work in vary considerably both nationally and internationally. Similarly, the professions directly involved in clinical imaging research, radiologists, radiographers, medical physicists and many more, will have varying backgrounds in terms of their education and training, their preparedness for research, and their roles, responsibilities and scope of practice within some countries, and, certainly, between countries.

Research is not for everyone; not every clinical radiologist or radiographer is suited to be a researcher, nor do they all wish to be a researcher. We need radiologists and radiographers who are completely focused on the provision and development of quality imaging services. Likewise, not all academic faculty are suited to be researchers or crave involvement in research; there is a need for faculty who are dedicated to teaching, learning and assessment. Having said that, it is essential that all health professionals, and all health professions educators, have the ability to engage with, and critique, published research so that their clinical and educational activities can be evidence-based.

Research and evidence-based practice (EBP) underpin modern healthcare and can lead to enhanced patient safety, improved patient outcomes, and efficiencies in service delivery. Some groups can say that they have a very well-established evidence base underpinning their profession, and/or specialty, and this is an area of international focus within radiography, my own profession. The contribution of radiographers, academic and clinical, to this evidence through undertaking quality research, on any scale, and subsequent dissemination is essential and will also serve to raise the profile and standing of radiography beyond our profession. Sackett et al. (1996) define such EBP as:

the conscientious, explicit and judicious use of current best evidence in making decisions about the care of the individual patient……integrating individual clinical expertise with the best available external clinical evidence from systematic research.

This definition captures the importance of individual clinical expertise, the 'best available' evidence, and, most importantly, the individual patient. In terms of the individual clinical expertise and the available evidence, it is important to look beyond the radiologist, the medical physicist, and the other medical specialties utilising imaging services. Similarly, we must look at the wider evidence base in terms of the literature we engage with. Of the professionals who contribute to clinical imaging services, and to the evidence base underpinning this, radiographers are often overlooked. Radiographers are at the heart of all examinations and interventions within the department, and as such we have a professional obligation to contribute to the evidence base through active participation in research. Within imaging departments radiographers need to move from being seen as the facilitators, or data collectors/providers, of research, to being equal partners in research, and leaders in research related to our profession, our professional roles and responsibilities, and the wider imaging evidence base.

> "FOR MEDICAL IMAGING RESEARCH TO HAVE TRUE IMPACT AND TO BENEFIT OUR PATIENTS IT MUST BE INCLUSIVE AND MULTIDISCIPLINARY AND SPAN THE ACADEMIC-CLINICAL DIVIDE"

For us to advance clinical imaging research over the coming decades, radiographers must move beyond the role of research assistants, to become full collaborators, co-investigators, and principal investigators on local, national and international research projects. A true multi-professional approach to research is now a requirement for many funding agencies. Many of the leading radiography researchers in the world can be found across Europe. These individuals lead large research groups, successfully compete for national and international research funding, collaborate beyond their profession, and publish in high-impact peer-reviewed journals.

The EFRS, the ESR, and the European Federation of Organisations for Medical Physics (EFOMP) all have clear agendas when it comes to developing, supporting, and promoting research. Indeed the development and promotion of radiography, and radiographer-led, research has been an area of considerable focus of the EFRS for the past few years. Many areas of collaboration between these three European organisations have a strong research focus. The coming together of the EFRS, the ESR, EFOMP, the European Association of Nuclear Medicine (EANM), and the European Society for Radiotherapy and Oncology (ESTRO) to form the European Alliance for Medical Radiation Protection Research (EURAMED) is a nice example of multidisciplinary collaboration with the goal of jointly improving medical care and its medical radiation protection issues through sustainable research efforts (**https://iii.hm/jj4**). Key aspects of EURAMED's vision and mission are to make sure that medical radiation protection research activity is translated into clinical practice, that practice across Europe is harmonised based on the best available evidence, and that a radiation protection safety culture becomes ubiquitous. Of course beyond radiation protection research we must also work towards similar goals at the local, national and international levels.

In 2016 the EFRS published a *Statement on Radiography Research in Europe*, which clearly sets out the EFRS position on encouraging, supporting and developing high-quality radiographer-led research in order to strengthen the knowledge base underpinning our profession. This statement, together with the 2015 *Statement on Evidence-Based Practice in the Undergraduate Curriculum* and the *European Qualifications Framework (EQF) Level 6 (Bachelors) and Level 7 (Masters) Benchmarking* documents for radiographers, clearly set out the importance of a clear research focus in educational programmes. Radiographers can add value at all stages of the research process, and for medical imaging research to have true impact and to benefit our patients it must be inclusive and multidisciplinary and span the academic-clinical divide. The EFRS *Statement on Evidence-Based Practice* states that a radiographer's work should be based on the best available, current, valid and relevant evidence; that radiographers must be able to attain, evaluate, apply and integrate new knowledge and have the ability to adapt to changing circumstances throughout their professional life; and it references the importance of the provision of evidence-based education. Of course this is not unique to the EFRS or to the radiography profession; the ESR similarly highlights the importance of research with their European Training Curricula at Levels I, II, and III (2008).

In a 2016 editorial in *Radiography*, the official journal of the EFRS, the Editor-in-Chief, Professor

Julie Nightingale discussed "Establishing a radiography research culture - Are we making progress?". The need to train more radiographers at doctoral level, the positive progress being made, and the significant improvements still required, are discussed. However, there are issues with accommodating sufficient doctoral students and major issues in the availability of doctoral programmes for radiographers, as highlighted by a 2016 EFRS survey. A lack of formal education at masters and doctoral levels has several potential consequences, including lack of transferability between hospitals, reduced recognition, and lack of opportunity for career advancement. Radiographers should be encouraged to seek postgraduate study; however, there is an onus on many countries to make masters and doctoral level programmes available to radiographers, as only 39% of educational institutions currently offer masters programmes for radiographers while only 14.6% offer doctoral programmes (McNulty et al. 2016). This places radiographers at a disadvantage compared to graduates from medicine, medical physics, nursing and other healthcare professions, who we work with on a daily basis. While producing more doctoral radiographers, who go on to work in both the academic and clinical practice environments, will help the profession progress toward a research culture, it is essential that the quality, quantity, and impact of research progress to allow radiography to be defined as an independent and strong profession, as radiology is viewed as a strong medical specialty (Nightingale 2016).

Moving back to the research session at ECR 2018, beyond the professional level, very strong organisational structure, and clear strategies for research are essential at the institutional and departmental level. Resourcing research, facilitating some protected research time, providing research training opportunities, having clear research leadership, offering mentorship, and having the insight to see the true value of clinical research at all levels, must all be addressed. This should all be multidisciplinary and multiprofessional, as is the case in our clinical practice where the value of multidisciplinary team meetings is clearly seen. Yet in some departments with clear multidisciplinary and multiprofessional approaches to clinical service delivery, research activity operates in silos. Academic institutions also have an important role to play in improving their interactions and communication with clinical departments and clinical staff. University researchers must spend more time in clinical departments engaging with and listening to clinical staff. We must make sure that our understanding of clinical research opportunities and needs aligns with the views of our clinical colleagues. We must discuss our work, at every opportunity and at all levels, with clinical staff. In doing this we can really move towards a research culture across medical imaging. ■

KEY POINTS

- ✓ Radiographers are at the heart of all examinations and interventions in the imaging department and have a professional obligation to contribute to the evidence base through active participation in research
- ✓ Radiographers must move beyond the role of research assistants, to become full collaborators and investigators in research projects
- ✓ High-quality radiographer-led research strengthens the knowledge base underpinning our profession
- ✓ For medical imaging research to have true impact and to benefit patients it must be inclusive and multidisciplinary and span the academic-clinical divide.
- ✓ Research in imaging departments should be multidisciplinary and multiprofessional, as in clinical practice

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EIBIR's role in imaging research projects

The European Institute for Biomedical Imaging Research, EIBIR, supports researchers and industry partners in the coordination of biomedical imaging research throughout Europe and beyond, relieving researchers of the administrative burden, and allowing them to focus on the scientific aspects, ensuring the best possible outcome for the project.

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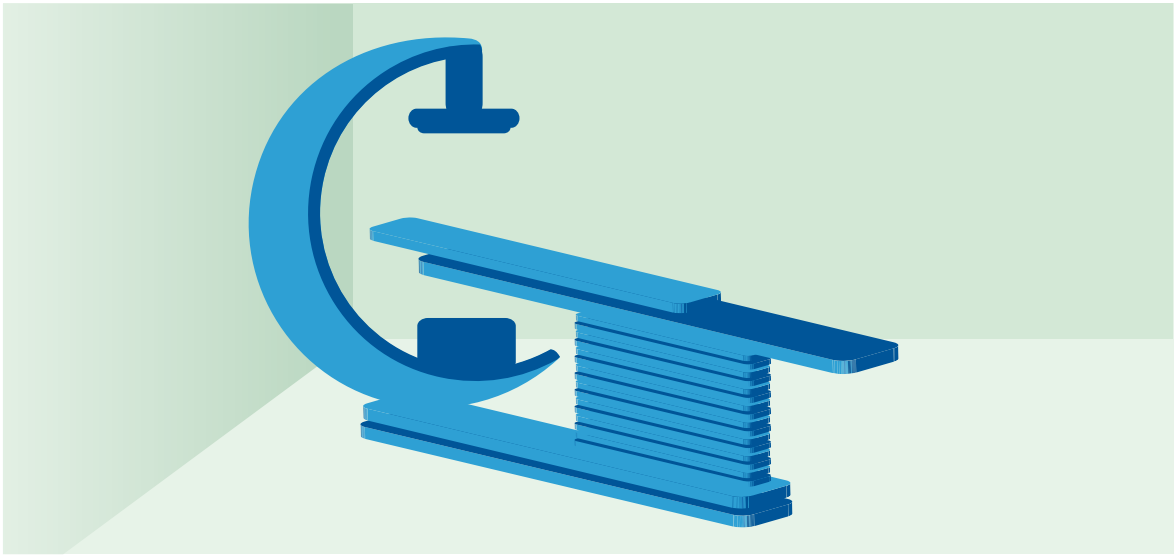

Why do researchers seek European funding?

Due to shrinking national research budgets, securing funding for research has become a challenge in past decades. Many national funding schemes do not support a cross-border approach, which limits the scientific collaboration of European research groups. Thus European researchers rely on European Union (EU) funding sources.

Horizon 2020

Horizon 2020 is the largest EU research and innovation programme, with a budget of nearly €80 billion for seven years (2014 to 2020). Horizon 2020 aims to ensure Europe produces world-class science, to remove barriers to innovation and make it easier for the public and private sectors to work together in delivering innovation. It also promises more breakthroughs and discoveries by taking great ideas from the lab to the market. However, due to the increasing interest in Horizon 2020 projects the programme has become highly competitive with a success rate below 13% and a risk that even high-quality project proposals will not be funded. Additionally, successful projects are facing the challenge of navigating through the rules and regulations of large EU projects while simultaneously carrying out innovative research with partners from across Europe.

Consequently multidisciplinary and multinational consortia require professional support for proposal preparation and project management to ensure the successful accomplishment of project goals.

EIBIR and its services

The European Institute for Biomedical Imaging Research, EIBIR (**eibir.org**), is a nonprofit organisation founded by the European Society of Radiology that supports researchers and industry partners in the preparation and coordination of biomedical imaging research projects throughout Europe. EIBIR comprises a large and diverse landscape of more than 130 network members (universities, hospitals and research organisations), 11 shareholder organisations representing the major scientific societies in the field, a Scientific

Advisory Board and a dedicated Industry Panel. EIBIR is currently partner or coordinator of seven projects that are funded under Horizon 2020.

At the EIBIR office in Vienna, Austria, an experienced team of six project managers offers a broad portfolio of services to its members, which cover the entire process chain from project planning until project execution.

In terms of proposal preparation, services include advice on relevant EU funding opportunities, identifying consortium partners, review of the project outline by EIBIR`s Scientific Advisory Board, the coordination of consortium meetings and conference calls, provision of call-specific templates, proposal writing support and handling of the administrative section of proposals in the online portal of the European Commission.

If a proposal is selected for funding, EIBIR coordinates the meetings with EU Project Officers, guides partners through the administrative process for signing the Grant Agreement, coordinates the preparation of the Consortium Agreement that regulates the collaboration of project partners and takes care of all financial provisions.

After the project kickoff EIBIR assumes responsibility for all day-to-day administrative tasks and communication with the European Commission, serves as the contact point for consortium partners, runs the quality assurance and risk management in collaboration with the project´s Scientific Coordinator, manages all project boards and committees and ensures the timely submission of all project deliverables, milestones and official periodic reports including financial reports.

In terms of dissemination, project partners also benefit from EIBIR`s established, extensive network and media contacts through which the conducted research is widely and rapidly communicated.

In summary, the offered support relieves researchers of the administrative burden, allowing them to focus on the scientific aspects and thereby ensuring the best possible outcome for the project. All services are free of charge for active EIBIR network members and can be used for a moderate annual fee.

Strategic research agenda for biomedical imaging

EIBIR is also active in advocating the inclusion of imaging topics in EU calls. To ensure that biomedical imaging is also well represented in the next EU Research and Innovation Programme (2021–2027) and to provide funding opportunities for the imaging community at large, the EIBIR team together with a dedicated taskforce from its Scientific Advisory Board are currently preparing a Strategic Research Agenda for Biomedical Imaging.

The aim of the document is to:

1. identify the current challenges and needs in healthcare
2. illustrate how biomedical imaging can help in addressing these, and
3. to stimulate dedicated research funding efforts.

> “EIBIR IS DEDICATED TO FACILITATE AN INCREASED ENGAGEMENT OF THE BIOMEDICAL IMAGING COMMUNITY IN RESEARCH PROJECTS”

Topics identified so far include:

- Preventing disease through precision medicine with imaging
- Contribution to a healthy start
- Targeted and precision therapies
- Impact of environment and lifestyle on health
- Healthcare demands of Europe’s population through disease prevention facilitated by medical imaging
- Disease-specific targeted therapies
- Early and improved information on fetal health and prenatal growth and prevention of anomaly development using advanced imaging technologies.
- Accurate depiction of the impact of lifestyle and environmental factors on health supported by medical imaging
- Machine learning and artificial intelligence in medical imaging by exploiting its existing data and expertise

It is expected that the document will be released in mid-2018.

Work with us

EIBIR is dedicated to facilitate increased engagement of the biomedical imaging community in research, and we encourage dedicated researchers and industry representatives to get in touch with us (**office@eibir.org**). ■

KEY POINTS

- ✓ EU project management
- ✓ Services for researchers
- ✓ Proposal writing
- ✓ Dissemination

Clinical audit

The pilot EuroSafe Imaging Star project

Lessons learned from using the European Society of Radiology clinical audit templates in a pilot project at Coimbra Hospital and Universitary Centre (CHUC) together with Coimbra Health School in Portugal.

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The EuroSafe Imaging initiative (**eurosafeimaging.org**) focuses on promoting appropriateness in medical imaging, maintaining doses within diagnostic reference levels, and emphasises the importance of using up-to-date equipment in order to develop a patient safety culture in medical imaging.

One of the secrets of success of EuroSafe Imaging is that for the first time a multidisciplinary and holistic approach was developed under the initiative of the European Society of Radiology (ESR), with the collaboration of stakeholder organisations: European Commission (EC), World Health Organization (WHO), International Atomic Energy Agency (IAEA), Heads of the European Radiological Protection Competent Authorities (HERCA), International Commission of Radiological Protection (ICRP), European Federation of Radiographer Societies (EFRS), European Federation of Organizations for Medical Physics (EFOMP), Cardiovascular and Interventional Radiological Society of Europe (CIRSE), European Society of Paediatric Radiology (ESPR) and the European Coordination Committee of the Radiological, Electromedical and Heathcare IT Industry (COCIR).

With this initiative a new paradigm for radiation protection amongst health professionals was raised, creating a new awareness momentum by shifting from a top-down to a bottom-up approach.

The original EuroSafe Imaging Call for Action number 2, when it was established in 2014, was to develop and promote a clinical audit tool for imaging to increase the quality of patient care and improve justification.

Clinical audit concept

Clinical audit is a systematic examination or review of medical radiological procedures. It seeks to improve the quality and outcome of patient care through structured review, whereby radiological practices, procedures and results are examined against agreed standards for good medical radiological procedures. Clinical audit is required under the Euratom Basic Safety Standards Directive (Council directive 2013) and therefore mandatory in the EU.

The ESR Clinical Audit Tool aids departments to carry out audit in a more comprehensive manner and thereby comply with the directive by assuring the protection of their patients.

> "THE SECRET OF SUCCESS FOR IMPLEMENTATION OF CLINICAL AUDIT IS THE COMMITMENT OF THE HEAD OF DEPARTMENT"

Although Portugal published the legal framework directive 1997), due to the absence of intervention by the health authorities, Portuguese hospitals have not taken any actions towards the implementation of international guidelines or EU directive requirements. Currently Portugal has a) no diagnostic reference levels (DRLs); b) no mandatory education and training in radiation protection; and c) no clinical audit in radiology departments, as defined in the Euratom Directive. At the date of this article, Portugal has also not transposed the Euratom Directive requirements that should have been in place since 6 February 2018. Although most Portuguese hospitals are accredited by Joint Commission International programmes, the majority have no items that assure implementation of the three main pillars of radiation protection: justification, optimisation and dose limitation.

Participating in the pilot project gave us the opportunity to engage better with the clinical audit process concept, mainly by focusing on radiology departments, using a comprehensive library of templates provided by ESR. In our experience, the

ESR Audit pack is indeed '*ALPINE*': **A**chievable; **L**ocal; **P**ractical; **I**nexpensive; **N**on-threatening; **E**asy.

ESR proposed 17 essential audit items to pilot amongst Eurosafe Imaging Stars—those imaging facilities recognised for best practice in radiation protection. We chose five to pilot:

1. What is the mechanism for record keeping and retrospective analysis of adverse incidents?
2. What is the departmental mechanism to confirm the non-pregnancy status of female patients?
3. Is there a written protocol for the justification of who is responsible for the justification process?
4. What mechanism is used to evaluate patient dose in high dose procedures?
5. How old is the equipment in your department?

A very positive aspect of taking part in this ESR pilot was the fact that for the first time a multidisciplinary team was created, involving radiologists, radiographers, medical physicists, students and academia. Integrating audit concepts into the clinical placements of radiography students contributed to easy adaptation and understanding of the audit philosophy. We found that the audit topics are adequate and useful, and use appropriate methods. Mixing hospitals with universities works!

Conclusion

A very important lesson learned from our experience in the pilot is that the secret of success for implementation of clinical audit is the commitment of the head of department. If we fail to have this commitment, the clinical audit process can start but will soon die.

As a final message we consider that whatever you use or do to change and improve your behaviour in a positive way will help you to become better. ■

Acknowledgments

Prof. Dr. Filipe Caseiro Alves, Director of the Imaging Department, University Centre Hospitals of Coimbra (CHUC); Prof. Dr. Joana Santos, Medical Imaging & Radiotherapy Department, Coimbra Health School.

Further information

- ESR Clinical Audit information including the Clinical Audit tool **myesr.org/quality-safety/clinical-audit**
- EuroSafe Imaging **eurosafeimaging.org**

KEY POINTS

- ✓ As a member of the EuroSafe Imaging Stars network, we took part in a pilot of the European Society of Radiology clinical audit templates
- ✓ In our experience the audit pack is achievable, local, practical, inexpensive, non-threatening and easy
- ✓ A positive aspect of the pilot was creating a multidisciplinary team of radiologists, radiographers, medical physicists, students and academics
- ✓ The commitment of the head of department is a critical success factor in implementing clinical audit
- ✓ The ESR Audit Tool helped us carry out audit in a more comprehensive manner

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Fibre-based soft tissue reconstruction

Solutions for challenging reconstruction of subcutaneous adipose tissue

Induction of blood vessel formation and adipogenic differentiation of fibre-bound human adipose tissue-derived stem cells for soft tissue reconstruction.

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The reconstruction of subcutaneous adipose tissue still represents a large challenge in plastic surgery. For a sufficient reconstruction of large-scale damages there is often a lack of autologous tissue. Until now, plastic surgeons were using skin flaps for the reconstruction of soft tissue defects. Depending on the size of the tissue defect, tissue expanders are used to stretch the healthy skin and fatty tissue for several weeks. It also requires few surgical interventions to prepare the wound area and the tissue flaps before transplantation. These processes strongly strain healthy surrounding tissue and are associated with many risks for the patient, eg hypothermia, cardiovascular problems and wound infections. Currently there is no suitable substitution technique that provides a long-term solution in the treatment of soft tissue defects. In small volumes, the autologous transplantation of fatty tissue showed reliable results but the autologous transplantation of larger adipose tissue grafts often results in necrosis and graft resorption. Other approaches in regenerative medicine are marking on artificial fat substitutes. But here again, poor vascularisation and an insufficient supply of nutrients often leads to graft volume reductions up to 60 percent.

Adipose tissue engineering (ATE) instead of autologous tissue substitution, is an upcoming field in regenerative medicine. For these approaches, human adipose tissue-derived stem cells (hASC) are often used. The use of a scaffold in combination with hASC may fix some problems of soft tissue reconstruction in different ways: hASC are known to secrete various growth factors including vascular endothelial growth factor (VEGF) and thus support neovascularisation. Improved blood vessel formation at the site of implantation can improve graft integration and tissue regeneration. On top, these easy accessible adult progenitor cells can easily be isolated from mature adipose tissue and are able to differentiate into the adipocyte cell lineage, what makes them a showpiece for adipose tissue engineering approaches.

For this reason, we thought to engineer adipose tissue grafts using biocompatible, pro-angiogenic scaffold structures in combination with immobilised hASC. Scaffold-induced adipogenic differentiation of immobilised progenitor cells, could in the end help to build up adipose tissue in situ de novo. For this we first selected and engineered suitable fibrous scaffold materials, eg meshes, nonwovens and alginate fibres as well as meshes and gels (Hirsch et al. 2018; Handel et al. 2013; 2012). Suitable scaffolds for adipose tissue regeneration should be biocompatible (according to DIN EN ISO 10993) individually formable, stimulate graft neovascularisation and should preferably directly induce the adipogenic differentiation of incorporated or scaffold bound hASC at the site of implantation.

Our approach for soft tissue regeneration based on human adipose tissue-derived stem cells (hASC) showed distinct angiogenic properties: Standardised in vitro angiogenesis models showed increased angiogenic potential when hASC were seeded onto the implant materials. The quantification of VEGF secretion of scaffold bound hASC followed by HUVEC tube formation assays with conditioned cell culture media showed improved angiogenic properties of the tissue engineered construct. These in vitro results were then correlated and finally confirmed by in ovo CAM angiogenesis assays (**Figure 1**). In these experiments, the combination of implant materials with undifferentiated hASC showed an enhanced blood vessel formation towards the scaffold material and thus an enhanced angiogenic potential (Handel et al. 2013) .

However, with progressing adipogenic differentiation of scaffold bound hASC, proved by microscopy as well as PPARγ gene expression analysis (Handel et al. 2012), gene expression as well as protein secretion of VEGF decreased significantly. To benefit from the pro-angiogenic potential of the progenitor cells, the use of

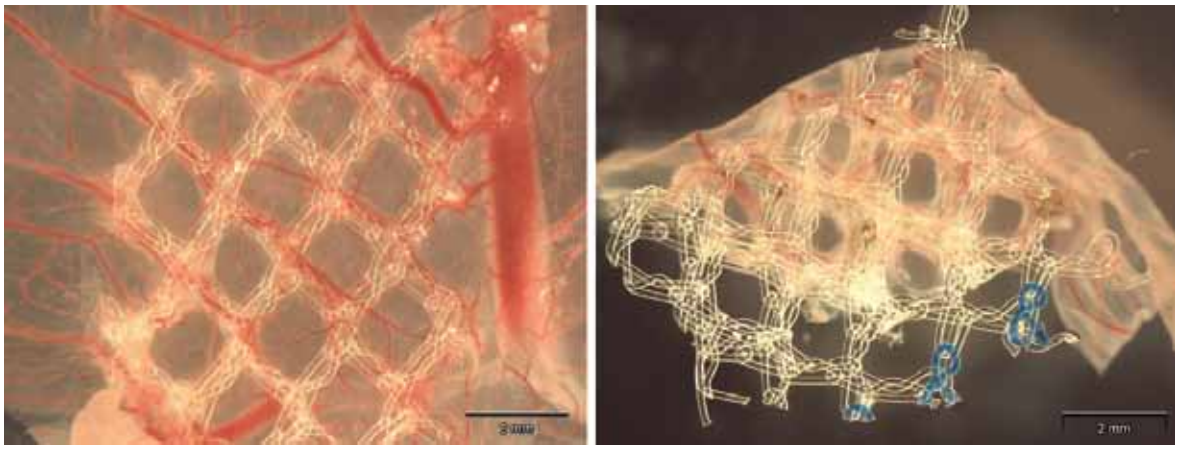

Figure 1. Modified in ovo CAM Angiogenesis Assay with fibrous scaffold structures. LEFT: Fibrous implant biofunctionalised by immobilised hASC RIGHT: Control scaffold biofunctionalised by immobilised human dermal fibroblasts.

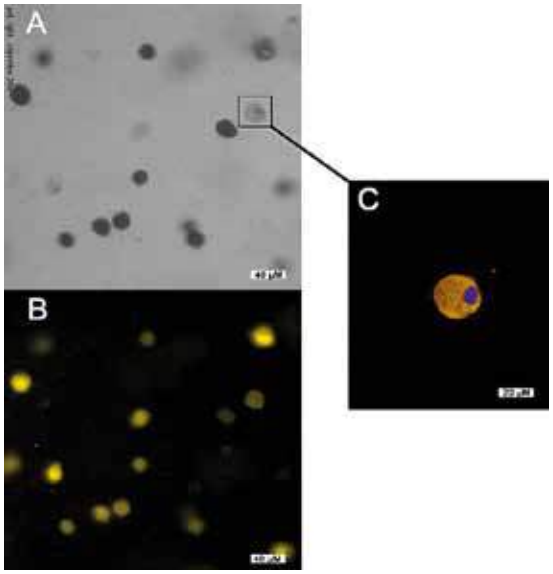

Figure 2. (A) Alginate droplet containing differentiation inducing components and hASC after 19 days of cultivation in minimal essential medium. Microscopic analysis of the hASC after 19 days of cultivation within the droplets shows mature adipocytes, proved by NileRed staining of the lipid droplet and DAPI staining of the nucleus (B &C)

native hASC is advisable.

Thus, we aimed to engineer biocompatible and pro-angiogenic scaffold materials, which can initiate the differentiation of incorporated or scaffold bound hASC into the adipocyte cell lineage. From a therapeutic point of view, this approach would ensure the required VEGF secretion of hASC and thus the angiogenic potential at the time of implantation followed by the built-up of new soft tissue in vivo. For this reason, we engineered "adipogenic" alginate droplets with incorporated nutrients and differentiation factors, which are intended to induce the adipogenic differentiation of the progenitor cells (Handel et al. 2012). Prior to these experiments, the alginate matrices as well as their production process were verified not to be cytotoxic to hASC (Hirsch et al. 2018). After gelling of the hASC-containing alginate, we obtained spherical alginate microcapsules with an even distribution of cells. With the preparation of an alginate gel by adding nutrients and differentiation-inducing factors directly to the polymer, we obtained scaffolds with an intrinsic adipogenic differentiation capacity. Finally, we could proof this concept by nile red staining of mature adipocytes after cultivation of hASC-containing alginate microcapsules for several days in minimal essential medium (**Figure 2**).

Our results support the theory that scaffold-driven adipogenic differentiation of hASC is feasible for adipose tissue engineering. The procedure shown here advantageously utilises the isolation of hASC from the patient's own adipose tissue and their immediate immobilisation on or into an adipogenic scaffold matrix. In addition to pro-angiogenic properties of the used alginate matrix (Hirsch et al. 2018), we used native hASC for immobilisation, to benefit from their pro-angiogenic potential. Adipogenic differentiation would thus be induced post transplantation within the body of the patient and could be further regulated by the body's own control mechanisms. This approach would significantly shorten the time span from cell isolation to a possible reconstructive surgery and thus simplify the surgical treatment of larger soft tissue defects. ■

KEY POINTS

- ✓ Soft tissue reconstruction
- ✓ Human adipose-tissue derived stem cells
- ✓ Blood vessel formation

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Game-changing skin-like electronics for stroke patients

Enabling continual monitoring and personalised care

An innovative new wearable for the throat could mean a turning point for care of stroke patients.

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Developments in skin-close wearable electronics are presenting healthcare with a breadth of new devices that can enable continued monitoring outside the hospital or rehab clinic, presenting a significant step forward in personalised care. These pioneering devices were brought about through a marriage of sophisticated engineering and electronics, as John A. Rogers explains:

A variety of stretchable electronics have been produced by our team of engineers at Northwestern University, Chicago, enabling enough precision for use in advanced medical care and enough compactness and flexibility to be worn outside the hospital, even during vigorous activities. The devices present patients with ongoing monitoring that impacts minimally on their lifestyle. Meanwhile, healthcare professionals are able to collect data about individual patients that was previously untapped—a continual flow of data through patients' daily lives.

The intermodal system of sensors that are placed on patients stream data wirelessly to clinicians' phones and computers, providing a full-body picture of patients' advanced physical and physiological responses in real time.

Ground-breaking use in stroke patients

The latest device in the growing portfolio of stretchable electronics is a monitor that can be worn on the throat and which could be a game changer in the field of stroke rehabilitation. Along with this, sensors can be placed on various other parts of the body to monitor body functioning and recovery progress. In stroke patients, sensors on the arms, legs and chest track patients' movements with a level of precision traditional wearables cannot achieve.

A big problem with stroke patients is that their gains tend to drop off when they leave the hospital. This is where these sensors can offer incredible value—they can alert health carers of the right time to intervene, which could lead to better, faster recoveries for patients.

The sensors stick directly to the skin and move comfortably with the body while providing detailed health metrics, including heart function, muscle activity and quality of sleep. The new throat sensor measures stroke patients' swallowing ability and patterns of speech, aiding in the diagnosis and treatment of aphasia, a communication disorder associated with stroke.

Whilst the tools that speech-language pathologists traditionally use to monitor patients' speech – such as microphones – cannot distinguish between patients' voices and ambient noise, these sensors measure vibrations of the vocal cords, thus solving that problem. This is only possible when worn directly on the throat, however. Throughout development of our devices, minimising discomfort to patients was of high importance, and we created novel materials that bend and stretch with the body, even allowing comfortable use on sensitive areas such as the throat.

A malleable structure

The key to the development of these stretchables was to find ways to use hard, brittle materials, like devices built with silicon, in formats that are soft and conformal to surfaces of biological tissues. Our strategies use laser cut platforms that serve as open network mesh architectures of interconnected active devices, entirely encapsulated into soft silicone elastomers. This combination yields systems that can be very thin and skin-like in their properties, yet still embed some of the most advanced components in modern electronics.

The challenge we faced when developing these stretchable electronics was to combine advanced mechanics designs and geometrical architectures with topologies needed for circuit operation – it's a coupled exercise in circuit and mechanics design, where layout considerations integrate into both areas. Another

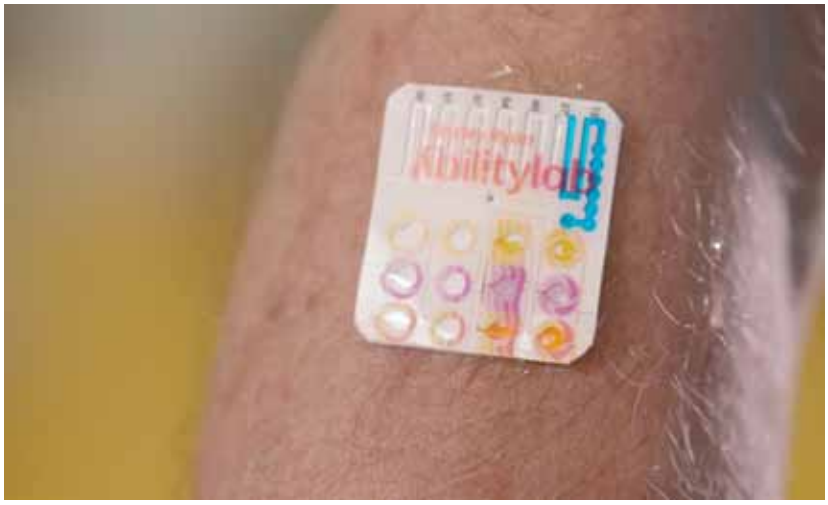
related aspect was in mechanical robustness against many cycles of bending, stretching, twisting, and so on. The solutions are in materials and mechanics designs that avoid excessive stresses on the active components and instead localise the deformations into the silicone material.

> “A BIG PROBLEM WITH STROKE PATIENTS IS THAT THEIR GAINS TEND TO DROP OFF WHEN THEY LEAVE THE HOSPITAL”

The stretchable electronics integrate with the skin using a double sided, thin fabric material adapted from the skin bandage industry. This adhesive is single-use, such that the devices themselves can be reused indefinitely. It means that the device can be taken on and off as required and as is convenient for the patient. A typical duration for wearing a device might range anywhere from five to 12, to several days. So far, in terms of the device’s comfort and use, we have received very positive feedback from physicians, nurses, rehabilitation experts and the patients themselves.

Wearing in the new technology

We started working on the idea of stretchable electronics about 12 years ago, culminating with a first



paper, "A Stretchable form of single crystal silicon for high performance electronics on rubber substrates" (Khang et al.), published in *Science* in 2006. Then, in the same journal, in 2011, we published our first paper on skin-like electronics in an article entitled "Epidermal electronics" (Kim et al.). Since then, we have developed a broad sensor suite, a set of power supply options and two different wireless communication schemes for complete systems that can address important challenges and opportunities in clinical medicine.

One aspect of the device has raised issues, and this is in terms of privacy, as is a common concern in today's technology-rich world. Data security is important in this context, as it is for many other applications—wireless payments, communications, and so on. As with other applications, the data can easily be encrypted in a way that addresses many of these concerns.

Stretchable electronics of the future

We are working to expand the range of sensing capabilities of these devices. For instance, we have new devices that combine microfluidic networks along with the electronics. In this way, we can capture, store and perform biomarker analysis on sweat—thereby yielding biochemical information that can complement the types of biophysical data that we can collect with our electronic sensors.

Over time, the devices will get smaller. In one example, we were able to build a blood oximeter that is small enough (about the diameter of a single M&M candy, and about as thick as a credit card) to mount on the fingernail. The nail serves as an optical window for reflection-mod measurements in the underlying tissue bed.

Because the sensors are wireless, they eliminate barriers posed by traditional health monitoring devices and are enabling doctors to get a far deeper understanding of how their patients are functioning in the real world. We look forward to seeing widespread use of our devices and are meanwhile continuing with our research and development at Northwestern University, to continue to add to the capabilities of our stretchable electronics. ■

KEY POINTS

- ✓ The stretchables provide stroke patients with ongoing and non-intrusive monitoring and healthcare personnel can gather a continual flow of data for better care
- ✓ The comfortable and malleable sensors measure vocal cords for a more accurate picture on patient condition
- ✓ An intermodal sensors system stream data wirelessly to clinicians' devices providing full, real-time patient data
- ✓ Patients can wear the device anywhere from five to 12 hours to several days
- ✓ Data is encrypted for patient privacy and protection

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AI and healthcare technology in India

Opportunities, challenges, and emerging trends

This piece describes the unique opportunities and challenges for artificial intelligence (AI) and digital health technology in India, describes some success stories, and brings up some current trends.

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With its vast inequalities in healthcare distribution, glaring lack of trained healthcare clinicians and infrastructure, and low government spending on healthcare, India is one of the countries in the world with the most room for innovative, sustainable and scalable healthcare technology to improve lives. Yet, in a country with 1 billion people, many now equipped with internet connections and smartphones, it is still difficult to name more than a handful of examples of digital technology that have significantly impacted healthcare outcomes or been used widely.

This piece describes the unique opportunities that the system offers, the challenges which prevent small initiatives from scaling up, describes some success stories, and brings up some worrying trends around artificial intelligence (AI) and Indian healthcare.

For India, it is imperative to design and develop technology that takes into account local constraints, among them affordability. There are many local and behavioural challenges in the Indian healthcare sector, but cost is still a key driver. For it to succeed and make a difference at scale, new technology has to be priced for the country and developed to tackle its constraints. The good news is that this is exactly what AI promises. If implemented correctly, AI boils down to redistributing scarce expert knowledge to a large number of beneficiaries by training algorithms machines to replicate this knowledge.

Unique opportunities

There is probably no better place than India to find a problem in need of a creative solution. Around every corner is a new gap to bridge - a skill gap, geographical gap, an infrastructure gap, an urban-rural divide or a spending gap. The diversity and potential scale of the Indian healthcare system affords an opportunity and incentives like no other to pilot and operationalise innovations. Each one of the systems that is a failing for the Indian healthcare system is a unique opportunity for AI or even for simple digital technology.

The country has witnessed the rapid penetration of internet and smartphones over the last decade and now meets the requirements for efficient delivery of digital solutions. Government enthusiasm for innovation and locally made technology is at an all-time high - both at the central policy level, as well as at local level, with individual states seeking to outdo each other at the adoption of new technology that can help solve old problems. Support for public-private partnerships is high. While this must be tempered by a healthy dose of scepticism about real ground conditions, this is an encouraging sign for innovators.

> “EACH ONE OF THE SYSTEMS THAT ARE FAILING FOR THE INDIAN HEALTHCARE SYSTEM IS A UNIQUE OPPORTUNITY FOR AI OR EVEN FOR SIMPLE DIGITAL TECHNOLOGY”

There are a plethora of healthcare issues that are still ‘virgin territory’ to technology, each with millions of potential beneficiaries in India. Areas such as anti-biotic resistance, health insurance, communicable diseases like malaria and tuberculosis, as well as emerging ones like diabetes are a few of the many worth looking at through the lens of the technology, connectivity and artificial intelligence available today.

Challenges

The upside for an innovator in India is that she is very likely to find a use-case and a chance to pilot new technology. However, in a country that is often called 'the land of pilots', the challenge is usually with scaling and distributing technology - even technology that has been proven to be cost-effective and useful. Several pilots of public-private partnerships have been successful. However, none of them has been scaled up to meet India's health challenges.

AI can potentially leapfrog some other technologies, but for AI to be used at any scale, digitalisation is a pre-requisite. Considering that, in many Indian health centres, medical records are still paper, and radiology still uses films (although this is changing rapidly). The pace of this change is rapid, but statistics on digitalisation of records, prescriptions, and radiology are hard to come by.

Healthcare systems everywhere are slower to adopt change than their counterparts in other industries, often with good reason. But in India, it is not only regulation which stifles innovation. Most healthcare services are provided by the private sector and paid for out-of-pocket. This means that to be broadly adopted, technology has to provide a clear short-to-medium term incentive to the private sector, rather than directly aligning with health outcomes. The lack of government spending on healthcare means that public health programmes are still largely funded from outside the country. This sometimes results in importing technology rather than fostering the development of indigenously developed locally appropriate inventions. Medical education in India does not place enough emphasis on research and on keeping up with new developments. Combined with an overburdened system, this results in generations of practicing clinicians with little motivation to innovate or to understand and adopt technology.

Pioneering examples

There are many examples of digital innovation that have demonstrated success in screening, prevention, and treatment in India. For each of these, there are likely dozens of comparable projects ongoing.

Most of the country's healthcare is pre-digital, and paper medical records and film-based radiology are still more common than their electronic counterparts. In this setting, even seemingly simple systems such as an online appointment-booking system at the country's largest public hospitals in New Delhi can have a large impact by sparing patients long waits and saving numerous trips to the hospital for those who can ill-afford to take a day off.

The last decade has also seen some great examples of dedicated hardware and technology that is engineered for the unique challenges of Indian health ecosystem. These include products for tuberculosis medication adherence monitoring (one of India's most significant public health issues), low-cost vital parameter monitors for use in the primary healthcare setting, and telemedicine programs that provide clinical expertise to areas without doctors. These are more mature than the artificial intelligence applications, which have begun to emerge over the last 5 years. Primarily used for screening, monitoring, and diagnostic assistance, AI applications include algorithms that analyse chest X-rays and other radiology images, read ECGs and spot abnormal patterns, automatically scan pathology slides and even assess fundus images for signs of retinopathy.

Certain branches of medicine in India have been more successful than others at fostering the development of innovation and adopting it. Ophthalmology is a clear leader on both these counts, with a relatively broad range of innovative technologies - high-quality imaging of both retina and cornea using smartphone-coupled devices, artificial intelligence for the screening of diabetic retinopathy - being developed and tested, and then brought into clinical use. This has largely been due to private-sector efforts and would not have been possible without the foresight shown by a set of well-organised large private eye care centres in the South of India that facilitated the data collection and piloted the new technologies.

Worrying trends

As the official use of healthcare electronic medical records and secure electronic means of aggregating and transferring medical data is gradually being adopted, an alternative is quickly taking its place. Indians are prolific users of the free messaging application 'Whatsapp' and doctor-patient communication and even inter-clinician communication by Whatsapp is frequent, with the medium used regularly by groups of clinicians to share and consult on cases.

A second, perhaps even more concerning trend for AI, in particular, is that India is starting to be seen as a 'data source' for radiology and ophthalmology images, and perhaps more. A combination of factors, including English-language reporting, privately owned healthcare systems and lax privacy, data protection and ownership laws. The data sharing itself may or may not be a cause for worry - but the lack of transparency and regulation around it certainly should raise red flags.

Current and future

The last 5 years in India have seen consumer-facing 'health tech' being talked about and embraced by investors, by the government and gradually by the public. Technology aimed at the urban, educated consumer is gaining traction, mostly in the form of online health service aggregators, telemedicine, e-commerce for home delivery of pharmaceuticals and a wave of fitness apps. Existing methods are also being used to reinvent healthcare delivery in the form of online consults or chat-based basic healthcare service apps.

More recently, physician-facing digital healthcare tech has begun to make its appearance - such as technology that performs or assists with core healthcare or medical tasks like analysing radiology, pathology or ophthalmology images.

Conclusion

The significant need for technology to bridge resource gaps in India, and the potential of AI to offer affordable solutions at scale means that India may soon be poised to realise the benefits of these technologies on health outcomes. ■

KEY POINTS

- ✓ Innovative, sustainable and scalable artificial intelligence technology has the potential to greatly improve healthcare outcomes in India
- ✓ AI applications being developed and deployed in India include algorithms that analyse chest x-rays and other radiology images, read ECGs and spot abnormal patterns, automatically scan pathology slides and assess fundus photographs for signs of retinopathy.
- ✓ Scaling up and distributing technology in India is challenging

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"This teaching method works very well for practical procedures (eg airway rescue manoeuvres), new protocols and policies (both new protocols and to refresh existing ones, eg major incident plans, major haemorrhage protocols) and even for electronic prescribing."

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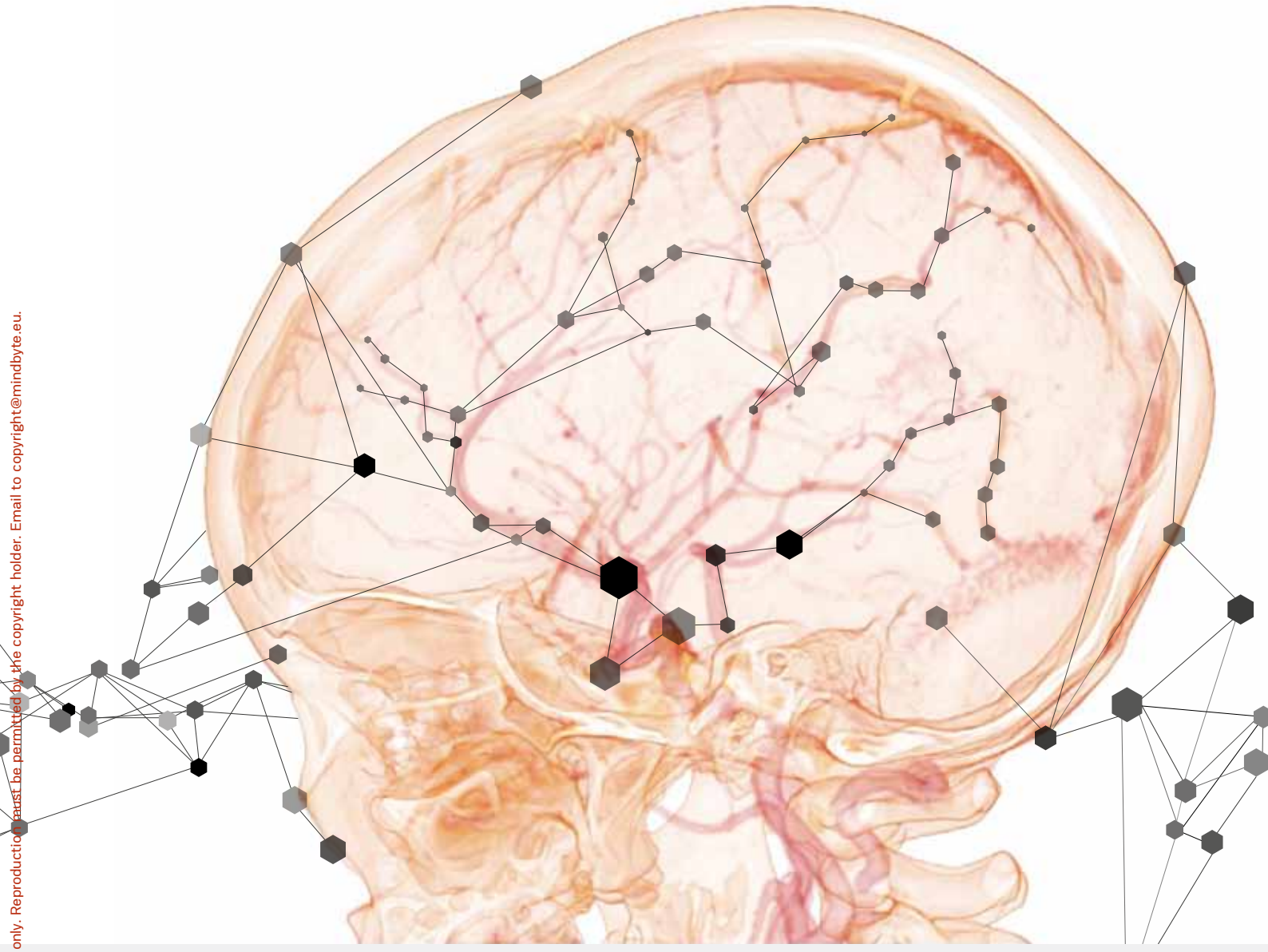

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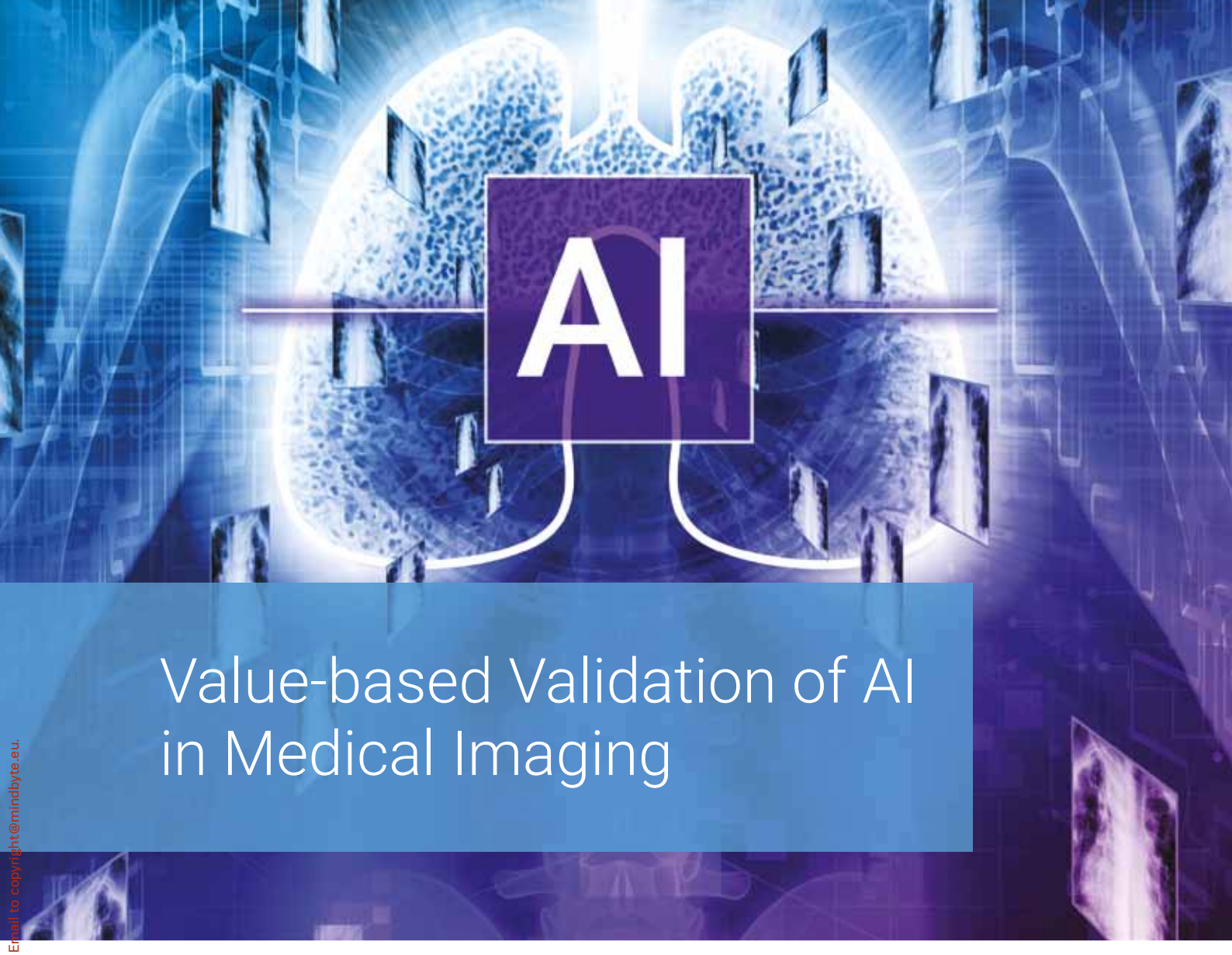

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