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Value-Based Healthcare in 2017

Porter and Teisberg introduced value-based health care (VBHC) in their seminal 2006 book, *Redefining Health Care*. At the time, several sceptics raised questions about the evidence and practicality of its prescriptions. One reviewer noted, “There are few data to support their concepts. ... no one has tried anything like the approaches they suggest.” A prominent healthcare economist described it as a “utopian vision by people not too familiar with the real world of health care” (Reinhardt 2006).

Ten years later, the real world has spoken and VBHC has been widely accepted and adopted. A substantial body of published literature, including case studies and teaching materials, has described how to put all VBHC principles into practice. The World Economic Forum has established a multiyear global working group of leading health organisations to adopt and disseminate VBHC best practices.

Progress on Key VBHC Components

Let us examine the progress on key VBHC components. The first, bringing together multiple types of clinicians, supported with dedicated behavioural and social service professionals, to treat specific medical conditions, has been adopted by numerous institutions, including MD Anderson Cancer Center, the Cleveland Clinic, and the U.S. Navy. The conditions range across osteoarthritis, cancer, diabetes, obstetric care and at-risk elderly populations. In each instance, the integrated practice units deliver superior patient experiences and outcomes.

The second VBHC principle, measure outcomes and cost at the patient’s medical condition level, has moved rapidly into actual practice. One previous barrier, the lack of standard outcome metrics by

medical condition, has been overcome by the International Consortium for Healthcare Outcomes Measurement (ICHOM) (ichom.org), which has convened two dozen international working groups of leading clinicians for important medical conditions. By the end of 2017, ICHOM outcome standards will cover medical conditions representing 50 percent of the global disease burden. The OECD, in collaboration with ICHOM, is driving the use of new technologies to routinely collect clinical and patient-reported outcomes (PROMS) in all 35 OECD countries.

Time-driven activity-based costing (TDABC), introduced to healthcare in 2011, has enabled providers to accurately measure the total costs of treating patients over condition-specific cycles of care. Adoption of TDABC has led to cost savings of at least 20-30 percent. TDABC and patient-level outcomes have provided the previously missing information for clinical practice to measure and improve the value they deliver to their patients.

The third VBHC principle, bundled payments to pay for complete, integrated treatments of a patient’s medical condition, has come into widespread practice in the U.S., Sweden, the Netherlands and other locations during the past six years. The U.S. Centers for Medicare and Medicaid Services (CMS) has taken the lead, with private insurers and employers now following.

Children’s Hospital of Philadelphia (CHOP) has been a great example of VBHC principle four: regional integration. The integrated CHOP network gives families the ability to seek the right care at the right place at the right time in the metropolitan Philadelphia region. Cleveland Clinic exemplifies how to achieve VBHC Principle five: focused and high-quality expansion in the U.S. and globally.

Integrated electronic information technology, VBHC Principle six, is also widely deployed today.

In summary, the Porter-Teisberg 2006 vision, and the literature built upon it during the next decade, has proven highly practical and applicable. The state of VBHC in 2017 is strong, and getting much stronger. We can reasonably expect to see more and more healthcare systems around the world restructuring around the VBHC framework. It has provided a clear road map for restructuring healthcare delivery around patients’ medical conditions. The only remaining question now is how quickly institutions and countries can implement it.



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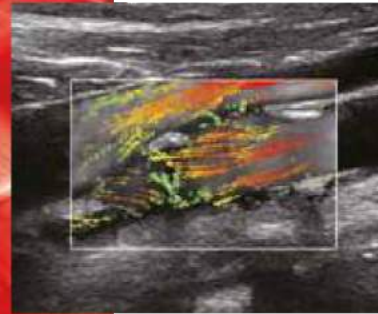
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HealthManagement.org Welcomes New IT Editor-in-Chief



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HealthManagement.org is excited to introduce our new Editor-in-Chief for Healthcare IT. Christian Lovis, MD, MPH, FACMI, has taken over the role from Christian Marolt who has stepped into the position of Executive Director at *HealthManagement.org*.

Lovis is head of the Division of Medical Information Sciences, University Hospitals of Geneva and Full Professor of clinical informatics, University of Geneva.

His research interests include advanced human-machine interfaces, clinical data, computer patient records, architecture, contextualisation and knowledge coupling plus citizen-centric health. He is also interested in socio-anthropologic impacts, evaluation and hospital strategic governance and IT return on investment (ROI).

“THERE ARE A LOT OF PROBLEMS REQUIRING GOOD, CREATIVE AND EFFICIENT SOLUTIONS. SO, LET’S START TO WORK”

“I’m very honoured to work for such an audience with such a great team but also very challenged to succeed Christian Marolt who truly started a new era with the publication,” Lovis told *HealthManagement.org*.

Lovis went on to speak about the HIT topics that he will put in focus with the HealthManagement.org editorial team. “Besides the great vision, hopes and also threats that can be seen in Artificial Intelligence, Big Data, blockchain, the Cloud and other animals, evolution is lagging,” Lovis said. “Today there is still poor interoperability, poor user interfaces for care providers, no transversal clinical workflow managers, less than poor semantic-driven system. There are a lot of problems requiring good, creative and efficient solutions. So, let’s start to work!”

To find out more about Christian, read on for Health Management’s Zoom On mini-profile.

What are your key areas of interest and research?

I am interested in improving health and citizen involvement; care and providers, patients’ involvement using new information technologies. This is about electronic patient or personal health records, decision support, but also re-use of data and better use of existing knowledge and information.

What are the major challenges in your field?

There are many... Leadership, education, maturity are the human ones; Privacy, pre-visibility, prevention are the societal ones. Interoperability, semantics, sustainability are the medical informatics ones.

What is your top management tip?

Surround yourself with people cleverer and more competent than yourself.

What would you single out as a career highlight?

Becoming full professor and Chair of the Division of Medical Information Sciences at the University Hospitals of Geneva.

If you had not chosen this career path you would have become a...?

Mathematician.

What are your personal interests outside of work?

My lovely wife, my son, biking, hiking and photography.

Christian Lovis, MD, MPH, FACMI

Christian is professor of clinical informatics at the University of Geneva and also leads the Division of Medical Information Sciences at the Geneva University Hospitals. As a medical doctor trained in Internal Medicine with a special focus on emergency medicine, he is also a public health graduate from the University of Washington. Alongside his medical studies, Christian studied medical informatics at the University of Geneva with an emphasis on clinical information systems and medical semantics. For ten years from 2000 he was responsible for developing and deploying the computerised patient record for the university hospitals of Geneva. Christian is the author of a large number of peer-reviewed papers in the field of medical informatics and an editorial board member of major peer-reviewed journals in the same area.



HealthManagement.org's Most Clicked Stories

Every week *HealthManagement.org* publishes top healthcare management, leadership and best practice news of the week in dedicated newsletters. We know you're busy, so we do all the work and pick the best three stories to send you. Read on for a variety of topics that piqued record interest recently.

Will HIT Cure Healthcare?

A chief architect of the Affordable Care Act (ACA) is sceptical that HIT is going to play the all-encompassing role in healthcare that Silicon Valley envisions. In a report in KQED , a media outlet in Northern California, Ezekiel Emanuel, M.D., senior fellow for the Center for American Progress and a University of Pennsylvania Professor said that tech will be in the passenger rather than the driving seat. See more at: <https://iii.hm/829>

Survey: Widening IT Divide in Healthcare

Despite the proliferation of high-tech medical gadgets and systems, a new U.S.-wide survey finds the digital divide is growing wider. Notably over the last 12 months patient adoption of healthcare technology dropped -- amid data hacking fears and a perceived lack of privacy protection by healthcare providers, according to the study by Black Box. See more at: <https://iii.hm/7rv>

C-suite: Key Challenges in Coming Year

Healthcare executives say staffing shortages and rising prescription drug costs are among the leading challenges they have to contend with in 2017, according to a new survey by Premiere Inc. Another major concern is "interoperability", with nearly 60 percent of those surveyed saying their organisations are unable to access ambulatory data from their affiliated (nonemployed) physician network. See more at: <https://iii.hm/876>

MRI Improves Prostate Cancer Detection, Avoids Unneeded Biopsy

An MRI scan given to men with suspected prostate cancer can help reduce rates of unnecessary biopsy by 27 percent and overdiagnosis by 5 percent, says a new study appearing in *The Lancet*. It's common for men to undergo a biopsy of their prostate if they experience symptoms of prostate cancer or have a prostate specific antigen (PSA) test showing high levels of the PSA protein in their blood. See more at: <https://iii.hm/7xx>

Key Reasons for Repeated CT in Trauma Transfers

Trauma patients often undergo repeated CT scans when being initially examined in another hospital and then are being transferred to a trauma centre, according to a Swiss study published in *European Journal of Radiology*. Problems with the CT image data transfer were identified as the main reason for CT repetition. See more at: <https://iii.hm/7xw>

Patients' Rude Behaviour Linked to Poor Care

Rude behaviour of patients and their relatives can have negative effects on the performance of medical teams resulting in poor care, according to a study by University of Florida researchers. While much has been written about the need to put an end to some doctors' rude and bullying behaviour, the new study shows the need for patients and

families to also control their behaviour. See more: <https://iii.hm/877>

Stem Cells Used to Regenerate the Heart's External Layer

Penn State researchers have developed a process using human stem cells to generate the cells that cover the external layer of a human heart (epicardium cells), according to a study published in the journal *Nature Biomedical Engineering*. This method of generating epicardium cells could be useful in clinical applications, for patients who suffer a heart attack. See more at: <https://iii.hm/7w7>

Over 50% of AF Patients Become Asymptomatic After Ablation

More than half of patients with atrial fibrillation (AF) become asymptomatic after catheter ablation, according to the largest study of the procedure published in *European Heart Journal*. The article details the in-hospital and one-year outcomes and management of 3,630 AF patients treated with catheter ablation in Europe, the Middle East and North Africa. See more at: <https://iii.hm/7y7>

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How Twitter is Changing the Congress Experience



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At HealthManagement.org, we use congress sessions as an opportunity to educate our Twitter followers. Twitter is more than just another social media platform. It enables users to transmit real-time information and it has changed how we receive and send out data. The internet has annihilated distances and places. We are in different countries at different moments, yet we can all communicate as if we were in one room. This is where HealthManagement.org becomes apparent – Twitter helps us provide live coverage at congresses and events.

Not only is it important how much we use Twitter but also how we choose to adapt our lives on the social media platform. It is incredible how mobile-dependent we have become. Mobile phones and tablets enable a much faster, smarter and easier experience compared to older and bigger devices. Twitter, for example is easier to use when you have a mobile phone as you are able to share whatever is happening at that moment. In fact, research shows that mobile phones are the most common devices used when accessing Twitter. DMR stats from November 2016 report (Expanded Ramblings 2016) found that approximately 257 million monthly users are currently on the social media platform.

Why is Twitter Essential to Healthcare Events and Congresses in Comparison to Other Social Media Platforms?



Twitter is an ongoing forum with news, information and research being posted by both everyday people and experts. Conversations are made between individuals who are not in the same place or country.

“ YOU CAN RET WEET AND FOLLOW OTHER PARTICIPANTS ’ POSTS IN YOUR FEED , MAKING YOUR TWITTER ACCOUNT MORE ACTIVE...”

Just as we are able to receive worldwide news from different digital sources, we are also able to be at conferences that we cannot physically attend. Healthcare is a discipline that is changing at all times. New findings, research and news is available at every minute.

Twitter has therefore become the ideal social media platform in healthcare.

The innovative use of Twitter at congresses is remarkable. Images, live videos, news findings, slides from presentations and backstage photos can be viewed under the official hashtag of the congress. It is impressive how organisers raise awareness before and during the congress by sharing tweets for those who cannot attend. They may not physically be there, but they are participating and engaging digitally. When you click on a hashtag feed for a specific congress, you are easily able to learn about different sessions that are taking place simultaneously, even in different rooms. You can also click on other hashtags that may be included in other posts, giving you more information about that particular topic.

GM85

Moving digital X-ray with Samsung's technology

Samsung Electronics' newly launched GM85, a premium mobile digital radiography system, provides advanced mobility, maximized user convenience and a high image quality.

Its ultra-compact design with 555mm narrow width and 349kg lightweight allow easy access around tight spaces, even in elevators. When moving the system in the hospital building, GM85's collapsible column gives users clear visibility and help access anywhere easily. The adaptive soft driving control and automatic front bumper sensor offer safe navigation and an ultimate driving experience.

The system features a multi-touch screen panel, image display screen on the THU (Tube Head Unit), and

extensive long tube reach for easier operation. The S-Align displays the detector's angle to the THU for precise alignment, and the quick-positioning function optimizes workflow and decreases fatigue, enabling users to serve more patients. It can also power up from 0 to 100% in only two to four hours and go on for a full day.

The GM85 goes further from this with advanced imaging which enables more accurate and confident diagnosis. It applies Samsung's advanced imaging engine S-View to enhance image sharpness and clarity. The SimGrid is an application which, even without the need of a conventional grid, produces superior image by reducing scatter radiation effects. With the SimGrid, radiographers can provide better patient care and lower retake rates, as it eliminates alignment errors that often occur with a conventional grid. The Tube and Line Enhancement feature brings improved clarity of the tube and line in chest images through single on-screen click.

For more information on Samsung's global medical equipment business, please visit www.samsungmedicalsolution.com

** Visitors of ECR 2017 will be able to see both GM85 and RS80A with Prestige at the Samsung booth located in Booth #12, EXPO X5, Austria Center Vienna, Austria.*

RS 80A with Prestige

Introducing the enhanced CEUS at ECR 2017

At this year's ECR, Samsung is introducing its latest contrast-enhanced ultrasound imaging and presenting the clinical benefits of using CEUS.

The RS 80A with Prestige, Samsung's premium ultrasound system, applies sophisticated imaging technology that empowers user's confident diagnosis. Samsung's CEUS+ provides superb resolution and improved uniformity with effective noise reduction, which help users acquire better clarity in the near field. Its automatic brightness control feature optimizes imaging in real time, enabling users to secure enough time to diagnose. The CEUS+, in particular, improves the diagnosis of small lesions and its clear expression of tissue boundaries helps users to achieve interventional procedures with ease and accuracy.

In order to present more clinical cases using CEUS+, Samsung holds the Satellite Symposium at ECR. Prof. Paul S. Sidhu, Consultant Radiologist and Professor of Imaging Sciences at King's



College Hospital in the U.K., will discuss about CEUS as a problem solving tool in clinical practices and Dr. Maria Sellars, Consultant Paediatric Hepatobiliary Radiologist at King's College Hospital in the U.K., will give a lecture on Pediatric CEUS. Prof. Dr. Vito Cantisani, Chairman of EPSC of EFSUMB and Professor at La Sapienza University in Italy, will speak on the topic of "New tools in Multiparametric ultrasound: from guidelines to clinical practice."

**Please visit Samsung's
Satellite Symposium on
March 3 from
12:30 to 13:30 p.m.
at Studio 2017, First
Level, EXPO GALLERY
and explore case
studies using CEUS+.**

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ROOM 0.14 ENTRANCE LEVEL

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THURSDAY, MARCH 2 | 10:00 17:15 | **ULTRASOUND / CT**

FRIDAY, MARCH 3 | 10:00 17:15 | **CT / HII / ULTRASOUND / MRI**

SATURDAY, MARCH 4 | 10:00 16:00 | **HII / CT**

For a complete overview of our educational program please visit

www.toshiba-medical.eu/ecr2017



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You gain more insight on particular issues by having real-time interaction with other online congress participants. People of all diversities can communicate on Twitter. As medical congresses take place, patients are able to interact and communicate with doctors, medical institutions, lecturers, experts and leaders in the industry in one place at the same time. In fact, people no longer have to leave the house in order to visit a doctor anymore. We face a new reality where relationships are now digital and created online.

HealthManagement.org and Twitter

At HealthManagement.org, we use congress sessions as an opportunity to educate our Twitter followers. We encourage both our followers as well as the congress audience to follow our feed. Our tweets direct our followers to our website where they can expand their knowledge on various healthcare topics. Generally, it is impossible to be active throughout all segments of a congress and it is difficult to transmit absolutely everything that is discussed and raised in each session. Nevertheless, Twitter is always at hand. You can “retweet” and follow other participants’ posts in your feed, making your Twitter account more active, and giving your followers something similar to read. You simultaneously become the sender and receiver of information.

One of the most useful online tools is Symplur. Although it established in 2011, Symplur has only grown increasingly popular among people and medical organisations over the past couple of years. According to Symplur, “Twitter hashtags are home-grown, without any rules, and without informing the rest of the healthcare community on Twitter what exactly your chosen hashtag means...By lowering the learning curve of Twitter with a database of relevant hashtags to follow, we hope to help new and existing users alike to find the conversations that are of interest and importance.” (Symplur 2016)

A great example occurred at the European Congress of Radiology 2016 (#ECR2016). The activity reached 5,436 tweets in a 5-day period. The Twitter users included healthcare product companies, media companies as well as individuals. More specifically, the congress had an average of 57 tweets per hour. By analysing this information, we noticed that each participant posted an average of three tweets during the period of ECR, among 1,937 Twitter participants. Last but not least, this hashtag had a staggering 25,549,078 impressions. This puts an emphasis on user engagement more than just the quantity of the tweets themselves.

The more tweets a congress publishes, the more engagement there is. Thanks to Twitter and its real-time updates, congresses become accessible events for those who are interested in them but cannot physically attend.

Live coverage isn’t the only advantage of Twitter. Speakers and experts of different sessions become congress “brands” by trying to build a persona through Twitter. When someone has a very active Twitter account with a lot of engagement (Retweets and Likes), they are perceived as trustworthy, knowledgeable and prestigious. Speakers try to create trends in their specialty through hashtags which in turn, help them become the source for information in a particular field. Symplur plays a significant role in this process. The “Mentions” table in the statistics of a congress reveal who the key influencers are. This positively represents them, making them appear credible and important for an event.

As mentioned previously, Twitter is a unique social media platform. Unlike Facebook and LinkedIn where the content and the frequency of posts may be limited, Twitter allows you to post more often, without bombarding your followers. The more you post on Twitter the more “modernised” you are.

Follow us on social media!



Twitter: @ehealthmgmt



Facebook: HealthManagement.org



LinkedIn: HealthManagement.org



Google+: HealthManagement.org

KEY POINTS



- ✓ Twitter is the new form of live coverage at congresses and events
- ✓ Congress organisers try to raise awareness before and during the congress by posting content online for the people that are not there, but who are participating and engaging digitally
- ✓ There is real-time interaction with other online congress participants
- ✓ Speakers and experts of different sessions become congress “brands” by trying to build a persona through Twitter
- ✓ HealthManagement.org helps educate our Twitter followers about congress topics
- ✓ Symplur provides Twitter with a database of relevant hashtags to find and follow the conversations that are of interest and importance
- ✓ The more you post on Twitter the more “modernised” you are



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Developing the Role of CIO in Healthcare Management

From “the IT Guy” to CIO



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The chief information officer (CIO)—also known as the chief digital officer (CDO), chief information digital officer (CIDO) or “the IT guy”—can be a difficult title to inhabit, precisely because it is such a new and developing role. If you join an organisation as an accountant people know what to expect, because they have been around for thousands of years, but many organisations have no preconception of a CIO’s role and ensuing responsibilities, because they have never had one on board. This can be very difficult not only for the CIO themselves, but for all those involved in the organisation, especially at the “C-Suite” level.

The history of the CIO, however, dates back over thirty years: the role was first officially defined in 1981, which might sound like a long time ago, but when you consider that accountants have been around since ancient Egyptian times, the CIO role is relatively young in terms of both its definition—and understanding—within an organisation.

CIO in Healthcare

From the point of view of a CIO in healthcare, there are opportunities to develop and define this distinctive role. You are in the unique position to understand how your organisation delivers care, and how IT can be used as an enabler for the delivery of patient care and



ultimately to achieve value and improve best patient outcomes.

Regardless of what stage of your career you are at, if you are given the opportunity to take on a role as CIO, grasp the opportunity with both hands, as it places you in a privileged position to drive the future of your organisation and to contribute to and shape the future of how healthcare is delivered. Healthcare is in a constant state of flux and transition—but this is where you can deliver success by leading change. However, this is also where the problems can begin in making that transition from “the IT guy” to CIO.

As CIO, a subtle change in your skill sets is required. The focus must shift from

everyday technical challenges and problem solving to concentration on the larger vision and strategic objectives of the organisation. There is a transitional change required from traditional IT technical jargon to everyday business language of an organisation.

A CIO needs to be able to inspire, influence and motivate the people around them. Particularly in healthcare, technology must be there to support the clinician and positively impact the health of a patient. A healthcare CIO must always remember that a clinician is there to do one job: to improve the health of a patient. Changing care pathways and clinical processes must provide benefits for the clinician and the patient, otherwise any



technology implementation will not succeed. Changing these pathways and processes requires constant collaboration and perseverance, therefore IT needs to be part of what the clinician does and must enable that process, not hinder it.

Working with the CCIO

With the emergence of the CCIO (chief clinical information officer) role within healthcare organisations, the CIO now has a person to complement their drive for technology enablement. The CCIO tends to be a clinician who has experience in delivering technology and is therefore a champion of technology among their peers. This relationship between the CIO and CCIO must be fostered and the CIO must listen to and learn from their CCIO colleague.

In large technology implementation projects within a healthcare environment, the technology is usually the easy part, because the technology usually does what you want, but humans, by our very nature, can be resistant to change. Changing the work practices of clinicians and patient care pathways can therefore be challenging.

Healthcare CIOs must understand that, if not implemented correctly, these changes can impact on clinical time with patients, resulting in less time for treating and consulting and more time trying to use technology. Therefore, before any IT system or piece of technology is implemented you must speak to your clinical colleagues and those who will be using the system and listen to what they want and what will work for them. If you forge ahead from a technical perspective with technology that you know is functional but clinicians and users are voicing objections to, the technology will never be used (or will be used inefficiently) and the project will not deliver value.

As a CIO in healthcare management it is your responsibility to bridge that gap between the technical and the clinical elements to ensure that both sides fully understand what is required and what will be used. If you are lucky enough to have a CCIO as part of your team, listen carefully to what they say while keeping in mind that the primary focus of a clinician is to treat the patient. If the technology does not support this and you do not listen to the users, your role as CIO will be short lived.

The Evolving CIO Role

The evolving role of the CIO in healthcare management touches upon many different aspects of an organisation and will be specific to each individual organisation. A person's transition to that role can be particularly challenging if they have developed and grown within the organisation. A title can be awarded to a person, but only time will tell if they earn that title and the respect of their colleagues by delivering the goods. It is important to lead by example and learn from others. To be accepted to the "C-Suite" can be difficult though, as the CIO role is not a traditional member. This is where a return to "the IT guy" must be managed appropriately. The CIO is not in the meeting to fix the projector when it breaks—they are there to bring innovative and new ideas using technology to strategically advance the organisation and future goals.

It is important, where possible, to speak to other CIOs and learn from their experiences. Do not underestimate the value of making connections and networking at conferences, events and even through social media. Learning and listening to others will galvanise you on the shared issues of making the CIO role part of the "C-Suite" and part of the business.

Integration. Integration. Integration.

It is very important not to isolate your role from others within your organisation; it is not good enough to be a separate "IT department" that functions independently. Technology must be a seamless part of the organisation that people cannot do without, just like finance. An organisation cannot operate without the chief financial officer (CFO), and the CIO role should be equally important. It is up to the CIO to ensure they become an essential member of this group by leaving behind the technical day-to-day problem solving and by demonstrating original thinking as well as embracing the "art of the possible" to further the goals of the organisation.

Ultimately, whether you are a new CIO, aspiring CIO, or have been in the role for a while, it is important to believe in what you do and in your vision for your organisation. It is important to take risks and trust in yourself when you know something is right, listen to others and always take other people's opinions and suggestions on board. Finally, self-belief is key: if you are implementing a large scale project you, the, CIO must believe in it and believe that it will be successful.

KEY POINTS



- ✓ Healthcare CIOs in unique position to develop role to enhance patient care
- ✓ Technology must support and enable clinicians
- ✓ Healthcare CIOs must be the bridge between technical and clinical



White Coats in the Boardroom

Why Executive Presence is Compulsory for Highly-Qualified Healthcare Professionals



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Today, healthcare professionals routinely receive executive appointments, achieve C-Suite status and join the elite ranks of Boards of Directors. These highly qualified professionals from multiple disciplines carry authority, experience and, often, prestigious reputations. Exceptionally well educated, they appear to have the ideal credentials for senior leadership roles. Expectations run high—from the people they are going to lead, from their new peers and perhaps highest of all, from themselves. Yet, when top ranks and stature are thrust upon these seasoned professionals they often fail to realise there are missing pieces: the skills to bring people on board, to share their vision, to move things forward. In short, they lack executive presence.

Leaders Are Made, Not Born

The expression ‘executive presence’ refers to the behaviour and mindset fundamental to achieve success as a leader. There is no leadership gene; leaders are made, not born. Unquestionably, high performance is a given— along with experience, knowledge, talent and ambition. The much-needed additive to this mix is executive presence. It combines the ability to influence with authority— often referred to as gravitas in the parlance of executive presence—with polished, poised communication skills and engagement expertise.



Healthcare focuses on managing and nurturing multiple patient relationships and caring for individuals on a case-by-case basis. Leadership, on the other hand demands big-picture thinking. To paraphrase Harvard professor Ronald Heifetz, consider this analogy: typically, if healthcare professionals were to attend a dance in a large ballroom, they would be focused on their individual dance partner. If, however, they were to go up on the balcony, they would have a far different perspective of what was going on. As Heifetz said, “The only way you can gain both a clearer view of reality and some perspective on the bigger picture is by distancing yourself from the

fray” (Heifetz 2002). Executive presence demonstrates an acute awareness of the view from the balcony. Developing this perspective requires the understanding that although ‘visiting’ the balcony is mandatory, it’s still critical to join the dance and move adeptly with diverse partners.

As executive presence training specialists, we have noticed a parallel between the healthcare and IT sectors. Despite their academic achievements, both groups frequently struggle to grasp the requirements that follow appointment. Why does successful leadership elude these intellectually-gifted people? Clearly,

EOS imaging



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• CONNECTING IMAGING TO CARE



recognising they must shift perspective and take a more holistic viewpoint represents a significant departure from their comfort zones. Another part of the puzzle may be that they simply are not aware of executive presence, its concept or importance, and as a result they don't investigate training.

Presentation Skills

We know, first-hand, that even the most "natural" leaders have carefully honed their presence. Just like riding a bicycle, once learned, it is never forgotten. The starting point is self-awareness—taking inventory of strengths and shortcomings. For example, acknowledging a fear of public

“HEALTHCARE FOCUSES ON MANAGING AND NURTURING PATIENT RELATIONSHIPS ON A CASE-BY-CASE BASIS. LEADERSHIP, ON THE OTHER HAND DEMANDS BIG-PICTURE THINKING”

speaking is a prime issue for leaders, whether newly appointed or long in denial. Presentation prowess is essential. From daily boardroom meetings to major conferences and conventions, the expectation across every leadership level is that speakers will deliver highquality, professional presentations. Executives and leaders overcome their public speaking anxieties by developing genuine skills. There is a system and process for preparing and specific techniques to practise. Speaking with confidence and conviction is a learned skill. It combines expressing ideas memorably to inspire, persuade and win people over. Facial expressions, eye contact and body language all combine with verbal delivery to elevate the message.

Communications Skills

Although presentation skills figure prominently in the context of executive presence training, they are only one segment of the spectrum comprising communications skills. The impromptu conversations and brief exchanges or meetings people have are the bridges that build connections. Leaders have a responsibility to develop highly-tuned messaging and listening skills.

Body language—the silent signals people send and receive—is a pivotal communications tool. There are far more subtle clues to what someone is really thinking than shielding the chest with crossed arms. Advancement to a high-profile role automatically increases visibility where the ability to 'translate' the interwoven connections between verbal and non-verbal communications is critical. The subtleties and nuances of body language include reading other people's signs and messages, and very significantly for leaders, managing their own.

Empathy

The ability to interpret and relate to the emotions of others is central to executive presence. Emotional intelligence, or empathy, demands an awareness and understanding of other people's emotions. Although executive presence training fosters its development—body language provides an ideal window—perhaps one of the most intriguing insights into measuring capacity for empathy is through a personal leadership profile assessment. Dr. Kathleen Kelley Reardon, Professor Emerita at the USC Marshall School of Business, developed this system (Reardon 2000). Through a series of questions, it takes stock of an individual's predisposed leadership style: Commanding, Logical, Inspirational or Supportive. The process assesses both the primary and backup styles. It describes how and when a style should be

modified or adapted to suit the situation. A byproduct of the process is developing the ability to identify other people's styles and, ultimately, work more effectively with them.

The mandate for every leader today is forging alliances, achieving goals and improving the bottom line. In our complex, challenging and competitive world, executive presence is not an optional asset; executive presence is an expectation. We encourage healthcare leaders to take stock of their presence to take charge of their future.

KEY POINTS



- ✓ Healthcare professionals need to work on leadership skills in order to meet C-suite expectations
- ✓ Presentation skills are essential for healthcare executives but are often lacking
- ✓ Leaders are made not born
- ✓ Emotional intelligence is a necessary leadership skill for team empathy



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The Keys to Staying Competitive in Today's Healthcare Market

Aging Populations and Cuts in Public Healthcare Funding are Driving New Levels of Competitive Pressure

p. IV



The keys to staying competitive in today's healthcare market.

Six things your competition is probably already thinking about

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Seven innovation strategies to win patients and staff

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Seven Innovation Strategies to Win Patients and Staff

Seven Strategies Hospital Systems Can Pursue to Advance their Clinical Capabilities

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Healthcare Executive Alliance

Insights for healthcare leadership



Dr Bernd Montag

Chief Executive Officer
Siemens Healthineers

Healthcare organizations do a phenomenal job. Today, an increasing number of diseases are treated successfully and people enjoy a better quality of life even into old age. Yet, while much is being done to discover new ways to improve patients' lives, we now see radical changes to structures, incentives, and processes within healthcare to sustain provisions for our inhabitant-rich planet.

Gone are the days of the simple equation that a higher price guarantees quality and vice versa. Faced with cost pressures, we see provider strategies of consolidation, industrialization, and population health management designed to meet the growing care demands. Times have changed — today, healthcare and its delivery are increasingly validated and regulated by performance metrics.

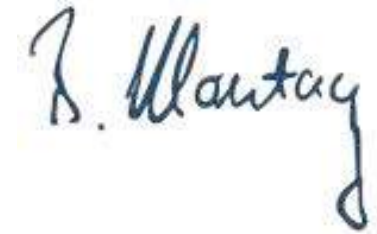
This development has led to nothing short of a paradigm shift in the structures and infrastructures of care.

In times of transformation, success comes from leading the changes. Riding the wave, rather than being washed away. We believe that effective healthcare transformation must include clinical, operational, and financial improvements. Delivering healthcare to more people with fewer resources is possible. But the levers need to be set in order to improve your particular clinical outcomes, streamline your operations, and optimize your financial performance.

Through the Healthcare Executive Alliance initiative, we would like to support you and your teams to find insights, ideas and solutions for succeeding in these

times. Our goal is to be your inspiring partner, helping you achieve better outcomes and reduce costs. As a starting point, we have developed this set of white papers to help identify key challenges in your healthcare organization and outline some innovative opportunities for improvement.

*Now's our time to
inspire the future of
healthcare together.*



The Keys to Staying Competitive in Today's Healthcare Market

Aging Populations and Cuts in Public Healthcare Funding are Driving New Levels of Competitive Pressure

As global populations continue to age and governments continue to cut back on public healthcare funding, the ability to strengthen clinical capabilities, patient outcomes, and process efficiency is rapidly becoming the battleground on which competitive strategies are being fought. Find out what can be learned from the U.S. market, the largest, most competitive healthcare market in the world, to strengthen competitiveness within a given healthcare system.

The Size Counts

Becoming larger – whether by acquisition, merger, or entering into joint ventures – confers a number of competitive advantages, including the ability to

leverage economies of scale, strengthen bargaining position with payers, and provide additional services through the verticalization of managed care programs along the supply chain.¹ It's little wonder that mergers and acquisitions in the healthcare sector are growing every year.² Both horizontal and vertical consolidation are up significantly. Surveys show that U.S. hospital managers see the verticalization of outpatient services and post-acute care as a way to improve patient outcomes and increase market share and revenues.³ The most common objectives of healthcare partnerships in the United States are to: increased market share, improved operational cost efficiencies, improve financial stability, expand geographical coverage, and strengthen payer negotiations.

It Pays To Be Where the Patients are

The U.S. healthcare market is moving quickly toward greater overall outpatient care. Retail and walk-in clinics offer convenient and accessible primary care as an affordable alternative to emergency room visits. Demographic targets call for half of all Americans to have a CVS MinuteClinic within 10 miles of home.⁴ Following their success in the primary care market, retail clinics are now looking to expand further into chronic and specialized care. Rather than see this as a reason for worry, far-looking hospital managers see an opportunity. Many providers, for example, have already entered into partnership agreements with players such as CVS and Walmart. The establishment and development of outpatient networks is particularly attractive for healthcare providers.

Leave the Customer Satisfied

In the U.S., since 2012, a growing portion of hospital reimbursements has been tied to Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores. HCAHPS performance will determine up to 2% of all Medicare payments for hospitals and health systems by 2017.⁵ The projection is that this amount will increase in the future. Investment in modern medical technology can make a particularly important contribution to patient satisfaction. Rapid and accurate diagnoses based on technology can enhance the competitiveness of an institution. Innovations in IT infrastructure contribute to patient satisfaction as well. While patient satisfaction is a clear marker for competitiveness,



Note: Excludes spin-offs, ride-ons, loan-to-own transactions and acquisitions of bankrupt assets based on announcement date; includes announced deals that are completed or pending, with data subject to change; deal value does not account for deals with undisclosed values. Source: Dealogic; AVCJ; Bain analysis.

Growing Volume of Merger and Acquisition Deals in Global Healthcare⁹

it's important to weigh the need to keep patients happy against the need to keep them healthy and the need of institutions to remain financially sound.

Smart Personnel Management Is a Smart Move

Nearly 70% of health workers worldwide are concentrated in Europe and North America.⁷ Still, even in industrialized countries, skilled healthcare professionals are hard to find. Not surprisingly, tech solutions are already proving their value. Effective hospital staff management today requires that all processes be optimized and calls for improved individual skills management and investments in safe, user-friendly technology. Easy-to-use tech solutions help reduce training costs, enable better staff rotation, and reduce the need to hire overspecialized experts for individual silos in the care delivery chain.

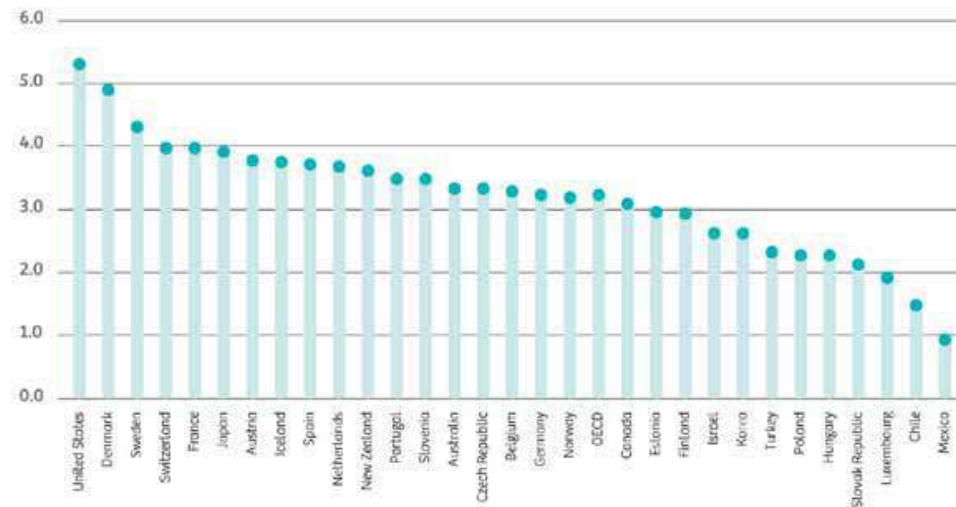
“The financial risk for not giving patients a good experience now becomes very high. Hospitals or practices that don't stand behind the fact that we need to take care of our patients both behaviorally and clinically stand to lose a significant amount of money.⁸”

Lori Kondas

Senior Director for the Office of Patient Experience
at the Cleveland Clinic in the United States

Cultivate Referrals

Practicing active referral management is crucial for a hospital's ability to influence patient flow. Referring physicians should be viewed and treated as valuable partners. Referrers may be broken down into categories such as frequent referrers, first time referrers, local referrers or external referrers. The most successful hospitals attempt to cultivate an ongoing relationship with all referring physicians in the catchment areas.



Hospital Expenditures Account for 2% - 4% of GDP in most OE CD countries



In a Nutshell: Six areas of focus most likely to strengthen competitiveness

Size

Becoming larger – whether by acquisition, merger, or entering into joint ventures

- confers a number of competitive advantages:
 - Ability to leverage economies of scale
 - Strengthened bargaining position with cost payers
 - More services in managed care programs through

verticalization along the supply chain

Customer Proximity

The trend toward greater overall patient care is growing. Retail and walk-in clinics offer convenient and accessible primary care as an affordable alternative to emergency room visits. Furthermore, establishing outpatient networks, verticalization of outpatient services and post-acute care, and telemedicine to widen geographic coverage approaches are on the rise.

Patient Satisfaction

Investment in modern medical technology can make a particularly important contribution to patient satisfaction. Rapid and accurate diagnoses based on technology can enhance the competitiveness of an institution. Innovations in IT infrastructure contribute to patient satisfaction as well. This

includes measures that relieve staff workload, freeing up time for more patient interaction.

Staff Allocation

Effective hospital staff management today requires that all processes be optimized and calls for improved individual skills management and investments in safe, user-friendly technology. Easy-to-use tech solutions reduce training costs, enable better staff rotation, and reduce the need to hire overspecialized experts for individual silos in the care delivery chain.

Referral Base

Hospitals can best remain competitive with referrers through referrer surveys that continually solicit feedback on an institution's strengths and weaknesses.

Useful criteria include:

- Satisfaction with patient care
- Collegiality
- Professional cooperation
- Admissions management / appointment scheduling
- Discharge procedures

Ability to Invest

Leasing or rental-based opportunities are effective solutions to limited investment resources. They help hospitals avoid large capital investments and provide funding based on readily calculable operating costs, which can focus on actual usage – and hence on positive cash flow.

Invest in Success

Without adequate profit margins to generate surplus for investment purposes, hospitals enter a dangerous downward spiral: necessary investments fail to occur, which decreases competitiveness, and in turn decreases surplus, preventing investment. Investing in modern IT, staff training, high-performance equipment, modern premises, and even contemporary room amenities is the price of entry for competing in most markets. Leasing or rental-based opportunities are effective solutions to limited investment resources. Overall, healthcare institutions are using smart finance to improve planning, acquire state-of-the-art technology, and manage cost-per-outcome in order to offer high-quality care and service to patients.



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Read the QR-code to watch a short video introduction about the topic of competitiveness in a given marketplace on YouTube

Seven Innovation Strategies to Win Patients and Staff

Seven Strategies Hospital Systems Can Pursue to Extend their Clinical Capabilities

Healthcare service providers face significant challenges in attracting patients and retaining qualified staff. The most obvious way to outshine one's competitors is to offer superior clinical capabilities, but such innovations can seem prohibitively expensive. Read about seven strategies that hospital systems can employ to advance their clinical capabilities, respond to the evolving challenges of healthcare today, and attract both clinicians and patients.

Invest in New Diagnostic and Therapeutic Modalities to Improve Outcomes and Expand Services

The most obvious way for service providers to augment their clinical capabilities is to offer the very latest diagnostic and therapeutic technology. For instance, innovative imaging techniques can significantly improve the speed and reliability of diagnosis, and hence of treatment success as well. They can also reduce the length of hospital stays, and as a result, the overall cost of treatment.¹ Novel clinical procedures and processes can also have a positive effect on medical staff – by reducing the workload, or promoting the flow of information and knowledge sharing along the treatment chain, for example. Ultimately, no service providers want to be the last ones in their region to offer diagnostic and therapeutic capabilities that are being touted by all of their competitors. Therefore, navigating this challenge requires an outcomes-based investment strategy for acquiring the new equipment necessary to remain competitive, along with a fleet management approach

to ensure that each new investment continues to provide clinical value throughout its lifetime.

Implement Patient-Centered Process Innovations

Companies that systematically focus on innovation in products, services, business models, and customer targeting grow more quickly, generate more revenue, and are more successful.² The same goes for healthcare providers, for whom innovation has become a key success factor. So, just like companies in the

“ HOSPITALS THAT MAKE THE LEAP TO A SERVICE-LINE ORIENTATION BECOME MORE PRODUCTIVE, IMPROVE THEIR QUALITY OF CARE, RECRUIT PHYSICIANS MORE EFFECTIVELY, AND BUILD MARKET SHARE ⁸ ”

business and academic sectors, hospitals benefit from participation in innovation networks as well. To be able to offer patients new treatment options, they need access to new medical procedures. A particular challenge for companies across all industries is how to create appropriate structures for innovation and develop an effective innovation culture. Healthcare providers with a strong culture of innovation that runs through all business sectors, and promotes ingenuity and knowledge sharing, are especially successful. Moreover, communication and a consistent, comprehensive implementation strategy have a strong influence on the success of an innovation.

Include Clinician Leadership in the Top Tiers of Management

Innovations that are removed from patients, such as improved logistics and accounting processes, may represent very sound, sensible investments. However, these innovations contribute less to building a good reputation or a strong competitive position for a hospital than innovations that directly contribute to improving clinical capabilities.³ While it is increasingly being recognized that clinician leadership within hospitals is not only beneficial, but essential, to ensuring that hospitals implement the kinds of patient-centered innovations that are needed to remain competitive, increasing such leadership can remain an elusive goal. When institutions make investment decisions, the focus is often more on the purchasing costs and return on investment (ROI) rather than their impact on patient outcomes, patient safety, and employee satisfaction. In order to identify and implement promising innovations with beneficial effects on clinical capabilities, physicians and business leaders must align each other's competencies to establish a qualified, shared decision-making process. This enables traditionally more numbers-oriented managers to develop a necessary understanding of the mindset and needs of their medical departments – and vice versa.

Pursue Innovation in eHealth

Electronic medical record digitization is transforming the flow of information and access to healthcare services – with corresponding implications for patient outcomes and treatment costs. The emerging



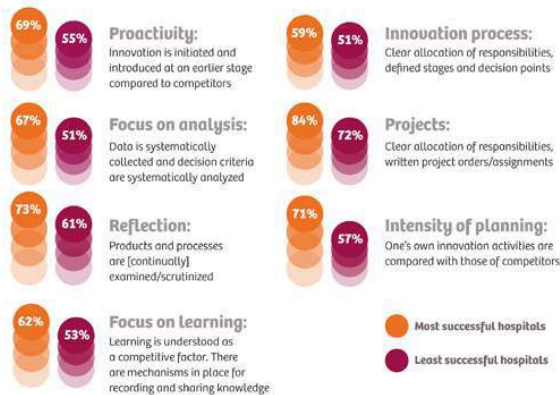
telemedicine market provides underserved rural populations in emerging countries with access to medical expertise for the first time.⁴ Furthermore, telemedicine has proven to contribute to improvements in diagnosis and treatment for aging populations⁵ and chronically ill patients.⁶ Suitable partners for hospital operators can also come from other industries, such as the retail, technology, telecommunications, and consumer products sectors, and can often innovate at a faster pace than traditional healthcare companies, with lower costs.

Improve Outcomes through Innovative Service Delivery Models

Integrated care programs have the potential to more adequately respond to the comprehensive needs of people with multimorbidities by taking a holistic approach, while making efficient use of resources. Such programs are characterized by patient-centered, proactive, and coordinated multidisciplinary care, using new technologies to support patients'

Innovation Leads to Success

Research by Kiel University shows that commercially successful hospitals are more systematic about cultivating a culture of innovation than their less successful competitors.¹²



self-management and improve collaboration between caregivers.⁷ The program shows that improved treatment results don't necessarily require groundbreaking technical innovations. Instead, significant progress can often be made through targeted knowledge and information exchange as part of an organizational innovation.⁷

Consider Specialization Instead of Diversification

A critical mass of patient cases is a prerequisite for capability advancements in any institution. Diseasespecific competency centers or service lines support hospitals in becoming established as clinical opinion leaders, recruiting highly qualified staff, and investing more successfully in technical equipment. Experience derived from managing a large number of cases can also increase clinical capabilities and thereby improve patient outcomes. One way that hospitals can effectively attract more patients and enhance their clinical experience and capabilities is to organize themselves by service lines in strategically defined clinical areas. By developing a focused service-line strategy, hospitals can also free up additional financial resources, which can then be redirected to further improve their clinical capabilities in key areas with investments in modern, patient- and user-friendly technical equipment and/or innovative services and care concepts.

Cultivate Opinion Leaders to Drive Patient Demand, Attract Qualified Staff, and Enhance your Institution's Reputation

Opinion leaders represent an often untapped resource for hospitals to ensure that patients receive medical care based on the best evidence. They can have a significant influence on whether (and how quickly)

innovations are implemented in clinical practice for the benefit of patients. As respected and well-connected sources of information, they can serve as a bridge from bench to bedside to span the knowledge-translation gap, through the early adoption of new evidence and subsequently influencing the majority of practitioners in a clinical group. Although full-service general hospitals are still the mainstay of acute-care delivery in most countries, this tradition is undergoing a revolution in the U.S., among other places. Immense clinical complexity, growing competitive intensity, and the advent of performance transparency for evaluating quality, service, and costs are challenging the notion that any hospital can excel across a broad spectrum of clinical service lines.⁹ Even if generalists won't disappear entirely, focusing on a few clinical service lines can help hospitals compete, while also improve operations, raise clinical quality, and enhance service in their communities.

Ways to Identify Opinion Leaders

- Regionally or nationally recognized celebrity
- Leadership survey within a group
- Staff-selected (based on group observation)
- Positional merit (currently in leadership position)
- Identified by experts within a community
- Identified by select community members
- "Snowball method": potential leaders identify other potential leaders
- Sociometric (interview majority of group community members to identify leaders)
- Sample sociometric (interview random sample of group/community members to identify leaders)

The key to commercial success is being more systematic.

Percentage of Clinically Trained Managers by Country



Physicians and businesspeople must align each other's competencies to establish a qualified shared decision-making process. (Source: McKinsey & Company10)

In a Nutshell:

Seven innovation strategies to extend clinical capabilities

Invest In Clinical Technology to Improve Outcomes and Expand Services

Innovative medical technology directly influences clinical capabilities. Service providers need an outcomes-based investment strategy designed to advance their clinical capabilities, and a fleet management approach that supports state-of-the-art, outcome-based medicine.

Use Patient-Centered Process Innovations to Expand Clinical Capabilities

Process innovations that are close to the patient, and in the field of care, help increase patient and employee satisfaction as well as treatment and process quality, and hence a hospital's reputation and market success.

Include Clinician Leadership in the Top Tiers of Management

To synchronize innovation budgets and clinical capabilities, medical and business management teams should interact as equals.

Pursue Innovation in ehealth

Electronic medical record digitization is transforming the flow of information and access to healthcare services, with corresponding implications for improving patient outcomes and reducing treatment costs.

Improve Outcomes through Innovative Service Delivery Models

Integrated care programs have the potential to more adequately respond to the comprehensive needs of people with multimorbidities by taking a holistic approach, while making efficient use of resources. Consider Specialization Instead of Diversification Disease-specific competency centers or service lines support hospitals in becoming established as clinical opinion leaders, recruiting highly qualified staff, and investing more successfully in technical equipment.

Cultivate Opinion Leaders

Opinion leaders represent an often untapped resource for hospitals to ensure that patients receive medical care based on the best evidence. They can have a significant influence on whether (and how quickly) innovations are implemented in clinical practice. Furthermore, they bolster a service provider's reputation, attracting high-quality staff, as well as patients.



Read the QR-code to watch a short video introduction about the topic of clinical capabilities strategies on YouTube.



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Four Steps Within Your Stride

Surprising Insights from Implementing Value-Based Care Delivery



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Around the world, value-based care delivery is gaining adherents (New Zealand Ministry of Health 2016; King's Health Partners 2016). Improving value—health outcomes that matter to patients for the cost of delivering those outcomes—is now widely recognised as a critical objective of health care reform. Since the publication of *Redefining health care* (Porter and Teisberg 2006), the concept of value has gone from being criticised as “a utopian vision” (Reinhardt 2006) to being viewed by leaders as a strategic priority.

How do organisations redefine care to dramatically improve value for patients? In nearly a decade implementing value-based care worldwide, we have found that when leaders set the compass—establishing value for patients as the unequivocal goal—they create a powerful cultural shift, inspiring care teams and renewing the professional calling of those in health and healing.

But what happens next? Inspirational objectives inevitably lead to the question of “How?” We've observed four steps that organisations seeking to redefine care delivery work through, albeit in varying orders, at different paces and to different degrees. Taking these “steps within your stride” transforms an organisation in the direction of higher value services for patients without heroic leaps.

Step One: Measure Results

The adage that what isn't measured won't improve is widely accepted. That makes medicine's dearth of systematic outcomes measures unusual, possibly even unique. Its oddity is compounded by the mandated reporting of long lists of process and input measures (Teisberg and Wallace 2015a). Although clinicians routinely ask patients how they are feeling, learning from feedback about patients' results is slowed by failing to systematically collect outcome data. The presumption becomes that patients who say thank you must have good results, though they may simply have good manners.

While anecdotal reporting of results slows learning, systematically collecting outcome data enables insights that have dramatic implications for care delivery. In fact, many value-based care transformation projects begin when a clinician starts measuring a discrete, meaningful set of outcomes (Teisberg and Wallace 2015b; ICOHM 2015). One striking example comes from our work with an administrator, who started his value journey by measuring the mortality rate of serious trauma patients brought to his rural urgent care centre to be stabilised before being transported to a trauma centre about an hour away. Approximately 90 percent of those patients died, compared to about 40 percent of the people taken directly to the trauma centre. That simple, shocking measurement drove an

immediate change in practice and a quest to dramatically improve care for his organisation's patients.

Measurement-enabled insights commonly surprise in two ways. First, outcomes unmask faulty assumptions. In the trauma case, patients' results didn't match clinicians' assumption that stabilising patients increased their chances of survival. Actual results about transported patients were not known. Second, outcomes measurement supports professionalism. When they know their patients' results have improved, clinicians usually experience unexpected professional pride and satisfaction. Not surprisingly, one meaningful measurement effort often leads to the next.

Step Two: Document Care Paths

Most care delivery organisations presume that they follow consistent care delivery processes for patients with the same medical circumstances. Often, however, very similar patients are treated vastly differently without a medically-based justification (Wennberg 2002). In practice, many models of care exist for any given set of patient circumstances (Dartmouth Atlas of Health Care 2017), though most organisations are surprised by their lack of shared norms. Understanding how care is actually delivered to your patients is a critical step within your stride toward value-based care delivery. The goal is to create a shared understanding by identifying

and discussing how your organisation cares for patients with medical and social circumstances you frequently encounter.

Identifying care paths exposes discrepancies in care, uncovers redundancies and leads to debate about improving practices. Like faulty care assumptions, waste and redundancy are often surprises; these activities would have been previously addressed if they'd been obvious before the explicit discussion of care paths. Care path identification also enables analysis of costs and reveals ways to reduce them. Beyond internal analysis, care path identification facilitates comparison to other organisations' good practices to inform ongoing improvement.

Care path identification can be challenging because of discomfort about standardisation. A care path for a medical condition should be a reality check, not a straitjacket. Professional judgment can and should still be applied and variations can then be analysed to drive learning and improvement. Intermountain Health Care's Dr. Brent James, an early pioneer in documenting care paths, advocates permitting clinicians to vary from the standard path as long as they measure and report patient outcomes. Identifying differences and determining which paths improve patient outcomes fuels innovation (James 2014).

Step Three: Create Teams

The essence of value-based care delivery is a team that integrates delivery across the full cycle of care, or an integrated practice unit (Porter and Teisberg 2006). The team works together, shares patients, learns together and drives improvement in its patients' outcomes. Before most organisations can implement integrated practices, they need to establish teams.

Clinicians often describe themselves as members of teams and are surprised to realise they really work within groups that lack the key characteristics of teams. Teams share specific objectives of their work, trust one

another, communicate consistently and effectively, and measure results together (Osarogiagbon et al. 2016). Building teams that learn together improves professional engagement by focusing on working together toward meaningful goals. This potent antidote to burnout is a very welcome surprise.

Teams that function well together quickly reach the issue of sharing payment, making bundled pricing of services a challenging but natural step rather than a daunting leap. Some services or activities that aren't directly reimbursed can improve patients' outcomes and lever clinicians' time. Bundled payments enable teams to incorporate these previously uncompensated (and previously precluded) activities by providing the team greater flexibility in allocating care resources. In many cases, the extra services are delivered most effectively and efficiently by a non-traditional caregiver such as a coach or patient-accompanier.

Step Four: Engage in Human-Centered Design

Most healthcare services are organised around providers and their training, rather than around the needs of patients. While each patient is unique, those with Type 2 diabetes, for example, have relatively predictable needs and typically require a collection of services from endocrinology, cardiology, podiatry, and retinal care, to name just a few specialties. Typically, patients bear the burden of organising and coordinating the many dimensions of their care. If the fast food sector followed healthcare's structure, lunch might require visits to three separate restaurants to get a burger, fries and a drink.

Leading care delivery innovators recognise that making care dramatically more effective requires restructuring services to be more convenient and efficient for patients. Often efforts intended to make care more patient-centric are well underway before surprised team members slap their foreheads as they recognise the need for patient perspectives on what happens outside of the clinical environment.

Both the Carolinas Health Care System and Dell Medical School have established teams of human-centred design experts to understand the patient perspective directly, identifying and addressing the unmet needs, obstacles to health and gaps in care that negatively impact patients' health in a given condition. Efforts led by clinical teams are then informed by insight about the patient experience outside of the embrace of medical care, which is a critical factor to improving health outcomes.

Start Stepping

The early steps on any journey depend on the starting point. Consider your organisation's strengths and start with the step that best uses those advantages. Not surprisingly, starting from strength enables early wins, and success energises momentum.

KEY POINTS



- ✓ Implementing value-based care delivery requires senior leadership commitment to creating value for patients
- ✓ Improving value hinges on measuring outcomes that matter most to patients
- ✓ Documenting care paths establishes best practices and uncovers variation
- ✓ Teams that integrate delivery across the full
- ✓ cycle of care and learn together are the essence of value-based care delivery
- ✓ Care redefinition has to focus on solutions for needs as patients experience them



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For full references, please email edito@healthmanagement.org or visit the website <https://iii.hm/8b1>

Five Reasons Why Value-Based Healthcare is Beneficial



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Patient-centered care is becoming a major topic in healthcare. Many initiatives have begun focusing their care around patients and their medical conditions. This requires focusing on patient value (Porter and Teisberg 2006). When focusing on value for patients, a few challenges may arise. Firstly, the meaning of value for patients varies widely among stakeholders in healthcare. Secondly, not all patients receive the same treatment for the same illness. Patients (and their families) want to be treated differently based on their preferences. Thirdly, the quality of care delivery in terms of patient relevant outcomes differs among hospitals. The diversity in measurements makes it difficult to compare.

I. Patient Value: A Common Definition

Doctors would base the meaning of patient value on the skills of a doctor, an improved medical lab result, or a well-performed surgery. These measurements are mainly based on the treatment or intervention perspective. On the other hand, a patient may base patient value on aspects such as the length of waiting lists, how kind the doctor was or perhaps how good the coffee or breakfast tasted. Most people would agree that both sets of measurements do not truly reflect the quality of care from a medical perspective.

Patients' perception: "They were so kind to me when performing the surgery seven times."

II. A Singular Language

Value-based healthcare provides a singular language that is comprehended by doctors, medical teams, patients and their families. Patient value is defined by an equation whereby patient-relevant outcome measurements are the numerator, and costs per patient in delivering those outcomes are the denominator. Patient value is defined for a specific medical condition over the full cycle of care (**Figure 1**).

Meetbaar Beter (winner of the VBHC Prize 2014) is a great example that transparently reports patient-relevant outcome measurements for specific medical conditions. They include coronary artery disease, atrial fibrillation, aortic valve disease and combined aortic valve disease and coronary artery disease (Meetbaar Beter 2012-2016). It is important to note that outcome measurements should be defined around a medical condition and should be manageable and actionable. Doctors and their teams are then intrinsically motivated to improve the quality of care they deliver to patients. All they need are the tools to measure and the ability to visualise accurate and valuable outcomes.

III. Focused on Measurable Health Outcomes To Facilitate Improvement

Measuring outcomes in healthcare began in the 1950s (**Figure 3**), followed by a strong trend towards process and structure

measurements. Some of the measurements focused on at that time were the length of waiting lists and the number of (certified) staff. This led to quality management based on the optimisation of processes, including Lean. All of these measurements are important in improving the internal process of care delivery. Patient and family perception only became important from a measurement perspective in the 1990s. Surprisingly, the healthcare sector took quite some time in realising the significance of patients in healthcare delivery. Luckily, healthcare providers are now able to present true patient-relevant outcome measurements to their colleagues and patients.

One of the most inspiring examples of improving measurable health outcomes is the Martini Klinik at the University Hospital Hamburg-Eppendorf (UKE) in Germany. Since the founding of the clinic in 2005, the Martini Klinik has focused on improving long-term health outcomes for patients with prostate cancer. The Martini Klinik massively improved their care by measuring patient-relevant outcomes (**Table 1**). The improved outcomes led to growth in volume and the Martini Klinik became the world's largest prostate cancer care clinic by 2013. It later received the VBHC European Inspirational Award in 2016 based on these inspiring results.

A second example is Meetbaar Beter. Meetbaar Beter has helped doctors learn from one another and improve care delivery based on reported outcomes. Over the last few years,

impressive effects on patient-relevant outcomes have been achieved by looking at and learning from fellow cardiologists and cardiovascular surgeons.

IV. Protocols Do Not Fit Every Patient, But Patients Benefit From Protocols

Every patient is unique but they each walk a different path through the cycle of care. Protocols are very useful as they provide care delivery guidelines for patients with common medical conditions. In the St. Antonius hospital (winner of VBH C Cost-Effectiveness Award 2016), elderly patients with end-stage renal failure are guided towards their choice of treatment. Previously, protocols stated that patients with this medical condition should primarily be treated with dialysis. Dialysis is highly invasive (and costly) for elderly patients and it requires them to remain in hospital for long periods of time. Research made by Dr. Willem Jan Bos and his team found that conservative treatment is much better than dialysis (Verberne et al. 2016). By having discussions with patients, protocols can be changed and care delivery can be optimized and adjusted to fit every individual.

The Care Delivery Value Chain Breast Cancer Care

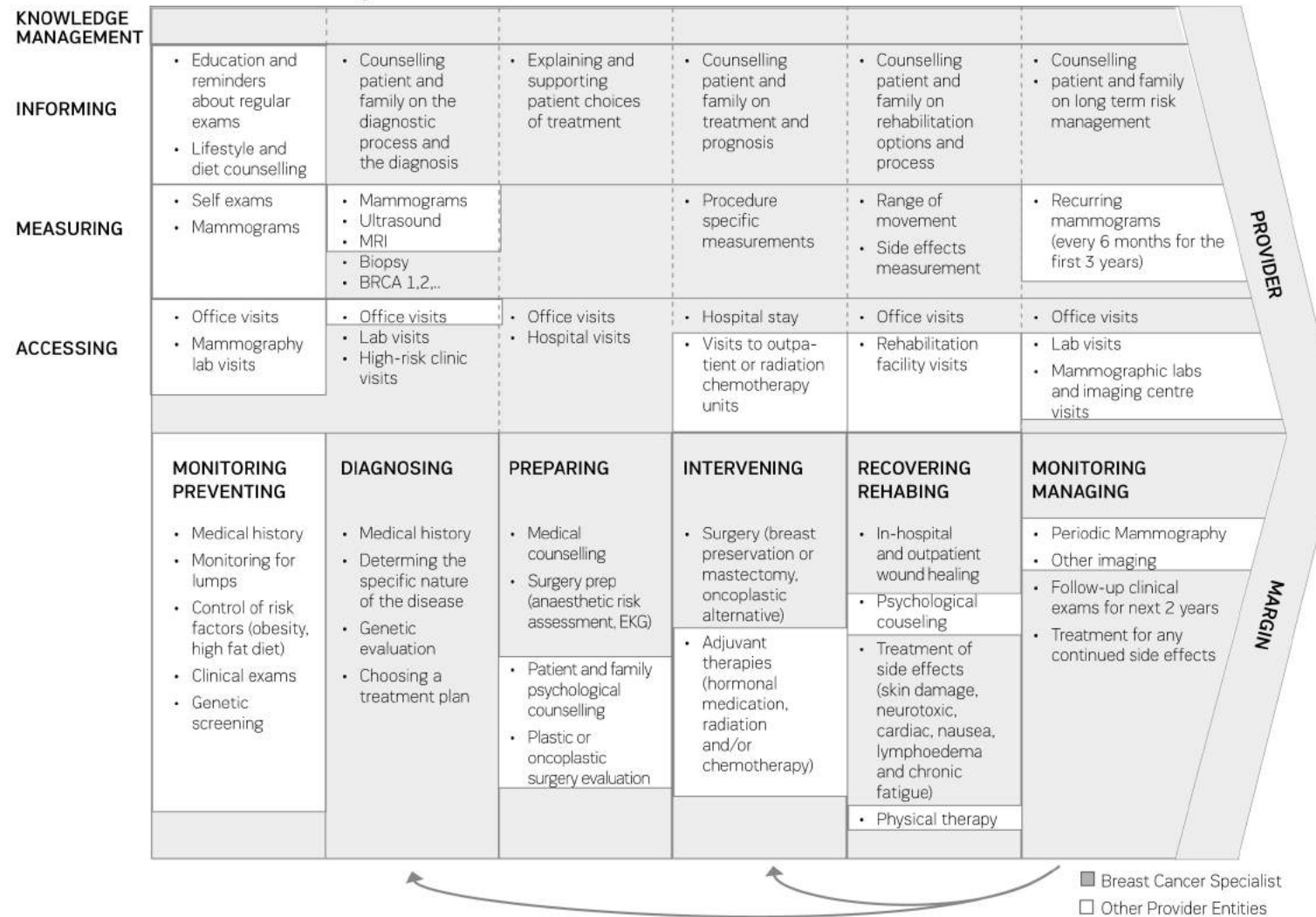


Figure 2. The Care Delivery Value Chain for Breast Cancer Care provides an overview of the care activities around breast cancer patients (Porter 2006) Reproduced by permission.



Figure 1. Patient value determined by the ratio of patient relevant outcome measurements to the costs per patient over the full cycle of care (Porter 2010)

Historical development of measurement in healthcare over the past 60+ years

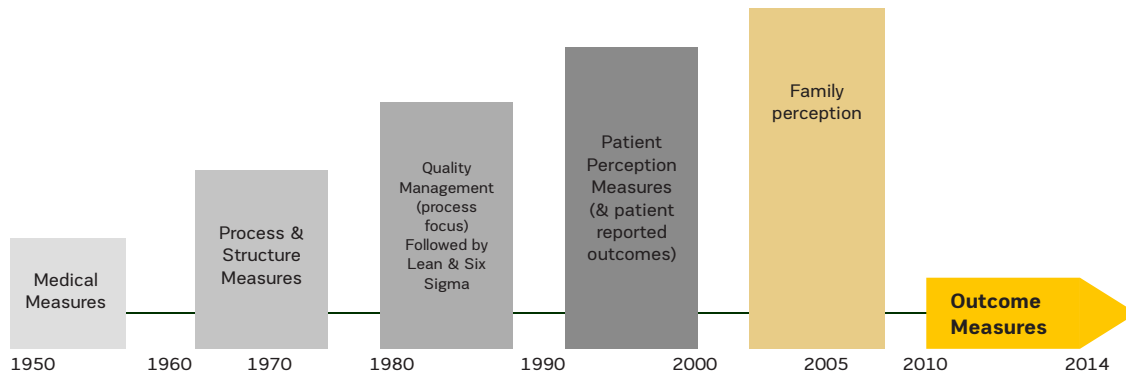


Figure 3. Historical development of measurements in healthcare. Started with medical measurements, followed by process and structure measurements, then quality measurements. Patient and family perception came into perspective in the 1990s. Currently, healthcare measurements are focusing on outcomes relevant for the patient (Van Eenennaam 2016)

“The Netherlands really is a remarkable example of what a country can do if the right culture, attitude, mindsets and knowledge base are really applied to actually changing how we deliver health care rather than just adding patches and bandages to try to stop the bleeding.” Prof. Michael E. Porter (Honorary Chairman of VBHC Prize 2014-2017) (Value-Based Health Care Europe 2016)

Results	German average	Martini Clinic
Fully continent ¹	56.7%	93.5% ¹
Severe incontinence ²	4.5%	0.4%
Severe erectile dysfunction (1 year) ³	75.5%	34.7%
Ureteral injury	0.6%	0.04%
Sepsis	2.5 %	0.04%
Pulmonary embolism	0.8%	0.1%
Delayed wound healing	1.7%	0.9%
Rectal injury	1.7%	0.2%
Thrombosis	2.5%	0.4%

Table 1. Patient-relevant outcome measurements of prostate cancer care at the Martini Klinik versus the German average. Source: Martini Klinik martini-klinik.de/en/results

“No protocol fits every patient and no protocol perfectly fits any patient.” James Brent (Bohmer et al. 2002).

1. Definition of fully continent: incontinence pads are unnecessary or are only used for safety
2. More than 5 incontinence pads per day
3. Including patients suffering from erectile dysfunction previous to the operation

V. Become a Patient-Centred, Fast-Learning Team

Value-based healthcare is centred around learning. Doctors who have a drive to show medical leadership and create a learning culture are key for the implementation of VBHC. Learning to improve value for patients provides satisfaction. This motivates doctors and their teams and also cuts costs. VBHC empowers doctors and their teams to do what they do best—provide excellent patient-value by using clinically relevant and evidencebased insights.

Creating Excellent Patient Value

- Patient-centred care is on the rise;
- VBHC provides a common definition for patientvalue and a common language for all stakeholders in healthcare;
- VBHC puts the patients, their families, doctors and their teams at focus;
- Patients with similar medical conditions have different preferences and they each follow roughly similar care-paths;
- Care quality improves by measuring the right patient relevant outcome measures. This creates compelling learning cycles for the medical team.

Working towards excellent patient value has never been more optimistic than it is today!



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International Value-Based Healthcare

Cross-Collaboration First



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Globally Comparing Outcomes for Pulmonary Sarcoidosis

Pulmonologists have started comparing treatment outcomes for pulmonary sarcoidosis patients among hospitals internationally. Participating hospitals collect, exchange and discuss their outcomes with the aim to identify best practices. The study was initiated by Prof. Dr. Jan Grutters, pulmonologist at St. Antonius Hospital in the Netherlands. An international team of pulmonologists was set up with leading experts regarding pulmonary sarcoidosis. In addition to St. Antonius, five other centres of expertise are participating: the Cleveland Clinic (USA), the Erasmus Medical Center (Netherlands), Royal Brompton Hospital (UK), the University of Cincinnati Medical Center (USA) and the University Hospital Leuven (Belgium).

“ FIRST EXAMPLE OF
AN INTERNATIONAL
IMPLEMENTATION OF
VALUE-BASED HEALTHCARE ”

Sarcoidosis is a rare immune disease involving the lungs and thoracic lymph nodes in approximately 90 percent of patients. Severe fatigue is one of the most common complaints in this patient group. No cure exists and treatment aims mostly for symptom relief and suppression of inflammation. As sarcoidosis is a rare disease,

limited data is available—for instance from randomised clinical trials (RCTs)—on the effect of treatments. Pulmonologist Daniel Culver from the Cleveland Clinic sees value in collaborative efforts. “Assessing quality in complex chronic diseases has been elusive in many cases, especially when there is significant heterogeneity among patient phenotypes, lack of evidence to guide care pathways, and imprecise techniques to measure disease burden,” he says. “Process measures rather than outcome measures, may be easy and tempting to collect, but do not necessarily provide true insights into value differences between competing therapeutic strategies or medical systems. For pulmonary sarcoidosis, an orphan disease, it is especially important that collaborative efforts be at the forefront of defining expected outcomes and responsiveness to change of the various proposed clinical indicators. Since there is significant population heterogeneity and different approaches to therapy, pooling multiple centres provides added power and better capacity to compare the value of techniques.”

The project is the first example of an international implementation of value-based healthcare (VBHC). Based on transparently sharing treatment outcomes of routine clinical care, the hospitals can learn from each other and improve patient value—defined as outcomes relative to costs (Porter et al. 2013; 2016). Moreover, these results

provide valuable input for further scientific research. As stated by Prof. Dr. Wim Wuyts, pulmonologist at the University Hospital Leuven: “It is very important for rare diseases that large centres bring together their experience. When evaluating a larger patient group, it is possible to significantly improve the diagnostics and the treatment of these complex conditions in the future.” The project started in 2014 with defining an international standard set of treatment outcomes. In 2015- 2016, data on these outcomes were collected retrospectively and first results were discussed in September 2016. Discussion of outcomes by the participating hospitals has already led to relevant insights on treatment differences between centres internationally.

Pulmonary Sarcoidosis

Sarcoidosis is a rare disease that can have high impact on the patient’s quality of life. It is a granulomatous disease of unknown aetiology, most commonly affecting young and middle-aged adults. Spontaneous remissions occur in about two-thirds of patients, but the disease course is chronic in 10 to 30 percent of patients (Costabel et al. 1999). Incidence and prevalence rates reported in the literature vary globally. Prevalence shows differences over geographical regions as well as ethnic groups, with the highest sarcoidosis prevalence reported in the Nordic countries and in African-Americans (Milman and Selroos 1990; Costabel et al 1999). Sweden has a prevalence of 160 per 100,000. Moreover,

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the incidence of sarcoidosis studied during the period 2003 to 2012 in Sweden was 11.5 per 100,000 per year and ranged by -10 percent to 30 percent, depending on the exact definition of the disease (Arkema et al. 2016). Sarcoidosis-related mortality is reported to be up to 7.6 percent in a US based population (Swigris et al. 2011). Most deaths are due to pulmonary fibrosis, neurologic and cardiac involvement (Costabel et al. 1999).

“ CLINICIANS NEED BETTER GUIDANCE ON WHAT TO MONITOR AS THEY FOLLOW THEIR SARCOIDOSIS PATIENTS ”

Patients suffer from a broad range of nonspecific symptoms, showing high variability regarding the inflammation level. Sarcoidosis is a condition that can occur anywhere in the body. In more than 90 percent of cases, sarcoidosis affects the lungs (Baughman et al. 2012). Severe fatigue is one of the most common complaints in this patient group (de Kleijn et al. 2009; Drent et al. 2012).

Treatment of Pulmonary Sarcoidosis

Despite advances since sarcoidosis was first described, much remains unknown regarding the aetiology of the disease. Due to the heterogeneous clinical manifestation, treatment can vary from no treatment to thorough follow-up with a variety of medications. The appropriate treatment for pulmonary sarcoidosis patients has not been well defined (Costabel et al. 1999). As stated in the Sarcoidosis Statement Committee,

the symptoms that need corticosteroid therapy remain controversial. In order to tailor treatment well to the individual level, the availability of centre-specific outcome data has the potential to provide important advantages for quality improvement efforts.

Dr.Elizabeth Renzoni, pulmonologist at the Royal Brompton Hospital, adds that “This unique project provides the opportunity to compare diagnostic and management modalities between different international expert centres, anchoring these practices against outcome. For example, there are differences between the participating expert centres also in the use of certain diagnostic modalities such as PET scans to assess sarcoidosis activity, and it will be very interesting to assess how this impacts differences in corticosteroid use and outcomes. Because of the wide heterogeneity in presentation, organ involvement and disease severity, it is only through analysing outcomes in large groups of patients that the observed differences in diagnosis and management between expert centres can lead to improvements in patient care.”

Definition of the Patient Population

The standard outcome set was designed specifically for pulmonary sarcoidosis patients. In order to be able to compare treatment outcomes among hospitals, not only the outcome measure and initial conditions need to be defined, but also a clear and uniform definition of the patient population itself is needed. The patient group is defined in line with the joint statement

on sarcoidosis (Costabel et al. 1999). The international team acknowledges sarcoidosis is a very heterogeneous population. Therefore, it was decided there has to be pulmonary involvement, as 90 percent of sarcoidosis patients show pulmonary involvement. Specifically, the patient has to be:

- Diagnosed with pulmonary sarcoidosis
- The diagnosis has to be performed by a pulmonologist (based on the joint statement on sarcoidosis)
- Extra-pulmonary sarcoidosis is not excluded

Standard Set of Outcomes

The pulmonologists from the six centres of expertise worked from early 2014 to early 2015 on the definition of an international standard set of outcomes measures for patients with pulmonary sarcoidosis. Prof. Robert Baughman, pulmonologist at the University of Cincinnati Medical Centre reports that “Value-based care has improved the outcome of patients with various conditions. Clinicians need better guidance on what to monitor as they follow their sarcoidosis patients. This initiative will collect information from centres across the world and determine the value of various markers of this multi organ disease.”

The team convened in a combination of face-to-face meetings, webinars and surveys. A systematic approach was used based on the principles of value-based healthcare (Porter 2010) and the methodology introduced in heart care by *Meetbaar Beter* (Meetbaar Beter 2013). First, a detailed description of the

care delivery process for pulmonary sarcoidosis patients was created, providing an overview of 'value' created by all specialties involved throughout the entire care chain. Combined with a literature review, this was used to create a list of all potentially relevant health outcomes for pulmonary sarcoidosis patients. In order to end up with a concise and feasible set of outcome measures, the most important outcomes were prioritised anonymously by all team members based on three criteria: impact of the outcome on quality of life, impact of quality of care on the outcome and the number of patients affected by the outcome. As a result, the standard set combines both clinical outcomes, such as mortality, symptoms and side effects, with patient-reported outcomes, such as quality of life. Discussions were organised to reach consensus on the final outcome set. Following a similar process, the most relevant initial conditions were selected in order to allow corrections for the complexity of the population.

Standard Set for Pulmonary Sarcoidosis

A final standard set of 7 outcomes (Table 1) and 15 initial conditions was identified. Some items from the final outcome set are not yet systematically measured as a part of routine clinical care. For example, the King's Sarcoidosis Questionnaire (KSQ) (Patel et al. 2013) and the Fatigue Assessment Scale (FAS), more often used for pulmonary sarcoidosis patients (de Vries and Drent 2007), have been measured prospectively in each centre starting early 2017.

"For pulmonary sarcoidosis, there is consensus on the standard set of outcomes," reports Frouke van Beek, pulmonologist at the St. Antonius Hospital: "We not only measure the effects of treatment on, for example, lung function, but also quality of life, patient's weight changes and whether osteoporosis occurs as a result of certain medication. By sharing our data, we will be able to learn what the best outcomes are of our treatment decisions, as there are many difficult decisions to make during everyday care for our patients. This approach can give us pulmonologists important new information on

Outcome set	Category	Details	Timing	Data Source
1. Mortality	Longitudinal Outcomes	Date of death	Tracked throughout	Administrative
2. Pulmonary function test (PFT)	Clinical monitoring	1. FVC % predicted and absolute over treatment period 2. FEV % predicted and absolute over treatment period 3. DLCO % predicted and absolute over treatment period	Every 3-6 months (depending on severity of sarcoidosis)	Clinical
3. Quality of Life; physical functioning	Patient-reported health status	King's Sarcoidosis Questionnaire (KSQ) and the (FAS)	Every 6 months	Patient reported
4. Activity marker in blood reduction: sIL2R	Clinical monitoring	1. Date measurement 2. sIL2R (measured in pg/ml, limit >3000)	Every visit to the clinic	Clinical
5. Weight	Clinical monitoring	Weight in kg measured at each PFT	Every visit to the clinic	Clinical
6. Clinical Outcome Status (COS) (Baughman et al. 2011)	Longitudinal outcomes	1. = resolved never treated 2. = resolved, no therapy >1 year 3. = minimal disease never treated 4. = minimal disease no therapy > 1 year 5. = persistent-no current therapy, never treated 6. = persistent-no current therapy, no therapy > 1 year 7. = persistent-current therapy, asymptomatic 8. = persistent-current therapy, symptomatic 9. = persistent-current therapy, worsening prior year 99. = unknown	After 2 years and or 5 years	Clinician evaluation/ administrative
7. Osteoporosis caused by medication	Clinical monitoring	Diagnosis T-score 1. = Normal >-1.0 2. = Osteopenia <-1.0, >-2.5 3. = Osteoporosis <-2.5 4. = Severe osteoporosis <-2.5 plus fragility fractures 5. = not indicated Based on WHO Osteoporosis Classification (Czerwinski et al. 2007)	Monitor throughout treating the patient	Clinical

Table 1. Summary of Standard Set of Outcomes for Patients with Pulmonary Sarcoidosis

best practices in specialised centres around the world. Especially as sarcoidosis is an orphan disease and is very heterogeneous it would take a long time for a single centre to collect sufficient data from which reliable conclusions can be drawn.”

First Result

Preliminary results were discussed in September 2016 and have already led to several hypotheses for improvements in care delivery, such as better monitoring and treatment of osteoporosis, an important and frequently occurring complication in patients with pulmonary sarcoidosis due to long-term and high dosage of corticosteroids. We also observed that in all centres it concerns an adipose patient group and in some centres obesity is very common. Further analysis on corticosteroid use and weight changes over time is ongoing. Dr. Marlies Wijsenbeek, pulmonologist at the Erasmus University Medical Center adds that “though one should be cautious with interpreting retrospective data, these data give insight in the differences in clinical practices and underline the heterogeneity of patients with sarcoidosis and their responses to therapy. It is unique that six centres of expertise transparently compare their practices and outcomes, and in the next prospective phase also importantly incorporate the patient’s perception of his or her health status. Not only will this hopefully result in better care for patients, but also the project may potentially generate new insights for future clinical trial design in sarcoidosis. In a disease with no cure and arguable long-term benefits of the current treatments, research is much needed.”

Conclusions

Applying value-based healthcare in pulmonary sarcoidosis is very promising. Even though the data needs to be further analysed, a first international implementation of VBHC has been realised. For the first time treatment outcomes for a specific disease have been measured and compared internationally for routine clinical care. Preliminary results have already lead to new insights with relevant impact on care delivery in the participating centres. CEO at the St. Antonius Hospital, Prof. Dr. Douwe Biesma, states that “measuring and improving patient-relevant outcomes is a central part of the strategy of the St. Antonius Hospital and the collaborating centres. The Dutch funding agency ZonMW has made this scientific research regarding the implementation of VBHC possible. For the current study we will be able to learn whether the VBHC approach is also applicable in an orphan chronic disease such as sarcoidosis.”

KEY POINTS

- ✓ First international implementation of VBHC
- ✓ Internationally comparing outcomes for pulmonary sarcoidosis patients with colleagues in 6 clinics (USA, UK, NL, BE)
- ✓ Promising approach for a rare, and in some cases a chronic, patient group in an area where there is a paucity of data from RCTs



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Does More Value Naturally Lead to Better Care?

Value-based healthcare (VBHC) starts with the patient and uses patient-oriented outcomes to improve care. Not everything can be expressed in figures: psychological and sociological factors play a role as well. The medical-industrial complex does not always benefit from VBHC, which is the reason why the different interests are not always advantageous to the patient. With an approach that starts with the patient and with the help of patient advocates it will be possible to change care into a direction that benefits the patient. VBHC is an important means with huge added value.



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Once I asked an economist if he thinks that an economic model can predict tomorrow morning's economy better than the meteorologist tomorrow's weather. In the discussion that followed it became clear to me that we have allowed mathematics and its figures to become too dominant. In reality there is more than only digits. There are citizens with their behaviour, events that influence those same citizens and so on. We should consider all this and then we are in the weatherman's neighborhood. We do not do this, for in our model we have created a reality and in that reality we are right. That feels safe.

Thinking of Michael Porter's article on value in healthcare and the discussion with the economist I will try in this article to show the importance of value-based healthcare (VBHC) from the patient's perspective. To come straight to the point: VBHC is good, has value for the patient and deserves our attention and effort, with due regard for the resistance against it. The largest opponents of VBHC come from the medical-industrial complex, the joint effort of patient organisations, doctors, scientists, industry, government and healthcare insurers. And strangely enough there is no evil intent. If this were the case, we could do something about it more easily. Fortunately there is a solution and it lies with the patient. The solution is difficult and

requires stamina. But it has to be done, for the benefit is worth it.

VBHC we can do it well.

In short VBHC means that:

- In consultation with the patient one illness is chosen (to start with). Transferring a complete hospital into VBHC all at once does not work. As an example: "prostate cancer and the manner of operating (prostatectomy)"
- A team is built consisting of the right combination of knowledge, involvement and experience required to get the best result
- It is researched well how this can and must be done and the patient's wish and interest gets priority. It is required to discuss with the patients how they see it and want it to be done
- You start as soon as you have the feeling that the first steps can be taken and not when everything has been worked out up to three decimal positions
- You use 'patient- and medical-reported outcomes' and improve all this in recurring cycles. There is continuous improvement and this also means that the team can or has to be adjusted.

Patient-Centered Value-Based Healthcare in Practice

At the Martini-Klinik, a private clinic of the University Hospital Hamburg-Eppendorf in Hamburg, Germany (martini-klinik.de/en/for-patients), they prove that patients with prostate cancer become impotent and incontinent less often as a result of the operation technique they use, with fewer complications that cause a large decrease in quality of life. The consequences of the operation technique in the Martini-Klinik are dozens of percentages less impotence and incontinence. This is the result of continuous improvement of the procedures and techniques. It is a pity that opponents of specialisation of healthcare immediately question the improvement figures to postpone the solution for the patient and to safeguard their own interest, which is that the treatment has to stay within their own clinic. The specialist has to be able to carry out his work in the same way and the money has to keep flowing into the same direction. The Martini-Klinik procedure is an example of VBHC, and from a patient's point of view it deserves powerful support. Patient advocates need to take the initiative to spread this further than Hamburg.

A Dutch example of VBHC is ParkinsonNet (parkinsonnet.info). Neurologists Bas Bloem and Marten Munneke have talked to patients

and have noted down how the latter want to be treated: by specialists in diagnostics and treatment of Parkinson patients and not by a random neurologist. Caregiving also proves to be important here. After that they made an inventory of more demands and wishes of patients and have realised

ParkinsonNet in cooperation with healthcare insurers. Better care, satisfied patients and working cost-efficiently were the result. ParkinsonNet and the Martini-Klinik are good examples of the fact that costs decrease when you focus on quality. That is by the way a result of VBHC and not the starting point. VBHC is not primarily about money and profit. That is a secondary aspect. Patient care and quality are number one. And then we see that costs decrease. This approach differs from the current procedure, where costs are diminished and quality decreases (at least the service to the patient).

Cardiologist Eric Topol from San Diego, USA, has a special view on the relationship between the patient and a doctor. In his book *The patient will see you now* he comes to the conclusion that we are on our way to an implementation of VBHC led by the patient and with modern techniques. Already patients enter the doctor's room better informed (through the internet and smartphones), and they indicate what they know and want. In the not too distant future they will make appointments via video for consultation with each other. Topol compares the patient's new tools with the invention of printing. Because of this the clergy lost its monopoly on reading and writing. That is happening to the doctor's primacy on health, shown symbolically as "from god to guide" (to quote Bas Bloem in his Tedx talk) ([https:// iii.hm/7s9](https://iii.hm/7s9)). The changing relationship between physicians and patients changes healthcare. This is a good and positive development, which is not without resistance, but brings us what we wish: healthcare attuned to the patient and agreed upon.

My conclusion, based on quite some literature and a few powerful examples from practice, is that VBHC works. But not always?

Why Aren't Figures Always Reality?

Patients prefer not to become a patient and, if they become one, they do not want to be a patient any longer than needed. Patients have hope and they want friendly doctors and nurses who pay attention. Patients want certainty. However, everything they are involved in contains psychological and sociological aspects and these cannot be expressed in figures. As a patient you live with this uncertainty and at the same time with the certainty that the best doctors, nurses, hospitals and treatments are available. That certainty is what VBHC can mean for patients. That is why it is necessary and important to come to an agreement with the patient about what care has to be offered and in what form.

Medical-Industrial Complex as Obstacle to VBHC

Care is about interest. According to all stakeholders, however, the patient is in the forefront. Worldwide, healthcare involves hundreds of billions of dollars and euros and together we are working hard for the patient, but also earning money. The unintentional consequence is that healthcare as a sector benefits from a situation with as many patients as possible, who remain patients as long as possible. We pay for the provision of services and that is exactly the outcome: providing many services. We know this, but many of us avoid the subject or look away, because the responsibility we have for this does not feel comfortable. This is what I call the immoral result of the medical industrial complex, namely the teamwork of the healthcare stakeholders, who together have allowed a form of cooperation that doesn't necessarily serve the patient best. In my book *Hoe heeft het zover kunnen komen* I have written about

this extensively, remarking that all this is not caused by evil intent, but by the ambition to get more money, power and influence. This amoral behavior leads to an immoral result that is undesirable and that we cannot and do not want to live with. The only solution is walking away from our responsibility and looking away from the damage we cause. Or is it?

Gerd Gigerenzer, managing director of Max Planck Institut in Berlin, investigated the pursuit of maximising profits and the consequences of this for the patient. In his book *Risk savvy*, but also in *Better doctors, better patients, better decisions*, he shows that in radiology there is strong pressure to carry out as many MRI scans as possible in spite of the fact that it can be demonstrated that an experienced doctor can determine some diseases in less time and with greater accuracy. As an example Gigerenzer mentions the MRI that is carried out with illnesses of the organ of balance, the 'acute vestibular syndrome'. With knowledge and experience a doctor can determine faster, cheaper and with more accuracy if there was a brain haemorrhage. Another example that Gigerenzer mentions is the choice of the harmful CT scan (because of radiation consequences), where the MRI scan would be a better option. A thing that many doctors do not know, but the hospital accountant does. The real costs of a CT scan are lower than those of an MRI scan, but the compensation of the healthcare insurer is the same. Thus more money remains in the hospital cash box.

What to Do?

Now I have said this, the question is of course how we can change this and how we can implement VBHC. It is essential that there are enthusiastic sponsors, people in influential positions that believe in it, such as Detlef Loppow, the CEO of Martini-Klinik in Hamburg. But he cannot do this alone. He needs the management of the Academic Hospital in Hamburg that supports him

and also believes in it. Besides, it requires teamwork of four components that mutually reinforce each other, but lose their power separately:

- **Put different people in a room:** The solution comes from people from different backgrounds who share the conviction that it's all about the patient. When you ask the same people to solve a problem they have not been able to solve in the past ten years, you know that it will not be successful in the next five years either. Change does not come from the inside.
- **Go for the root cause:** Remain polite and strict when the search for truth is at stake. Keep asking questions until you have the certainty and the feeling that you are at the bottom. Only then you can start. And that is why you should:
- **Scale fast:** Think big, start small and scale fast. When you and your team have found out what the situation is like, you have to speed up. Keep approaching each other critically, give feedback about the results and adjust actions when circumstances change or the result is

different from what you expected. Holding on to your original plan does not serve the patient. And finally:

- **Be independent:** The most difficult component, for everyone has a job, a family and a boss. And you want to keep those. Fortunately, the first two ingredients help to minimise independence.

Conclusion: 'Central position of the patient is not enough'

It sounds nice to put the patient in a central position and take him/her as the starting point in everything we do in healthcare. However, it is not sufficient for a successful implementation of VBHC. The medical-industrial complex does not surrender just like that. And that is not because it wants to do evil. On the contrary, people involved in healthcare want to do well. What it is all about is that the system is moving into a direction that seems irreversible. Inevitability seems to have arisen that reinforces this irreversibility. Yet it is possible to turn the tide by letting the change come from the patient. Bizarre, for the patient comes from outside healthcare. Up to now he/she has not had a

say in healthcare and has had to undergo what others have decided. But it is all about us, the patient: "If about us, not without us". It is necessary that patients stand up and defend their interests, force them with arguments and express them in clear language. The arguments are supplied by VBHC. Combine emotion ("I want to get well again") with facts and continue working harshly at the solution you have devised and worked out with the various stakeholders. Through cooperation, placing the patient in the central position and the patient taking the leading role and with the help of patient advocates an excellent way out of the existing situation has become possible. Isn't that beautiful? Those who benefit from excellent care are the ones that give direction to the solution and fulfill an essential role in this. Patient advocates are independent patients with a lot of knowledge; they are well informed and eloquent. In every discussion with any stakeholder they are capable of saying: "Do your work well, then we will all benefit."

We know how it must be done. We also want this and we can do it, for we have done it before. What remains is doing it for all patients. And do it now.

Dr. h.c Peter Kapitein is a cancer survivor and founder of a Dutch and internationally focused patient advocacy organization, Inspire2Live. Peter is supported by his employer: The Dutch Central Bank. For this reason he is able to act independently in the medical industrial complex.

KEY POINTS



- ✓ Value-based healthcare, looking at healthcare from the perspective of adding value to patients
- ✓ Medical-industrial complex, the cooperation of patient organisations, doctors, researchers, industry, government and health insurance companies
- ✓ Patient advocacy, an activist way of taking care of the interests of patients by patients
- ✓ Change management, changing healthcare is like moving a cemetery



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Value-Based Radiology

View from Europe



Hans-Ulrich Kauczor

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What does value-based healthcare and valuebased radiology mean to you as a Radiology Director?

Value-based healthcare as a whole is an issue beyond the radiology department. For the time being, in Germany, it is more of a general trend. The insurance and the reimbursement systems haven't really implemented the value-based reimbursement of services. For me, it's more something that we want to move towards, because this is an important concept for the future of radiology. I don't think that the general approach of generating more exams or more reports in less time is useful in translating innovation and it is of limited benefit to the patients and clinical practice.

The general idea of value-based radiology is very important. It implies that we are performing appropriate quality examinations in terms of precision and personalised medicine. We will come back to other questions important for the future of radiology, because the simple reporting volume of radiology examinations will be supported to a substantial degree by machines in the future.

Referring to the talk you will be giving at the European Congress of Radiology 2017 about clinical decision support, what is the difference between basic and advanced decision support?

I consider basic a clinical decision support (CDS) system that is more educational to

referring physicians than aiming to change and improve the workflow of the radiology department. The basic clinical decision support system will check whether the modality of the examination requested is appropriate with regard to guidelines that are the basis of a CDS system. It will give a response whether MR or CT, with contrast or without, is the most appropriate imaging modality to answer the clinical question. This implies that more information will be made available in the request to the radiology department than is normally encountered nowadays. In many situations, especially with regard to outpatients, the information that comes with the request for the radiological examination is minimal. And so, because with minimal information the CDS is not going to work, it will ensure that the request of the referring physician will provide more information or that the system can access data from the electronic health record of these patients in order to make the recommendation regarding the appropriate radiological examination for the clinical question.

This would be the basic clinical decision support from a data specialist point of view. Up to 20% of requests are not appropriate in that you can't get the answer that you need, or you can get the answer cheaper or faster depending on age and gender. Or a non-ionising radiation exam could be more appropriate, for example. These are the simple issues for CDS in my view.

As for advanced CDS, it would improve the workflow in the radiology department in order to generate more value so that we not only pick the appropriate modality, but we also pick appropriate protocol, examination lane, dose, dose of contrast, number of phases, additional sequences in MR to really answer and solve the diagnostic question. Normally in the out-patient setting, we very often don't invest enough to really solve the issue, whereas in the university setting, we do too much in situations where the clinical question is straightforward. So the CDS could be used to tailor the examination protocol in a personalised way and make not only the modality appropriate but also exposure and the report.

What are your thoughts on sustainability and value for radiology?

Well I think we can only be sustainable when we generate value and prove that we generate value that cannot be generated by a machine. At the same time, there are machines out there that are already at a pretty high level, and there will be very fast progress. I think we should use them in supporting us in generating structured personalised reports. The role of the radiologist is really to generate value for the whole process of imaging and diagnostics. I think for quite a number of years we will still need a radiologist to find and to generate value in terms of "this is what we feel the diagnosis is" and "this is what we recommend". So that's why the general

shift from volume to value-based radiology is very important. Volume-based processes will be taken over by the machines and the interpretation might even be shared with other disciplines. Radiology will survive and will be even more important in the future of imaging. It is about the discipline of radiology and its roles as gate-keeper, communicator and diagnostician.

In reference to the German National Cohort Study (nako.de), you lead the whole body MR imaging part. How do you see that research contributing to the future of radiology?

This is taking us to the “Image wisely, diagnose wisely” activities. Because imaging has become so important and so good that we are detecting thousands of abnormalities, we have to find an appropriate way to deal with them and communicate them. There are so many abnormalities that are not going to mean anything to the health and to the survival of the patient. From the National Cohort we will identify what is normal, what level of “abnormalities” - is normal. We feel that we know the normal size and signal of the liver, but there is no big current database, to support many of these “normal” values. They have been determined one hundred years ago by autopsy studies - not by modern imaging. Also the population is changing; lifestyles are changing. We will learn what type of sub-clinical changes might predispose to the risk of developing disease in the future. Already we have more than ten thousand examinations performed in our study. It is a cross-sectional study currently. The cross-sectional part, including more than 30,000 exams will be done by the end of 2018/beginning of 2019. We will adjust the time following the funding period in order to have a repetition of MRI examinations around five years later.

In this move to value-based radiology, do you feel that education and training of radiologists is sufficient for making this transition?

I think we have to educate and train our radiologist differently for the future because the approach that we

use nowadays is that you're in the reading room, you go through 25 different sequences and then you write your reports or you use speech recognition to dictate your report. I think this has to change and this will be changed as a part of everyday radiology. I think that structured reporting is becoming a must in value-based radiology.

Are you implementing structured reporting in your department?

We identified the first set of structured reporting templates, and we are implementing it more and more. We are teaching our residents about the benefits of structured reporting. It's quite a shift, but after a short period of time, the residents recognise the value of what they have to learn about the patient and patient history before getting the report done. The information in the report is quickly available for the referring physician, who doesn't have to read a whole paragraph of prose. Everything is changing in radiology in the last 50 or 100 years except the report, so we have to take the lead and change the report too. We use automatic templates. Two or more steps in, you have an automatic system providing inputs into these templates for a radiologist to report. This will certainly be a big contribution to value-based radiology in future. We started with a single template using images from a single scanner as a pilot. The first two were so successful that we are now expanding to more scanners and indications.

Following the publication of the white paper on lung cancer screening in 2015 (Kauczor et al. 2015), what development has there been?

There is a lot of interest from many researchers, politicians and policymakers in many European countries. I am very optimistic that we have clear evidence and data that CT lung cancer screening is of benefit to smokers. We are working on many activities to have this established in quite a number of European countries. We have additional applications for EU

funding in this field for additional studies of combining lung CT screening with novel software analysis tools, biomarkers, exhalation markers and so on.

In time might we expect programmes at the level of mammographic screening programmes?

Yes, I think it will take some time and certainly depend on the country. There is a lot of interest in this field. There are many countries that already have established a programme, like the USA, or are in the process of implementing a programme like this, such as Korea.

Hans-Ulrich Kauczor is full Professor and Chairman of Radiology at the University Medical Center in Heidelberg, Germany. He is especially known for his clinical and scientific work on CT and MRI in chest diseases and oncology. Since 1990 he has published more than 700 scientific publications.



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Value-Based Radiology

View from the United States



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As the United States moves to value-based healthcare, how should radiology concentrate on delivering better value, both at the individual and organisational level?

Radiology across the world is facing the same challenges. There was a time, before digitised films, picture archive and communication systems (PACS) and computers to view the images, when the images were printed out as hard copies. If clinicians wanted to look at the films, they had to come down to the radiology department and talk to the radiologist. That was extremely helpful to radiology and to clinical services, because we had that contact between primary care, the physician, the surgeon and the radiologist. Some senior radiologists say that at that time we were considered the doctor's doctor, because the surgeon wasn't going to operate without going over the films with the radiologist; the primary care doctor wasn't necessarily going to treat the patient without going through the film with the radiologist and so on. That has all changed. Physicians look at their films remotely. It is a rarity for a clinician to come down and go over cases with us. They still do, but not as much as before. I think this has made radiology and radiologists much more of a commodity, because we are not presumed to be part of a value-based team.

We recognise that this is an issue that we have to focus on. There are initiatives underway to address this. The American College of

Radiology (ACR) has been instrumental, along with the Radiology Society of North America (RSNA), and the European and world radiology community is active as well. For example, the ACR's Imaging 3.0 initiative is asking us to be less concerned about the volume but to focus more on value. I think it is a big challenge still. There are a lot of films that need to be read. We want to get to value, but we've got to get the work done. What makes it easier is that there's legislation in this country. The Medicare Access and CHIP Reauthorization Act (MACRA), is asking us to demonstrate and provide value. This will make it easier for radiologists to focus on doing those things that are examples of how we can provide value. The most important thing is to collaborate with the referring physicians. This may be as easy as stepping away from the reading station, where we're very marginalised, and joining our colleagues on intensive care rounds, for example. In intensive care rounds, you have the gastroenterologist, cardiologist, pulmonary physician—there is no reason that the radiologist can't be there as well. There are computer monitors there, or we can bring along a tablet and go over the images. We are part of the team and we want to help the patient.

Patient-centred medicine is also a huge focus. It is bringing the patient to the centre of care. Producing a value-based report means reviewing the patient's chart, to tie the description of the findings into what is going on, giving an informed interpretation as any specialist would do. The ACR has established a Commission on Patient and Family Centered

Care to address this important issue, and I serve on the Commission's Outreach committee.

We have to focus on outcomes: are we doing appropriate imaging? Are we reducing incidental findings? How do we address incidental findings? We don't want patients to get more imaging, if they don't have to: it's unnecessary radiation exposure, and it costs the patients. The Image Wisely® and Image Gently® initiatives have helped to address radiation safety concerns and to decrease the exposure to the patient as well as to eliminate unnecessary procedures.

Radiology has to be integral to hospitals: we can't just sit in our reading room and read films. We need to serve on hospital committees. We need to be part of our culture. For the hospital community as a whole, there is no reason that we shouldn't be going to local organisations outside of medicine, outside of the hospital and helping. We have a lot to contribute. We can certainly contribute in mammography. We can educate the public. These are all things that we can do so that radiology isn't perceived as someone sitting in their dark room not contributing to patient care and overall healthcare.

What should the priority be for radiologists moving towards value-based care?

As I tell my residents, we've got to be available for referring physicians, to collaborate and be there. It has got to be a team approach.

The other aspect, which is extremely important, is the patient. We have to put the patient at the centre of care. The patient is what counts. We have to step aside, put the patient where they belong and collaborate with the patient as well. If we can do this in a team-based approach with the referring doctor, the radiologist, the patient and the administration, this is the way we are going to improve healthcare and continue to provide value

Are younger radiologists prepared for this change to value-based healthcare?

My perception, based on working with young radiologists, is that it's a different generation. The millennial generation really wants to be more involved. They are much more team-oriented, and they don't remember how radiology was previously. For many older radiologists, if they are not generating the same income, they feel like they are failing. Younger radiologists have never experienced that way of working, so for them it is about working as a team and solving problems. I also think a lot of them value life in the work-life balance as well. There are many people from my generation, who are very dedicated physicians, but who do not have time to spend with their families. But the younger generation, they want to spend time with their family.

How can radiologists work with referring physicians to ensure only the best value and appropriate imaging is performed?

The most important aspect is collaboration. Fortunately, there are initiatives underway to make it easier for radiologists to do this, including Radiology Support Communication and Alignment Network (R-SCAN)[™] (rscan.org), and the Imaging 3.0 case studies, both provided by the ACR. For example, in one organisation, by collaborating closely with the emergency room physicians, radiologists were able to decrease unnecessary imaging by 50%. This is an active process, which is funded through the Transforming Clinical Practice Initiative of

the Centers for Medicare & Medicaid Services (CMS). By using resources from the ACR, such as R-SCAN[™], research from the Harvey L. Neiman Health Policy Institute, and also drawing on Image Wisely[®] and Image Gently[®], we are going to make sure that we're doing appropriate imaging and that patients are getting the best care they need with the least amount of radiation.

In your own organisation, the Veterans Health Administration, how is the transition to value-based healthcare being managed?

The Veterans Health Administration (VHA) is a federal organisation; it's the largest healthcare system in the United States. I have worked both in private practice and now for the VHA. When I was in private practice, I wanted to help patients and provide value. However, I felt pressure, as did a lot of my colleagues, to generate a high volume. At the VHA they don't ask for the same metrics or the same volume as the private sector. They want us to focus on providing value, to not do unnecessary imaging and to stop excess radiation to the patient. We face less pressure from that point of view. We also have a very robust integrated healthcare system. If a patient is seen in a different state to mine, I have access to the charts. I can pull together the information and make sure I give them a value-based interpretation.

In 2014, the VHA published their Blueprint for excellence (Veterans Health Administration 2014). This recognised that, like other healthcare organisations, the VHA has to improve performance, promote a positive culture of service, advance healthcare innovation and increase operational effectiveness and accountability. The VA has established a Center for Innovation (www.innovation.va.gov) that encourages employee participation, including 'spark' grants to support proof-of-concepts through to 'seed' and 'spread' grants. Designing for veterans: a toolkit for human-centered design (Veterans Administration 2015) supports the move to patient-centred medicine, putting the patient at the centre of care.

Ian Weissman, D.O., is a radiologist and strong patient care advocate who believes in using innovation and leadership best practices to improve the patient experience. He is the first radiologist in the U.S. to earn the prestigious title of Leadership Mastery through the American College of Radiology's Radiology Leadership Institute. Dr. Weissman serves on the Board of Directors of the Wisconsin Radiological Society, and is Secretary- Treasurer of the Milwaukee Roentgen Ray Society. He is a member of the Radiology Advocacy Network, and a mentor and contributor to the Veterans Affairs new Innovator's Network. Dr. Weissman is an active participant on social media @ DrIanWeissman, named by CompassPHS as one of the "10 fantastic physicians to follow." Weissman serves on the American College of Radiology's new National Commission on Patient and Family-Centered Care.

Value-Based Radiology

ACR Commission on Patient-and Family-Centered Care
acr.org/Membership/Commissions-Committees/Operational/Patient-and-Family-Centered-Care
ACR Imaging 3.0 acr.org/advocacy/economics-health-policy/imaging-3
ACR Imaging 3.0 Case Studies acr.org/Advocacy/Economics-Health-Policy/Imaging-3/Case-Studies
Harvey Neiman Health Policy Institute neimanhpi.org
Image Gently imagegently.org
Image Wisely imagewisely.org
Radiology Cares[®]-The Art of Patient-Centered Practice
rsna.org/Radiology_Cares



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Meetbaar Beter

Value-Based Healthcare for Heart Patients

Introduction

Meetbaar Beter (En: Measurably Better) is a doctor-driven and patient-focused initiative with strong scientific roots that aims to improve the transparency and quality of cardiovascular care in the Netherlands.

Meetbaar Beter has become an international best practice in the implementation of value-based healthcare (VBHC). The project started as an initiative of two hospitals, and by now 19 heart centres participate, covering over 85 percent of complex heart care in the Netherlands. In 2016, outcomes that matter most to patients have been published for over 150,000 patients, including the treatment of high prevalence medical conditions like coronary artery disease, aortic valve disease, atrial fibrillation and mitral valve disease. Limited sets of outcome measures per medical condition, selected by doctors (cardiologists and cardiothoracic surgeons) and validated by international experts, form the basis for the open learning and development culture of Meetbaar Beter. Doctors gain insight in outcomes and use this information to cooperate and continuously improve the quality of care for heart patients (Van Veghel et al. 2016). In this article we share the approach that has led to the success of Meetbaar Beter.

The Goal of Meetbaar Beter

Meetbaar Beter's aim is to facilitate quality improvement for patients with heart diseases in the Netherlands. Its focus is on health

outcomes that matter most to patients. The hypothesis, based on Porter's VBHC (Porter 2010), is that improvement of outcomes will lead to a reduction of costs. Measuring costs will be included in Meetbaar Beter, in a later phase.

Transparency of outcomes is an intermediate but important goal as it helps build high levels of trust between heart centres and stakeholders such as patient organisations, health insurance companies and government organisations. Transparency is considered a sine qua non in being able to identify best practices. Study results support the importance of transparency and its strong relation with quality (Larsson et al. 2012).

Leading Principles

Meetbaar Beter has a few leading principles. Firstly, it is doctor-driven. Doctors and their teams regularly create changes in healthcare. In Meetbaar Beter, the board of directors, advisory board and outcome team typically consist of doctors making lead decisions. Strong connections have also been built with the Dutch societies of cardiologists and cardiothoracic surgeons.

Secondly, Meetbaar Beter is patient-centred. The organisation and improvement work is structured around medical conditions. Outcomes are measured for medical conditions both independent and dependent of the chosen treatment. The selection of outcome measures is validated by large

patient groups and outcomes are published in a comprehensible manner for patients. For instance, infographics have been developed (Figure 1).

Thirdly, transparency is a leading principle. In Meetbaar Beter, strict data quality and data completeness criteria are used. When the data quality of a hospital fulfils the minimum quality criteria, data is published independent of the results. This has proven to be a strong stimulation for heart centres in improving the quality of data. Already in the very early stage of Meetbaar Beter, the publication of data led to hypotheses for quality improvement. Lessons have been learned quickly by heart centres in organising outcomes-based quality improvements.

Finally, Meetbaar Beter focuses on outcome measures. Outcome measures are considered leading with respect to process and structure measures. Outcomes are influenced by the initial conditions of patients and the quality of care delivery. For an insight in quality of care, in several analyses, outcomes are corrected for the initial conditions of patients. A limited number of process and structure measures can be included to facilitate learning. For example, to evaluate the success rate of techniques.

Solid Methodology

The VBHC theory has been implemented within the Meetbaar Beter practice. This is one of Meetbaar Beter's cornerstones of success



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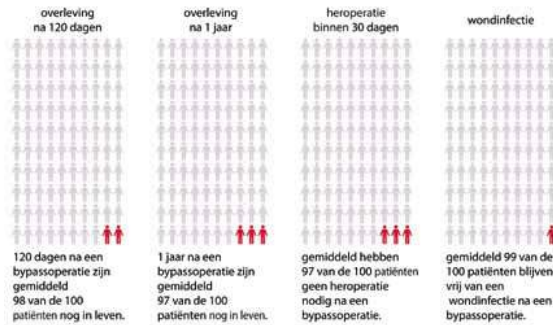


Figure 1. Infographic example of a comprehensible outcome publication for patients. The figure includes a 120-day and 1-year survival rate, reoperations and deep sternal wound infections in patients with coronary artery disease (CAD) treated with a Coronary Artery Bypass Graft (CAB G). Source: hartenvaatgroep.nl

and it is seen as a guidance for other initiatives.

Key Factors Include:

- Outcomes Teams

Outcomes teams are formed to select, define, and perform maintenance on the most relevant outcome measures and initial conditions. Outcomes teams are multidisciplinary and are organised around one medical condition. They include both cardiologists and cardiothoracic surgeons from participating heart centres.

- Care Delivery Value Chain

The Care Delivery Value Chain (CDVC) is one of the main elements of Porter’s VBHC theory (Porter and Teisberg 2006). The CDVC is described by the outcome team and is used to define the medical condition, inclusion/exclusion criteria and any potentially relevant outcome measures.

- Selection Criteria and Outcomes Hierarchy

After defining the medical condition and CDVC, a list is created of all the available outcome measures using scientific and grey literature, the best practices, guidelines and so on. Subsequently, a small, feasible subset of the most relevant outcome measures is

made by categorising them according to the Tiers of Porter’s Outcomes Hierarchy (Porter 2010). Outcomes within each Tier are then selected and ranked based on the following criteria:

- 1. Patient Relevance** - What is the impact of this outcome on the patient’s quality of life? Large patient groups are involved to assess this criterion.
- 2. Medical Relevance** - To what extent is it possible for healthcare professionals to positively influence the outcomes?
- 3. Patient Volume** - How many patients is the outcome relevant to? How often does a negative outcome occur?

- Validation

Validation is organised at several levels. Validation is a continuous process that ensures the independence and quality of Meetbaar Beter.

- **Internal Validation:** Medical and statistical experts engage in total quality management and medical decision-making.
- **External Validation:** An international academic advisory council (IAA C) is organised which consists of independent internationally renowned experts. The IAA C consists of three dimensions:
 - Methodology council - five experts in VBHC, change management and quality improvement.
 - Medical council - over 25 renowned medical experts.
 - Data management & statistics council - two internationally renowned experts.
- **External Validation:** A sounding board is organised to ensure the involvement of health insurance companies, patient organisations and government organisations. Discussions in this sounding board have shown to be helpful in creating an alignment in strategic goals and ensuring a correct interpretation of published data.

- Data Quality System

All participating heart centres are responsible for the completeness and quality of their own data. The Meetbaar Beter organisation is responsible for data quality control and for reporting feedback to heart

centres. Meetbaar Beter has developed a data quality control system that includes quality control formats, audits performed by medical experts and compliance statements that must be signed by medical leadership at the heart centres.

- Maintenance Cycle

After the annual publication of outcomes, the selected outcome measures and initial conditions are evaluated at several levels. Subject to evaluation are the standard sets of outcome measures, the definitions, data analysis methods and so on. Meetings are organised, questionnaires are sent to medical experts and data managers from participating heart centres and all comments are discussed by the outcome teams. Any adjustments made in the maintenance cycle are regularly checked against all elements of the Meetbaar Beter methodology, such as the selection criteria described above.

“MEETBAAR BETER HAS IMPLEMENTED VBHC IN PRACTICE, CREATING AN INTERNATIONALLY UNIQUE AND TRANSPARENT LEARNING ENVIRONMENT”

Publication of Outcomes

Meetbaar Beter publishes the outcomes per individual hospital and all heart centres combined in the annual Meetbaar Beter Books (Meetbaar Beter 2017). The primary goal is to provide insight into the outcomes and to facilitate generation of valid hypotheses on potential improvement. To define such hypotheses, data on outcomes must always be combined with medical expertise. Outcomes are published at three levels. The first level of publication is uncorrected results (Figure 2). The percentage of events is presented without taking differences in population characteristics into account. Although the comparison of heart centres based on these uncorrected results

Uncorrected results and distribution of patient initial conditions – Coronary artery disease | PCI

	AMC	Amphia	Antoniüs	Catharina	Erasmus	Haga	Isala	MCL	MST	MUMC	OLVG	Radboud	UMCG	UMCU	Overijssel
Year	11-14	11-14	11-14	11-14	11-14	12-14	11-14	11-14	11-14	2013	11-14	13-14	12-14	12-14	
Number of patients	5664	2775	5796	9165	5820	3483	6838	4647	5657	1262	6795	1597	4061	2259	
Outcome measures															
30-day mortality	3.0	2.6	2.0	3.3	3.4	3.0	2.1	2.7	2.0	3.2	2.5	3.0	3.1	3.2	19.2
1-year mortality	6.4	5.8	4.4	6.4	6.7	5.3	4.7	5.2	4.4	5.4	4.5	7.6	6.2	7.4	19.2
Quality of life															
Angioplasty not successful	5.3	5.9	4.1	4.5	5.1		5.4	4.8	2.5	8.0	4.7		3.3	6.8	19.2
Urgent CABG	0.2	0.3	0.3	0.3	0.2	0.6	0.4	0.2	0.2	0.4	0.2	0.1	0.5	0.1	100.0
Discharge of MI	1.1		1.3	1.4	1.3		0.9		1.0					1.9	19.2
Discharge of TVR	7.8			7.9			7.4		2.9		6.6			12.5	19.2

Figure 2. The uncorrected results (2015 included 14 centres) for the treatment of patients with CAD by a percutaneous coronary intervention (PCI). (TVR = Target Vessel Revascularization, MI = Myocardial Infarction). Source: Meetbaar Beter Foundation

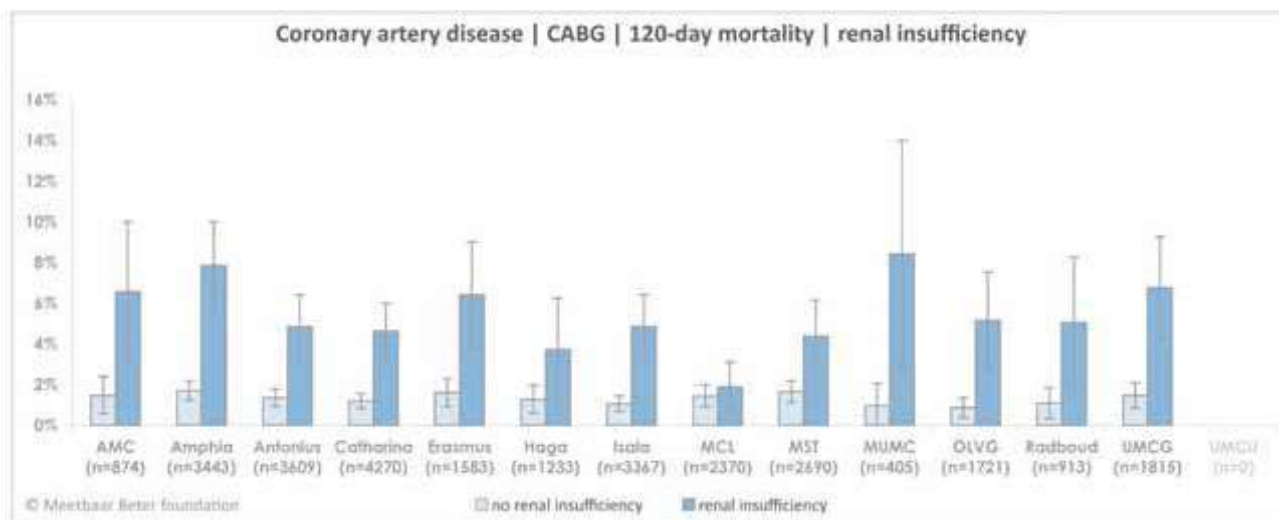


Figure 3. The dependence of the 120-day mortality on the risk factor ‘renal insufficiency’ for patients with CAD treated by CAB G. Source: Meetbaar Beter Foundation

is not possible, it still gives insight into the true outcomes and offers possibilities for improvement. The second level of publication is segmented outcomes. Outcomes are presented in subgroups of initial conditions without risk correction (**Figure 3**). This gives doctors a deeper insight into the outcomes for relevant subgroups. Finally, if statistical data are adequate, regression analysis is made. Outcomes are corrected for the impact of the case mix across heart centres. Comparison between heart centres then becomes possible using these analyses (**Figure 4**).

Quality Improvement

Meetbaar Beter organises events that encourage doctors and heart centres to use insights in outcomes as a way to initiate quality improvement projects.

Examples are round table sessions where doctors can select best practices; internal events that encourage the organisation of quality improvement projects and cycles and finally, brainstorm sessions with doctors to advance data analyses and create more insights.

Several heart centres have been successful in organising improvement projects, and as a result have seen a progress in outcomes. Examples are the reduction of mortality after PCI for patients with renal insufficiency (in OLVG from 9.2% to 5.0%) and complications after PVI (reduction of tamponades in Catharina Hospital from 3.6% to 0.7%) and CAB G (reduction of deep sternal wound infections in St. Antonius Hospital from 1.5% to 0.8%). More examples have been published in the Meetbaar Beter Books (Meetbaar Beter 2017).

A successful practice in Meetbaar Beter was rolled out in 2013. The 2013 regression analyses showed a significant lower mortality rate in Isala. The hypothesis proposed that a check in the operating room called the Isala Safety Check (ISC) contributed strongly to this relatively low mortality rate. The ISC was implemented in six other heart centres that voluntarily joined the project. The implementation will be

subject to scientific evaluation.

In 2016, three potential best practices have been selected. These projects include the Haga Braincare Strategy, a protocol to reduce CVAs after heart surgery, a protocol for PCI patients with renal insufficiency used in OLVG; and the Cleveland Checklist used by the Catharina Hospital to reduce reoperations after heart surgery. These projects will be presented to other heart centres for a roll out in 2017.

Conclusion

VBHC is a concept that supports and encourages the improvement of quality and efficiency in healthcare. Meetbaar Beter has implemented VBHC in practice, creating an internationally unique and transparent learning environment. The solid methodology

of Meetbaar Beter has created traction in Dutch healthcare, built enthusiasm amongst doctors and heart centres and has made a great leap forward in the transparency of healthcare quality. The first results of quality improvement projects within and amongst heart centres are more than promising. The ultimate success of Meetbaar Beter and VBHC will be concluded within a few years. With regards to Meetbaar Beter, success is defined by improved outcomes over the full range of medical conditions in heart care.



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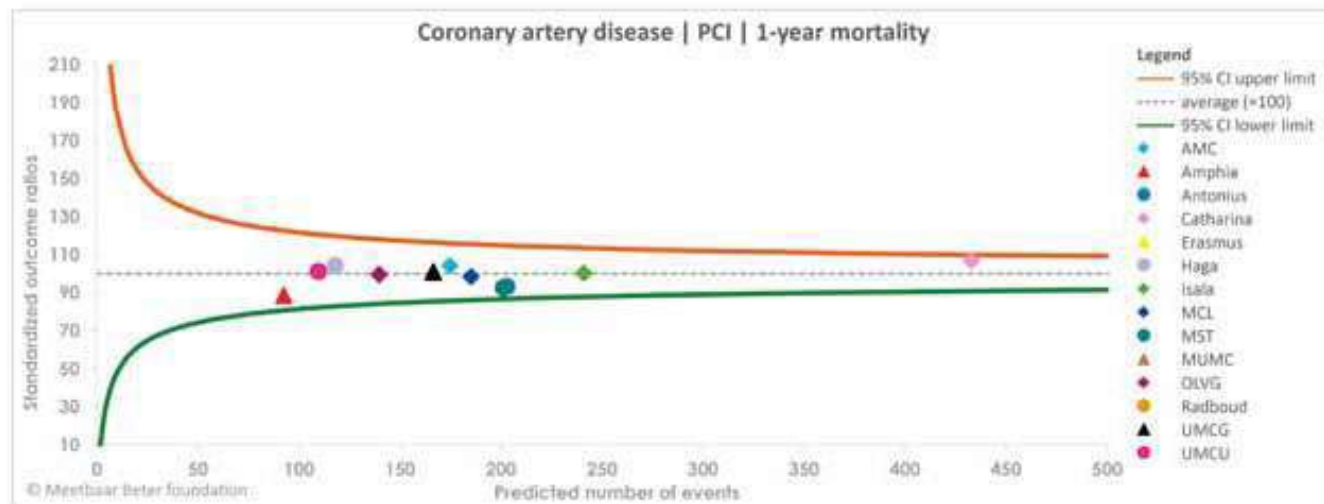
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C-statistic = 0.83 (goed)
 Corrected for chronic total occlusion, diabetes mellitus, previous MI, previous CABG, gender, age, multi-vessel disease, renal insufficiency, resuscitation, shock and urgency of the procedure.
 The regression analysis indicates natural variation between the centers.

Figure 4. Regression analysis for the 1-year mortality for patients with CAD treated with PCI. Source: Meetbaar Beter Foundation

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Value in Cardiology



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Is value in cardiology well understood?

When we consider value we are focused on improving quality and lowering costs. In cardiology we have a long history in the development and implementation of quality measures. The American College of Cardiology (ACC) has been a leader in the development of quality measures, practice guidelines and appropriate use criteria. On the cost side there are opportunities where we can reduce costs by improving the coordination of care, decreasing redundancy in testing, and eliminating unnecessary emergency room visits and hospitalisations. The American College of Cardiology has developed a series of programmes and tools to help cardiologists be successful in providing high-value cardiovascular care for their patients such as those with heart failure.

How is the American College of Cardiology assisting cardiologists to transition to this new payment model?

In the United States, the Medicare Access and CHIP Reauthorization Act (MACRA), which replaces the Sustainable Growth Rate (SGR), is being implemented in 2017. The ACC has been focused on educating physicians about MACRA including its various components. This includes working with physicians and practice managers in all types of practice settings, from academic medical centres to rural solo practitioners on how to leverage the entire care team to improve quality and lower costs. The use of tools, such as appropriate use criteria, can help guide the decision-making for ordering stress tests to

referring patients for cardiac catheterisation and percutaneous coronary intervention (PCI). The use of shared decision making tools is also encouraged to engage patients in thinking through what care path is the best for them.

How can a cardiology team best promote and support value-based care?

Many cardiology practices have a combination of medical assistants, nurses, nurse practitioners, physician assistants as well as physicians working in the office setting. The goal is to leverage the abilities of each member of the team and have them work at the top of their licence. In certain office settings, such as heart failure clinics, nurse practitioners work very closely in collaboration with a heart failure physician in a way that leverages the expertise of a physician and maximises the abilities of the nurse practitioners. It is an efficient way for more patients to access providers with specific expertise. In addition to improving access, these specialty clinics improve coordination of care for patients who often see other specialists along with their primary care physician.

What is the background for appropriate use criteria in cardiology?

The ACC has 8 inpatient registries (cvquality.acc.org/NCDR-Home/Registries.aspx), including the CathPCI Registry®. These registries allow data collection, and feedback to physicians on the appropriateness of the test or procedure as well as the outcomes. For example, the CathPCI® registry allows physicians to not only evaluate

appropriate use but also the 30 day outcomes of those patients both in terms of survival and complications. Then in the PINNA CLE Registry®, the outpatient registry, we can follow those patients longitudinally. We can track quality outcomes that are not just process measures, but are clinical outcomes for patients over time within the registries.

Is the ACC involved in developing patient-centred outcome measures?

The ACC participates in many of the committees of the National Quality Forum (NQF), where quality measures are reviewed to be used in by both governmental and commercial payers. The ACC also participates in a core measure collaborative with the Centers for Medicare Services (CMS) and America's Health Insurance Plans (AHIP) in the development of a core cardiovascular quality measure set. The first core cardiovascular quality measure set was published last year and plans are to convene this workgroup next month to continue this work.

Paul Casale, MD, serves on the U.S. Department of Health and Human Services Physician-Focused Payment Model Technical Advisory Committee and the NQF Measure Applications Clinician Workgroup. He is a member of the Board of Trustees of the American College of Cardiology.

VALUE-BASED HEALTHCARE

Value for patients is the core purpose of healthcare



Source: Emory University <https://iii.hm/86u>

“Delivering high value for patients must be the central goal of every healthcare organisation. Financial success is the result of delivering value, not the end in itself.”



Michael E. Porter, Bishop William Lawrence University Professor and director of the Institute for Strategy and Competitiveness, at Harvard Business School

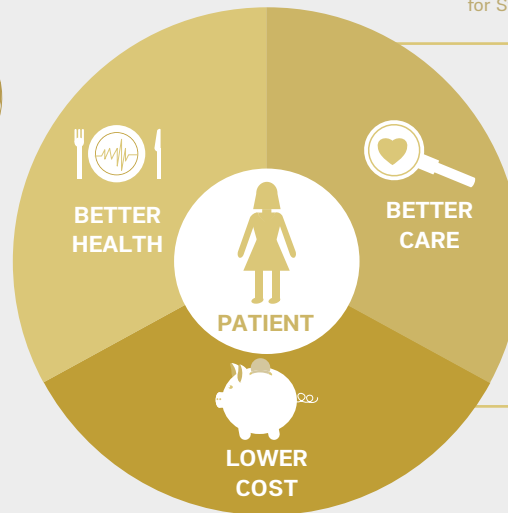
IN A VALUE-BASED WORLD

patients are able to choose providers based on informed expectations of outcomes and the associated costs

providers that deliver superior outcomes at competitive costs thrive, while others improve or lose their position

payers negotiate contracts based on results and encourage innovation to achieve those results

suppliers succeed by marketing their products on value, showing improved patient outcomes relative to costs Source: icohm.org



LISTEN



Value-Driven Outcomes Program and Health Care Cost and Quality (JAMA podcast)

<https://iii.hm/87a>

“This study at the University of Utah hopefully will be the proverbial shot heard around the world”

- Michael E. Porter

FOLLOW

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ADDRESSING CONSUMER PRIORITIES IN VALUE-BASED CARE: GUIDING PRINCIPLES AND KEY QUESTIONS

- 1 Include patients/consumers as partners in decision-making at every level of care
- 2 Deliver person-centred care
- 3 Design alternative payment models that benefit patients/consumers
- 4 Drive continuous quality improvement
- 5 Accelerate use of person-centred health information technology
- 6 Promote health equity for all

Source: Health Care Transformation Task Force (2016) <https://iii.hm/87b>

WATCH



Measured Outcomes: A Future View of Value-Based Healthcare vimeo.com/141066658

Value-Based Healthcare at Karolinska youtube.com/watch?v=YegWi053x-l

Karolinska's New Operating Model and Value-Based Healthcare youtube.com/watch?v=dR6sa2cmv9E

Value-based Healthcare: Innovations for a New Era youtube.com/watch?v=wDexzoAs8Js



Robotic Ultrasound Imaging

Improving access to Care for rural and remote populations



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What is the current situation for Canadians living in remote communities who need an ultrasound scan? Are there any mobile services, or are they expected to travel?

Approximately 20 percent of the Canadian population live in rural and remote communities with limited access to imaging, due to lack of radiologists, technologists and infrastructure in these communities. Sonography is unique in that it is an operator- and user-dependent imaging modality and the skill and experience of the operator is paramount to accurate diagnosis. Since a sonographer is required to be on-site, ultrasound imaging is simply not available in many hospitals and communities in Canada, and patients—both inpatients and outpatients—must travel or be transferred to secondary or tertiary care centres or imaging clinics. In some cases, this delays diagnosis and subsequent treatment, burdens patients and their families, and increases healthcare costs.

What is the potential for telerobotic sonography technique based on your initial experiences and current clinical trial?

Our group has trialled a telerobotic ultrasound system for abdominal and second-trimester prenatal imaging, directly comparing telerobotic examinations and conventional examinations.

Using a telerobotic ultrasound system, sonographers could remotely control all fine movements of the ultrasound transducer—including rotating, rocking and tilting—by manipulating a mock transducer at a central site. Sonographers communicated with the patient and an assistant at the patient’s site through a videoconferencing system, and the assistant grossly positioned the frame for the robotic arm based on instructions from the sonographer. We found that organs could be reliably visualised using the telerobotic ultrasound system and measurements of common structures were comparable using the two systems (taking into account the user-dependency of sonography). Importantly, all patients agreed that they would be willing to have a telerobotic scan in the future if conventional sonography was not available in their community.

Telerobotic sonography opens up the possibility of establishing remote ultrasound clinics within smaller communities, enabling patients to access sonography in their home community and improving access to care. Telerobotic sonography may facilitate routine imaging studies or after-hours sonography for emergent cases, possibly avoiding transport to a larger centre for imaging or calling in a sonographer for a single study. In small to medium-sized centres, telerobotic sonography also may enable patients to access subspecialty imaging consultations that would otherwise not be available.

How did previous studies on telerobotic sonography inform the set up of your current clinical trial?

Telerobotic technology has advanced significantly since previous reports; for example, early telerobotic ultrasound systems did not allow users to remotely control settings such as gain or depth, and other telerobotic ultrasound systems required operators to use a computer mouse for movement of the transducer rather than a transducer similar in appearance to that used conventionally. We are now at the point where commercial-grade telerobotic ultrasound systems have been developed, and a key prerequisite for widespread adoption into clinical use is assessment of diagnostic capability. Directly comparing telerobotic and conventional sonography—with sonographers and radiologists blinded to findings of the corresponding examination—is a key part of our assessment.

The initial experiences showed some differences in diagnostic performance between telerobotic vs conventional ultrasound, which could not be attributed solely to the method - how has this been factored in to the current clinical trial? Please comment on the important differences between conventional sonography and robotic telesonography.



Figure 1. A remote clinic is equipped with an ultrasound unit and robotic arm (MELOD Y Patient System, AdEchoTech, Naveil, France) to which an ultrasound transducer is attached. An assistant with no prior ultrasound experience guides gross placement of the frame for the robotic arm based on instructions from the sonographer or radiologist.

In our initial study, there was no significant difference between telerobotic and conventional measurements of liver span and diameters of the proximal aorta and spleen; however, telerobotic assessments overestimated distal aorta and common bile duct diameters and underestimated kidney lengths compared with the conventional scan. Some of the differences in measurements may be related to different sonographers performing the conventional and telerobotic scans (sonography is a user-dependent modality, and variations in measurements may occur between two sonographers using the same ultrasound system with

the same patient). Additionally, this may be related to the challenge of positioning the transducer for an optimal view for measurement, which can be more challenging using a telerobotic system, especially for

users with less experience in using the system. This has resulted in increased duration of examinations, though we have found the duration of exams continues to decrease as sonographers gain additional experience using the system.

You envisage a network of telerobotic ultrasound systems in remote centres to be serviced by sonographers at central telerobotic sonography clinics. What would the business case be, compared to providing mobile services, for example?

Many centres do not have sufficient patient volume to economically justify employing sonographers in their communities, and even in communities with sufficient

volume, recruitment and retention of sonographers remains a challenge. Mobile services provide only sporadic coverage and may not be available for acute or semi-urgent imaging. For prenatal imaging, many patients simply forego imaging due to the lack of availability of sonography in their home community, compromising patient safety and potentially resulting in higher downstream healthcare costs.

“USING A TELEROBOTIC ULTRASOUND SYSTEM, SONOGRAPHERS COULD REMOTELY CONTROL ALL FINE MOVEMENTS OF THE ULTRASOUND TRANSDUCER”

We believe networks of telerobotic ultrasound systems in rural, remote or low-volume centres—established in partnership with local communities and healthcare organisations—will fill an unmet need in providing timely access to ultrasound services. Sonographers at a central site would remotely perform routinely scheduled examinations, with urgent and emergent cases from any community added as required.

Images from telerobotic examinations can be transferred into existing picture archiving and communication systems (PACS) so that remote examinations become integrated into the daily workflow for radiologists. In North America, in a mainly fee-for-service environment, adoption of telerobotic sonography can increase volume and revenue for radiology groups that report remote studies. Telerobotic sonography may be a natural extension for teleradiology providers in terms of both image interpretation services as well as the technical component of performing telerobotic examinations.

Barriers for widespread adoption include capital costs of equipment (the cost of a complete telerobotic ultrasound system is approximately equivalent to that



of a high-end conventional ultrasound unit) and the need for development of partnerships with diverse local communities and health organisations.

Ultimately, remote presence technologies such as telerobotic sonography will help to narrow the gap on inequality of healthcare delivery in both industrialised and developing countries. We believe that these technologies will be important in the delivery of healthcare in a timely and cost-effective manner in the future.

There are competing telerobotic ultrasound systems available. Are you able to comment on what the key requirements are for these?

While we don't want to comment on specific equipment as our work so far has been limited to one telerobotic ultrasound system, in general, off-the-shelf comprehensive solutions integrating robotic, ultrasound and videoconferencing components into single user-friendly systems are required for routine adoption of this technology. High image quality—yet with low bandwidth requirements—is a prerequisite for any telerobotic ultrasound system. An experience as similar to conventional scanning as can be—through use of a mock ultrasound transducer similar in appearance to an actual transducer and ability to remotely control all ultrasound settings as on conventional ultrasound units—will minimise the learning curve for sonographers. Enhanced ability to control movement of the transducer in all planes, with feedback for the sonographer on pressure applied, are key considerations for next-generation systems.



Figure 2. At the central site, a mock transducer enables the sonographer or radiologist to remotely control all settings and fine movements of the transducer, and a touchscreen monitor, which displays the ultrasound system interface, enables the sonographer or radiologist to remotely control all settings. A non-dedicated internet connection connects the two sites, and a videoconferencing system allows for communication between the sonographer, and the patient accompanied by the assistant.

KEY POINTS



- ✓ Telerobotic ultrasound systems enable radiologists and sonographers to remotely control all fine movements of an ultrasound transducer—including rotating, rocking and tilting—by manipulating a mock transducer at a central site
- ✓ Networks of telerobotic ultrasound systems in rural, remote, or low-volume centres—established in partnership with local communities and healthcare organisations—may enable patients to access sonography in their home community and may fill an unmet need in providing timely access to ultrasound services
- ✓ Telerobotic sonography may facilitate routine imaging studies, subspecialty imaging consultations, or after-hours sonography for emergent cases, possibly avoiding transport to a larger centre for imaging or calling in a sonographer for a single study

MEDICAL-CART COMPUTERS

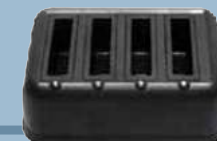
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3D Printing

An Interdisciplinary Lab



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3D printing will most likely transform the medical field as it presents a multitude of new opportunities from visualisation of complex anatomy, building training models or templates for challenging procedures to patient-specific implants. A variety of disciplines work with 3D printing and various regular use cases have been identified. Since the late 1980s, craniomaxillofacial (CMF) surgeons have been using 3D printed anatomical models to visualise and facilitate the treatment of complex facial pathologies. With the advent of consumer-grade 3D printers that can be bought for less than €2000, many hospitals are starting to investigate this emerging field.

At our 3D print lab, this is most often a CT study, in fewer cases an MR sequence or cone beam volume CT. Some authors also report success in printing 3D ultrasound data. Further on, the technical requirements for 3D printing include, besides the aforementioned printer, segmentation software which turns the image dataset into a three-dimensional model that the printer software can read. This can often be done with common radiological visualisation suites or commercially available medical segmentation and planning tools. There is also open source and freeware software available online. This process of image transformation from two-dimensional images to virtual 3D objects—called segmentation—identifies the structures of interest comprising the final model. Segmentation can be done automatically, semi-automatically (for example

by region growing algorithms) or manually. Depending on the structure of interest, this process can be quite easy when there is high contrast between objects (eg, bone surrounded by muscle in a CT scan) or it can be quite difficult (eg, differentiation of white and grey matter on a brain CT scan). Therefore, it is advisable to select the imaging modalities best suited to depict the structure of interest, eg, contrast media application for the segmentation of vessels. When the desired structure is segmented, it is exported as a STL file (stereolithography), which is subsequently converted by the printer control software into the specific movements of the printing head. Alternatively, the model can be sent to an external 3D printing service provider.

But where would you place the 3D lab within the complex infrastructure of today’s hospitals? When we started inquiring about 3D printing within our hospital, we found a highly variable degree of involvement. Some disciplines had heard about it, some already worked with it, while others did not see any need for 3D printing. Consequently, we decided to form a partnership between two disciplines that had already gathered substantial 3D printing knowledge.

This—to our knowledge—unique approach in forming the 3D lab as a joint operation by radiologists and CMF surgeons allows us to tap into the knowledge of these core disciplines for 3D printing: the advanced 3D printing knowledge of CMF surgery in the

surgical context as well as the radiologists’ knowledge about the acquisition of imaging datasets and experience in imaging and image postprocessing.

“ THE STARTING POINT FOR ALMOST ALL 3D PRINTS IS A VOLUMETRIC DATASET OF THE STRUCTURE OF INTEREST ”

At our hospital, the 3D print lab is located in the department of radiology. Radiology is at the intersection of many disciplines: it is usually the place where most colleagues turn to for “all things regarding visualisation” and was among the first fully digitised disciplines. We then established a simple online order entry workflow for new 3D print jobs out of the clinical information system, which gets transferred to a common email inbox. Depending on the kind of print job, the referring department and the schedule, the printing job is then managed by either the radiologist, the CMF surgeon or, in complex cases, in a joint effort. Additionally, we formed a partnership with the University of Applied Sciences Northwestern Switzerland that can provide the biomedical engineering know-how when needed. A cloud-based solution addressing all 10 fused filament moulding (FFM) printers allows uploading and submission of the final 3D model from within the hospital or remotely from outside while simultaneously assisting in monitoring the print jobs. For ultra high-



resolution prints and printing of bio-compatible materials, such as surgical guides, our 3D printing lab offers a stereolithography (SLA) printer.

The benefit of this collaboration has been immediately evident since the inauguration of our 3D print lab in June 2016. We have seen a steady increase in 3D planning cases and prints—more than 250 3D models in 6 months—with many referring physicians providing positive feedback about the impact of the 3D prints on their practice. To date, we have been working with more than ten different medical disciplines and the number of requests keeps rising. As another benefit, the installation of the 3D lab brings the radiologist closer to the clinician, which improves the understanding of our colleagues' expectations and needs. The 3D printing lab is an enriching set-up for both the clinicians and the radiologists.

KEY POINTS



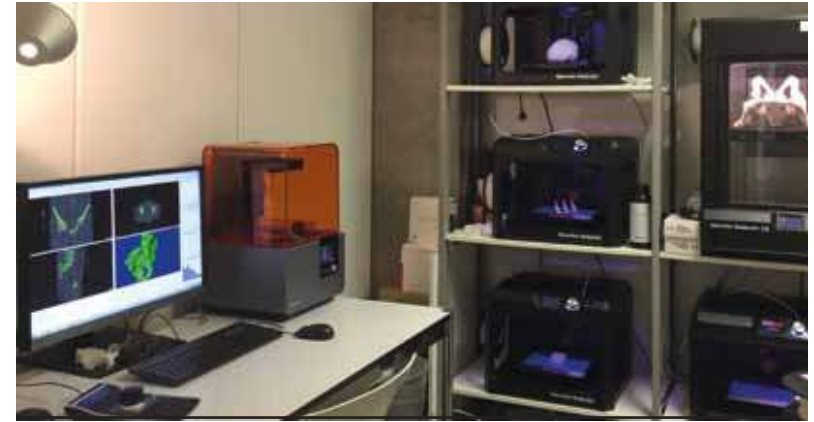
- ✓ 3D printing will transform the medical field as it provides many new opportunities for visualisation, training and creating templates
- ✓ The threshold for 3D printing is low: post processing freeware and an entry-level printer are all that's needed to get started
- ✓ In our hospital, the 3D printing cooperation between craniomaxillofacial (CMF) surgeons and radiologists turned out to be especially fruitful since their expertise was complementary for creating a 3D printing lab in-house, offering fast preparation of models, improved collaboration and increasing interest from clinicians



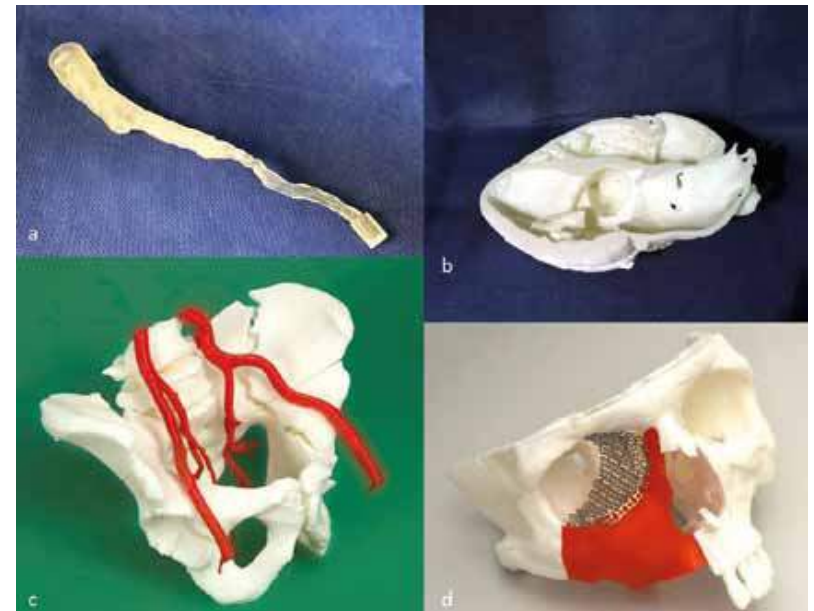
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3D Print Lab at the University Hospital of Basel



Exemplary Models Developed in Our 3D Print Lab

- a. Vascular training model for stent placement
- b. Preoperative planning model for complex cardiac surgery
- c. Complex pelvic fracture with corresponding vascular anatomy—used for prebending of osteosynthesis plates
- d. Prebend titanium plate in a model used for preoperative planning of a large tumour resection in CMF surgery



Neoadjuvant Chemotherapy

Unanswered Questions

The value and importance of multidisciplinary teams in breast cancer was demonstrated at the European Society of Breast Imaging (EUSO BI) congress in Paris in October 2016, when oncologists, radiologists, pathologists and surgeons spoke at a session on neoadjuvant chemotherapy



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Rationale for Neoadjuvant Treatment

Neoadjuvant chemotherapy (NAC): the expected benefits must be real!

Several clinical benefits are expected from NAC: lesser extent of surgery, better long-term control of the disease, gaining prognostic information. The only proven patient benefit, however, is to increase the rate of subsequent breast conservation. To ensure that conserving surgery is feasible and to avoid axillary clearance if possible, thorough initial and on-treatment evaluation of disease extent is essential. The patient's genetic background should be informed. The need for chemotherapy must be certain (use of gene profiling?) and the magnitude of response realistic (avoid luminal A or lobular subtypes).

What do we currently know about NAC?

In terms of survival and disease progression, NAC has been found equivalent to adjuvant chemotherapy (Mauri et al. 2005). Regarding tumour response, the effect of NAC is heterogeneous across cancer subtypes. The effect is major and includes nodal downstaging in HER 2-positive and triple negative cancers (ie, $\geq 50\%$ and 40-50% of pathologic complete response (pCR), respectively) but limited in breast and nodes in luminal (ER +

HER 2-negative) cancers (ie, 10-15% pCR). A recent meta-analysis showed a differential association between pCR and event-free survival (EFS) among cancer subtypes with highest prognostic value in aggressive tumours, but could not validate pCR as a surrogate for improved survival in the overall study population (Cortazar et al. 2014). In the HER 2+ subtype, there is evidence suggesting that pCR might, however, be a surrogate endpoint for survival, with best outcome occurring in hormone receptor (HR)-negative tumours with breast and node complete response (Gianni et al. 2016).

What are the therapeutic prospects?

► Regarding the issue of response-guided treatment data are, as yet, still investigational. In the exploratory GeparTrio trial, longer disease-free survival (with marginal benefit in overall survival) was found when switching early HR-positive "non-responders" by clinical and conventional imaging evaluation to a different chemotherapy regimen (von Minckwitz et al. 2013). The AVATAXHER trial, a phase 2 study, was conducted in HER 2+ breast cancer patients with [18F]-FDG PET assessment of response after one cycle

of chemotherapy (Coudert et al. 2014). In patients deemed unlikely by PET to respond to standard docetaxel plus trastuzumab therapy, the addition of bevacizumab increased the rate of pCR (43.8%) compared with findings in the standard arm (pCR 24%). However, several clinical issues such as unknown survival benefit, use of suboptimal therapy, finding of discordant results with bevacizumab in other breast cancer studies, prevented further application of this imaging-guided therapy explains Dr. Delalogue.

"THOROUGH INITIAL AND ON-TREATMENT EVALUATION OF DISEASE EXTENT IS ESSENTIAL"

► An area of research is to use residual disease for its prognostic and potentially predictive value of response to (adjuvant) therapy targeted on the tumour biomarkers. Residual disease could contain resistant clones, eventually causing metastatic recurrence and death. Advanced genome sequencing would allow identifying these "lethal clones", hence eradicating them through treatments targeted on specific genomic alterations. Furthermore,



surveillance targeted on circulating tumour DNA could permit early detection of relapse.

▶ Two other concepts are currently being investigated to 1) identify new effective therapies, 2) search for predictive biomarkers and 3) obtain early assessment of response. One uses a therapeutic “window-of-opportunity” design where patients receive an investigational agent for a short time prior to NAC. Biologic effects of the agent are assessed by molecular analysis or functional imaging (currently, PET imaging). The second concept uses an adaptive design allowing for rapid testing of multiple new agents in combination with standard chemotherapy. The I-SPY 2 trial is such a phase 2 trial, where early Bayesian estimation of pCR, histologically validated at the end of the study, is used to

adapt ongoing patient randomisation to investigational arms (Park et al. 2016). The MR imaging component of the trial (ACRIN 6657) showed the better performance of tumour volume change over clinical size predictors for early response assessment (Hylton et al. 2012), and the predictive value of the quantitative “functional tumour volume” parameter regarding recurrence-free survival with a median follow-up time of 3.9 years (Hylton et al. 2016).

▶ For luminal cancers, a new paradigm could be to replace chemotherapy by endocrine therapy with good clinical results and lesser toxicity. The NEOPAL trial (clinicaltrials.gov/ct2/show/NCT02400567) addresses this issue of a possible therapeutic de-escalation in luminal tumours by comparing conventional

chemotherapy with an association of endocrine and targeted therapy.

Conclusion

To decide which of primary systemic or surgical treatment is best for each patient, multidisciplinary team discussion is crucial. The decision is based on assessment of the initial breast and axilla tumour burden, where imaging is most contributive, and on tumour biology. The expected benefits from current neoadjuvant treatments are to perform less axillary surgery along with defining more personalised therapy based on the individual clinical prognosis and on tumour sensitivity. Both issues are of research in imaging with functional and quantitative analyses.

Importance of the Histopathological Definition of pCR

Pathological complete response (pCR) has been proposed as a surrogate endpoint for prediction of long-term clinical benefit—event-free survival (EFS) and overall survival (OS).

Pathologist’s Role

Before neoadjuvant chemotherapy a core needle biopsy is performed to determine:

- Tumour histological type + DCIS component
- Tumour cellularity
- Predictive markers (ER, PR, HER 2, Ki67)

After neoadjuvant chemotherapy the pathologist examines the surgical specimen in order to define pCR and to bank residual tumour tissues for molecular analysis.

To perform these analyses, cooperation between surgeons, radiologists and pathologists is essential, emphasised Dr. Salomon.

Molecular classification is based on immunohistochemistry (IHC) (**Figure 1**).

There is no consensus definition of pCR and different definitions have been used in major neoadjuvant trials. For example, some trials used a definition of pCR where DCIS is present, while others did not (Provenzano et al. 2015). An international working group has proposed the elements to be included in the pathologic evaluation and reporting of post-neoadjuvant systemic therapy breast cancer specimens (Provenzano et al. 2015).

Cortazar and colleagues (2014), in their pooled analysis of more than 11,000 patients,

looked at the association between three definitions of pCR and event-free and overall survival by breast cancer subtype. They found the highest EFS and OS when pCR was defined as ypT0/Tis/ypN0 in the American Joint Committee on Cancer (AJCC) staging system. In breast cancers that were grade 3, HER 2+ and ER - PR - or triple negative they found a marked difference in survival between cases with pCR and those without pCR.

Standard for Post-Neoadjuvant Specimens

A standard for pathological evaluation of post-neoadjuvant specimens in clinical trials is required, says Dr. Salomon. This will include systematic sampling of areas identified by informed mapping of the specimens, close correlation with radiological findings and



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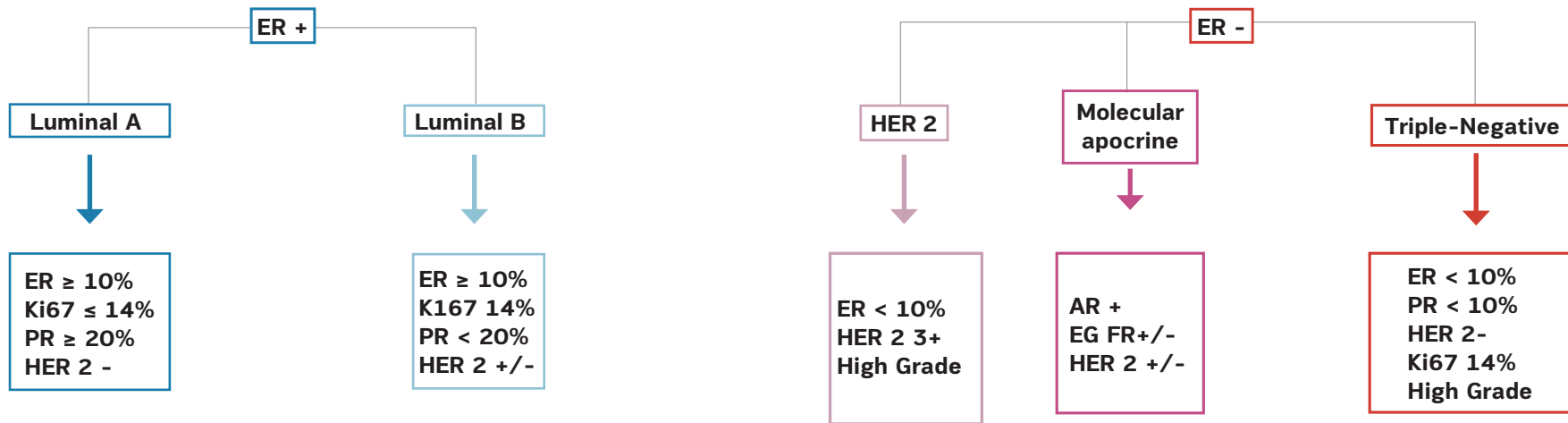


Figure 1. In Practice “Molecular” Classification Based on IHC

References: Cheang et al. 2008; 2009; Prat et al. 2013, Kennecke et al. 2010; Goldhirsh et al. 2012; Cirqueira et al. 2015, Blows et al. 2010

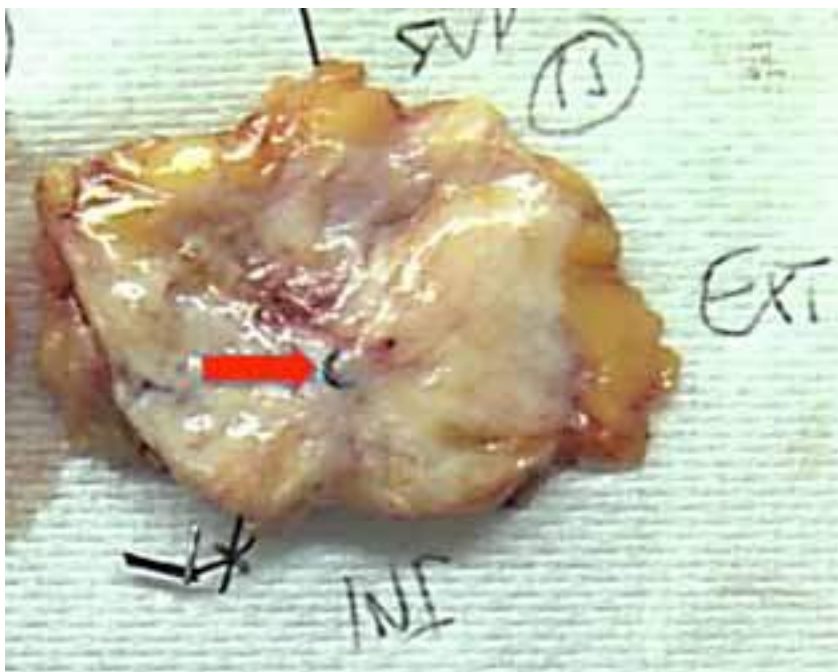


Figure 2.

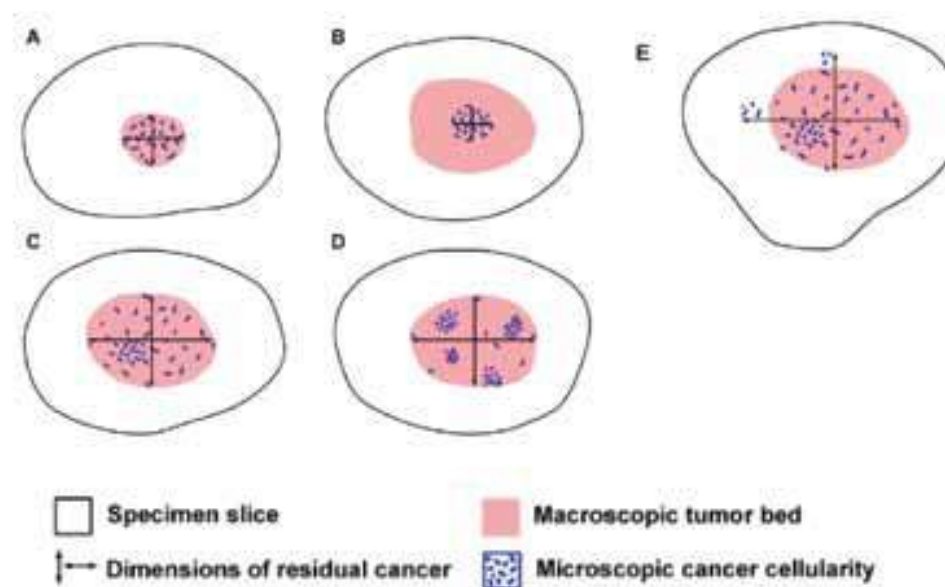


Figure 3. Adapted from Symmans et al. (2007)



tumour banking for translational research. The residual cancer burden method is preferred, and the MD Anderson website has a calculator that automatically calculates the score (<https://iii.hm/86m>). There are three classes:

- RCB-I: minimal residual disease
- RCB-II : moderate RD
- RCB-III : extensive RD

Yp TN M should be included (Provenzano et al. 2015). Symmans et al. (2007) recommended that tumour size, percentage of residual cells (both DCIS and invasive cells), the number of metastatic nodes, and size of the lymph node metastasis (ypN+) should be used to calculate the residual cancer burden.

Correlation with the radiological image is essential for macroscopic analysis of the surgical specimen if there is no apparent residual tumour. Here the coil is important as is sampling oriented by the radiological size evaluation after chemotherapy (**Figure 2**).

The residual tumour size (ypT) definition is based on the histological size of residual disease (**Figure 3**)

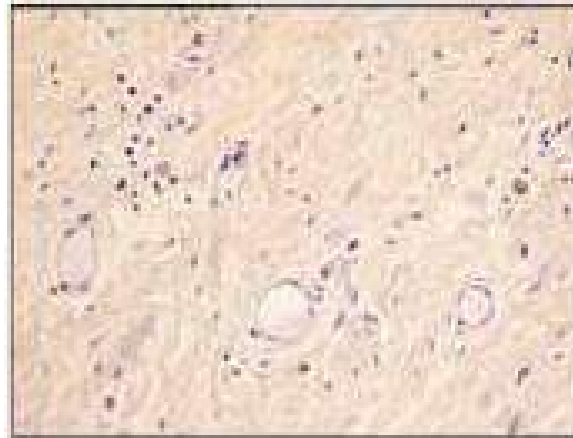
Is pCR the Answer?

Pooled analyses (at a trial level) could not validate pCR as a surrogate marker of EFS and OS (Berruti et al. 2014; Cortazar et al. 2014).

As Rose et al. state (2016): “It is a maxim of statistics that correlation does not necessarily imply causation. Similarly, correlation does not necessarily imply surrogacy.”

There is a need for other prognostic markers determined on residual disease after chemotherapy.

Complete pathological response



Fibrosis without carcinomatous cells = residual stroma = macrophages + oedema + lymphocytic infiltrate

Incomplete pathological response

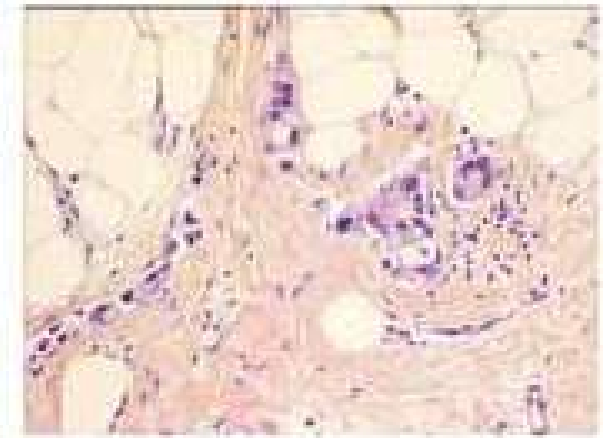


Figure 4.

Biomarkers under development have recently been reviewed (Penault-Llorca and Radosevic-Robin 2016). Genomic analysis also shows potential (Gu and Fuqua 2016).

Conclusion

In assessing efficacy of NAC predictive parameters are important, namely the histological type and ER, PR, HER 2, Ki67 to define molecular classes of breast cancer.

The residual cancer burden method is the recommended standardised method: pCR = ypT0/Tis ypN0. pCR is a favourable prognostic marker at the individual level and its prognostic value is greatest in aggressive subtypes of breast cancer. However, pooled analyses at a trial level could not validate pCR as a surrogate marker of EFS and OS. Other biomarkers are needed to define prognosis after neoadjuvant chemotherapy.



MRI as an Imaging Biomarker of Response Evaluation: Response-Adapted Strategies

Women who receive NA C are imaged with MRI before, during and after treatment. **Before treatment** the baseline MRI scan assesses the morphology and extent of the breast cancer. **During treatment** MRI scans are performed to monitor early response to NA C and to predict non-responders. **After treatment** the MRI scan is conducted to inform surgical planning, to predict residual disease or pathologic complete response (pCR) and to predict relapse-free survival (RFS) and overall survival (OS).

Predicting Residual Disease after NAC

MRI is around 74% accurate at predicting residual disease (Chen et al. 2008; de los Santos 2013). However, accuracy is variable, and it depends on the definition of pCR (Marinovich et al. 2013a). MRI has been shown to underestimate and to overestimate the size of tumours that respond to chemotherapy (Chen and Su 2013; Marinovich et al. 2013b). Nevertheless it is superior to ultrasound (US), mammography (MG) and clinical examination for this purpose (Orel 2008; Marinovich et al. 2015).

MRI is most accurate at discerning breast cancer mass - the clear tumour boundary and any concentric shrinkage. MRI is less accurate at discerning nonmass breast cancers— invasive lobular carcinoma, and tumours with extensive ductal carcinoma in situ (DCIS)

component (Chen et al. 2008; Bahri et al. 2009; Mukhtar et al. 2013; Vriens et al. 2016).

Three MRI phenotypes have been identified (**Figure1**); phenotypes 2 and 3 are the most common. Triple-negative breast cancer is more often phenotype 1 and 2. Hormone receptor positive (HR+) cancers are more often diffuse (phenotypes 3, 4 and 5). MRI images show higher concordance with tumour size in triple-negative breast cancers (Mukhtar et al. 2013).

Complete Remission

In radiology complete response does not equal pathological complete response (pCR). Radiological complete response could be defined as complete absence of pathological contrast enhancement in the original tumour bed on MRI after NA C (Loo et al. 2016).

MRI had the greatest negative predictive value (NPV) for triple negative and HER 2+ tumours (Boughey et al. 2014; de Los Santos et al. 2013; Fukuda et al. 2016).

MRI assessment for complete remission has been shown to underestimate residual tumour by around 40% according to type of NA C regimen (eg, Denis et al. 2004). The issues are that there may be multiple small foci (<5mm) and contrast enhancement too weak in these studies.

There may also be overtreatment of patients with pCR, as surgical resection may

not improve locoregional control and thus outcome (Straver et al. 2010)

Outcome after NAC

After treatment the aim of imaging is to predict outcome—RFS/OS. Outcomes after NAC are similar to patients treated with adjuvant chemotherapy (Rastogi et al. 2008; van der Hage et al. 2001; Kuerer et al. 1999). Patients who show pCR have better survival outcome (Rastogi et al. 2008; Kuerer et al. 1999). Thus pCR is used as a surrogate endpoint for disease-free survival (DFS) and overall survival (OS), but there is no standardised definition of pCR and it is variable in different breast cancer subtypes (von Minckwitz et al. 2012).

Breast Cancer Subtypes

A pooled analysis of more than 6000 patients found that:

- pCR defined as no invasive & no in situ residuals in breast & nodes had the best predictive value
- pCR is suitable in HER 2+, triple negative (TN) and luminal B tumours
- pCR in TN and HER 2+ tumours was associated with excellent prognosis (von Minckwitz et al. 2012)

pCR is not suitable as a surrogate endpoint for patients with luminal A (ER -positive HER



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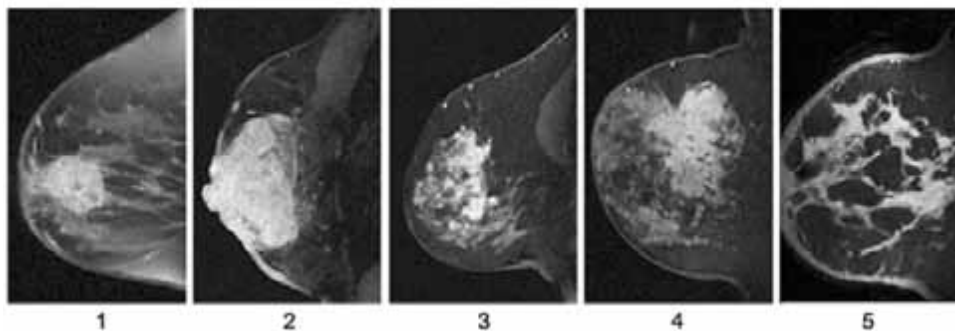


Figure 1. Examples of each of the five MRI phenotypes: 1 well defined, unicentric mass; 2 well defined, multilobulated mass; 3 area enhancement with nodularity; 4 area enhancement without nodularity; 5 septal spreading

Source: Mukhtar et al. (2013) Reproduced under CC BY 2.0 (creativecommons.org/licenses/by/2.0)

2-negative, grade 1-2) tumours. A pooled analysis could not validate pCR as a surrogate endpoint for improved event free and overall survival (Cortazar et al. 2014).

Several trials have assessed the predictive value of MRI for RFS/OS. The multicentre ACRIN 6657/I-SPY trial found that MR imaging tumour volume measurements were better than clinical assessment (Hylton et al. 2012). Other trials have investigated dynamic contrast-enhanced MRI imaging parameters as well as prognostic factors such as changes in tumour size and transfer constant (Ktrans) (Li et al. 2011; Pickles et al. 2009; Ah-See et al. 2008; Yu et al. 2007), concluding that some can predict final clinical and pathologic tumour response. Partridge et al. (2005) found that initial tumour volume rather than tumour diameter was more predictive of RFS after NAC.

Choi et al. (2016) showed that background parenchymal enhancement (BPE) of the contralateral breast is associated with outcome, in a retrospective study of 93 cases. In a multivariate analysis, they showed that high BPE on pre NAC MRI and Triple negative breast cancer is independently associated with worse RFS.

A study from the Netherlands Cancer Institute (Loo et al. 2016) evaluated in 272 women whether response evaluation by MRI is associated with RFS after NAC in ER + HER 2- (luminal) breast cancer. The results showed that a complete response at MRI after NAC in ER + breast cancer is associated with an excellent prognosis.

Conclusion

MR imaging helps to show differences in treatment response among breast cancer subtypes. This may lead to tailored imaging approaches with improved predictive performance, says Dr. Loo. However, the predictive performance of MRI differs among breast cancer subtypes. MRI is most accurate when imaging breast cancers that have mass lesions, are triple-negative and HER 2+.

“ MR IMAGING HELPS TO SHOW DIFFERENCES IN TREATMENT RESPONSE AMONG BREAST CANCER SUBTYPES ”

A multicentre study that analysed 162 breast cancer cases for functional tumour volume (FTV) and RFS found that FTV is a strong predictor of RFS (stronger than pCR), and that FTV during and after NAC is predictive of RFS (Hylton et al. 2016). The strongest predictive performance was found to be that combining MRI (FTV), histopathology (pCR) and breast cancer subtype (HR /HER 2).

	ACOSO G Z1071 Alliance (Boughey et al. 2014)	TB CRC 017 (de los Santos 2013)
	N=756	N=746
Triple Negative	38.2%	37%
HER 2-positive	45.4%	38%
ER -positive/HER 2-negative	11.4 %	13%

Table 1. Retrospective analyses by de los Santos (2013) and Boughey (2014) of pCR rates after NA C showed pCR by hormonal receptor status determined by immunohistochemical phenotype.



Surgery of the breast after preoperative chemotherapy

Breast conservation is not improving despite better pCR rates ... Why?

In prospective randomised trials in the neoadjuvant setting, Taxane-based (Bear et al. 2003) and HER2 targeted therapies with dual blockade (Baselga et al. 2012; Guarneri et al. 2012) have resulted in a marked (up to twofold) increase in pathologic complete response (pCR) rates compared with the reference arms. However, this did not translate into higher rates of breast-conserving surgery in down-staged patients after chemotherapy (Bear et al. 2003; Baselga et al. 2012; Guarneri et al. 2012).

Several factors may have contributed to this situation, one of these being that surgical treatment of the breast after chemotherapy largely relies on retrospective analyses, although sometimes of prospectively recorded data. As a result of this lack of high level evidence, little to no consensus exists on a number of surgical issues. Taken altogether, this may have led to insecurities for breast preservation both on the patient and the physician side, suggests Prof. Dubsy.

Is resection in the new margins adjusted for response after NAC a safe surgical procedure?

The long-term follow-up of several large cohorts provides evidence for the safety of breast conservation in the neoadjuvant

setting, where no subgroup (including patients with multifocal or multicentric disease) can be precluded from breast-conserving surgery (BCS) if clear margins are obtained.

Trials comparing locoregional recurrence (LR) rates in patients undergoing BCS after NAC versus initial BCS followed by chemotherapy have shown no significant differences after adjustment for age and initial stage (Wolmark et al. 2001; van der Hage et al. 2001; Mittendorf et al. 2013). In the MD Anderson Cancer Center cohort (Mittendorf et al. 2013), factors for LR were pejorative clinico-pathologic factors, multifocal residual disease on pathology, and close (< 2mm) or positive margins. Similarly, the German Breast Group neoadjuvant trials (Ataseven et al. 2015) showed that breast conservation was feasible for initial multifocal or multicentric disease at the condition of tumour-free margins or pathologic complete response.

“ THE OPTIMAL SURGICAL PLAN RELIES ON OPTIMAL INTERDISCIPLINARY COMMUNICATION ”

Based on all these results, Pr. Dubsy has suggested that: no tumour on ink and in case of close (<2mm) margins and multifocal residual disease, reexcision should be considered. Furthermore, resection within new margins, which will allow preservation of breast tissue, appears as a major goal of surgery after NAC.

Keys to performing optimal surgery after primary chemotherapy

First of all, the optimal surgical plan relies on optimal interdisciplinary communication stressed Prof. Dubsy, referring to the triple task of diagnostic, response and intraoperative assessment. The role of breast imaging and image-guided procedures is essential. Radiohistologic documentation and marking of the initial tumour site are key steps.

Regarding response evaluation, the accuracy of MRI has been shown to vary largely upon factors such as tumour subtype, initial morphologic presentation and pattern of response. While effective for assessing triple-negative and HER2-positive tumours, MRI has low accuracy in determining residual oestrogen receptor-positive disease (Loo et al. 2011).

Hence, the contribution of MRI for delineating residual disease and help obtain clear margins should preferably be addressed clinically through radiosurgical discussion of individual cases, and for further scientific evidence through joint elaboration of trial protocols.



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Scatter Radiation Exposure During Mobile X-Ray Examinations



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The main goal of this research was to quantify scatter radiation exposure from mobile x-ray examinations. The simulation consisted of reproducing the technical conditions for the chest anteroposterior (AP) examination in supine and semi-supine positions as well as for the abdomen tangential projection, using a full body anthropomorphic phantom and an x-ray detector. For distances above 1m, the national dose limits for exposed workers is not exceeded (12 mSv/year), but for members of the public it is exceeded (2 mSv/year). Therefore, exposed workers should use a personal dosimeter, employ protective measures and stand behind the mobile equipment.

The use of ionising radiation for diagnostic and treatment purposes has increased due to the development of new equipment and easier access to radiologic examinations.

It is also a useful tool to evaluate devices for clinical support, such as catheters, tracheal tubes and other life support systems (American College of Radiology 2011).

The radiograms are acquired using ionising radiation and they rely on the differences in the coefficients of attenuation of human tissues. Several effects result from interaction of the radiation with the human body. However, the best known are

the photoelectric and Compton effects, the transition between these two phenomena being approximately at 80 kVp in the soft tissues (Lima 2009; Bushong 1999).

The interaction of radiation with tissues may produce scattered radiation, which is prejudicial for image quality and contributes to patient and professional/staff exposure (Lima 2009).

Physical interactions of radiation with matter constitute the first stage of a set of phenomena that cause biological changes of two types: the acute or chronic effect and the immediate or late manifestations. To reduce these effects and to ensure the best working conditions for the professionals, diagnostic reference levels were developed to standardise the doses applied by radiographers (Evans et al. 1999; Siemens Medical Solutions 2004).

Since the rooms where mobile x-rays are performed aren't prepared for radiation exposure, special radiation protection measures have to be considered to protect patients and healthcare professionals. This includes lead aprons and other personal protective equipment (Decree-law 180/2002; Soares et al. 2011).

In keeping with the ALARA principle (as low as reasonably achievable), all exposures have to be justified and be as low as

possible, respecting the national dose limits established for exposed workers (20 mSv/year) and members of the public (1 mSv/year) (Decreto-lei 222/2008).

“ PORTABLE GENERAL RADIOLOGY IS A FUNDAMENTAL MODALITY FOR THE DIAGNOSIS OF SEVERAL PATHOLOGIES ”

During the procedure, radiographers must use personal protective equipment and/or other protective imaging measures that minimise the exposure and absorbed radiation (Soares et al. 2011).

In a hospital environment, the radiographer may need to access the ward to acquire x-rays from non-transportable patients. During this procedure, there is a need for some individuals to remain in the room, such as bedridden patients, the radiographer and other staff.

The basis of this study and the main concern is the increasing number of examinations required for nontransportable patients in environments where many individuals are present and unprotected as well as to verify whether radiation exposures are within the limits established by national law considering the frequency of this type of examination (Santos 2010; Santos and Maia 2009; Medeiros et al. 2002).

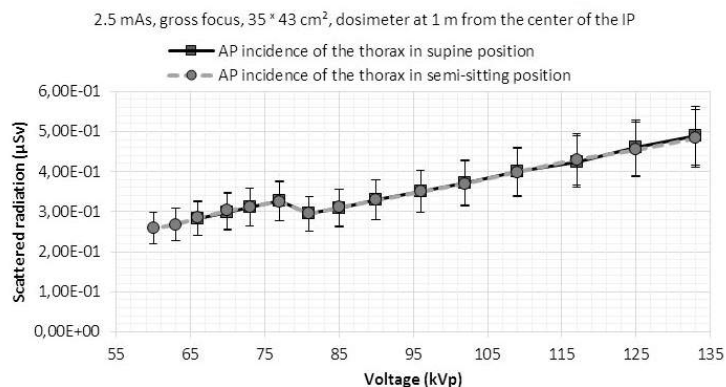


Figure 1. Variation of scattered radiation in relation to tube voltage for configuration 1 and 2

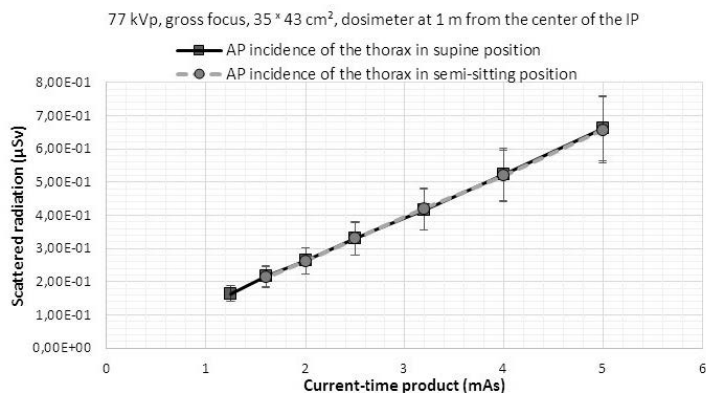


Figure 2. Variation of the scattered radiation in relation to current-time product for configuration 1 and 2.

Materials and Methods

The first stage of this study was conducted through an observational grid where technical parameters were recorded (examination type, mAs, kV, distance between the patient and the x-ray tube and the requesting department) from 194 chest AP mobile x-ray examinations.

Then the simulation consisted of reproducing the conditions of a mobile x-ray examination in three different configurations:

- configuration 1 for chest AP examination in supine position;
- configuration 2 to semi-supine position; and
- configuration 3 for abdomen tangential projection, using a full body anthropomorphic phantom and an ATOMTEX x-ray detector.

The background dose rate was measured with a maximum intrinsic uncertainty of $\pm 15\%$ in continuous mode. The mobile x-ray equipment used was a Siemens Mobilett XP Hybrid. Quality control of mobile equipment was performed with an Unfors Xi detector. The table was placed at a height of 0.96m above the room floor, the distance between the x-ray tube and image plate was 1.27m (maximum allowed by the equipment), and the detector was placed at 1m distance from the centre of the region under study. The technical parameters for voltage and current were in accordance with the results obtained in the first stage for every configuration (77kVp and 2.5mAs).

Finally, various measurements were conducted:

- A. Dose rate variation depending on the voltage (between 60-133kV).
- B. Dose rate variation depending on the current-time product (between 1.25- 5mAs).
- C. Dose rate variation depending on the distance (to study the scattered radiation dose rate depending on the distance, the equipment and the phantom were maintained in their original positions, and the radiation monitor was placed at a fixed height of 0.96m, corresponding to the middle coronal plane of the phantom for configuration 1. As technical conditions 2.5mAs and 77kVp were used, only the distance between the phantom and the detector varied in both configurations. Measures were taken for both configurations at a 90° angle to the median sagittal line of the phantom, between 0.25 m and 1.5 m, with the detector being repositioned in increments of 0.1m. After 1.5m, the detector was repositioned in increments of 0.5m up to 2.5m).
- D. Dose rate variation depending on the height (once again, the equipment and the phantom were maintained in their original positions, and the radiation monitor was placed at a fixed

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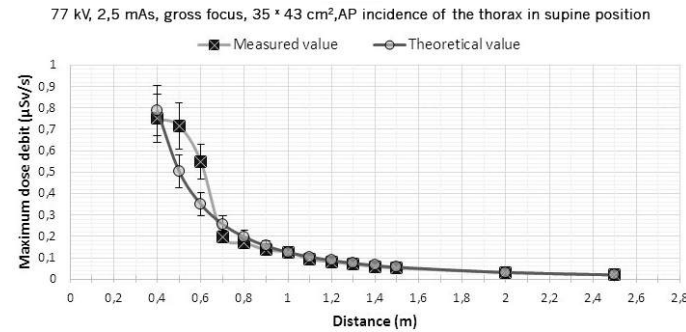


Figure 3. Variation of scattered radiation in relation to distance to the centre of the patient for configuration 1

distance of 1m from the centre of the region under study. Readings were taken at a 90° angle to the median sagittal line of the phantom, between 0.1m and 1.80m, changing the position of the detector in increments of 0.1m).

- E. Dose rate variation around the phantom (radiation monitor was placed at 1m from the centre of the exposure field, at a height of 1.25m in the plane of incidence of the radiation beam in configuration 1. The position of the detector was changed in 150 increments; the 0° angle corresponds to the median sagittal line in the direction of the head).

Results

The hospital department that requires the highest percentage of mobile x-ray examinations (36.7%) is the intensive care unit (ICU). In accordance with the measures

mentioned above the following results were obtained:

A. Dose rate variation depending on the voltage

For 60kVp corresponding scattered radiation was 0.258µSv, and for 125kVp it was 0.455µSv for chest AP x-rays in the supine position (Figure 1). The change between 77 and 81kVp may be due to the transition between the Compton effect and photoelectric effect. Voltage and exposure were correlated and linear regression analysis confirmed that the scattered radiation is directly proportional to the voltage ($R=0.9994$). The values are similar for both configurations (1 and 2) due to the same technical conditions.

B. Dose rate variation depending on the current-time product

We observed an increase of scattered radiation with the increase of current-time product. For 2mAs corresponding scattered radiation was 0.264µSv, and for 4mAs it was 0.523µSv for the chest AP in the supine position (Figure 2). These results

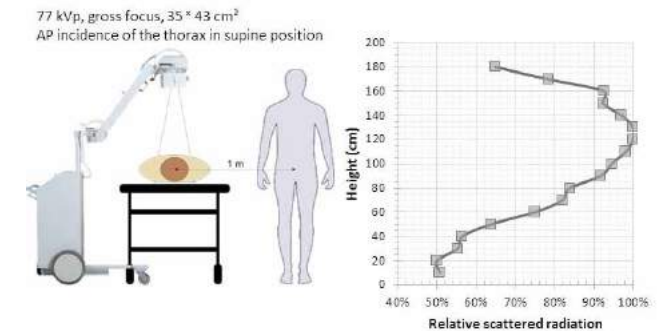


Figure 4. Variation of scattered radiation in relation to the height of the exposed worker for configuration 1

are consistent with the literature and the scattered radiation is proportional to current-time product. The correlation between the scattered radiation and the current-time product showed that the secondary radiation is directly proportional to the current-time product ($R=0.9995$).

C. Dose rate variation depending on the distance

According to the general rule of irradiance, an extended source may be considered a point source if the distance from the source is greater than five times its diameter (Santos 2010). Therefore, to calculate the theoretical values, the value measured at the greatest distance was used, allowing the application of the inverse square law. We observed differences between the measured values and the theoretical values for distances less than 1m (Figure 3). Comparing the measured values with the theoretical framework, both results overlap from 1m due to the inverse square law. Up to this distance, the measured values are different because the patient simulates a set of multiple sources.

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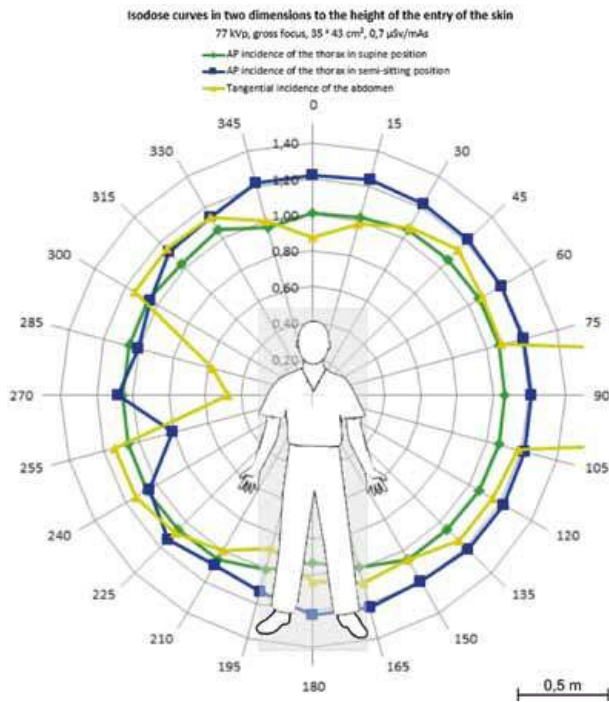


Figure 5. Isodose curves in two dimensions to the height of the entry of the skin for the three configurations

D. Dose rate variation depending on the height

The lowest dose rate was measured under the table at 0.1 and 0.2m (0.131 μ Sv and 0.133 μ Sv respectively). The intensity of the scattered radiation is higher above 1m. At 1.2 m and 1.3m the scattered radiation reaches its maximum (**Figure 4**). Between 0.2 m to 0.4 m and between 0.6 to 0.8 m there were variations in scattered radiation which may be explained by metallic structures of the litter.

E. Dose rate variation around the phantom

Considering the scattered radiation dose rate readings around the phantom we used the inverse square law formula to estimate, for each angle, the distance at which the detector should be to receive the maximum scattered radiation dose rate registered (0.175 μ Sv/s) (**Figure 5**). Lower doses of scattered radiation were observed at chest AP x-ray incidence in the supine position.

Conclusion

Radiation protection is necessary in order to reduce the levels of radiation exposure in medical imaging activities such as mobile x-ray examinations, which subject patients and healthcare professionals to radiation exposure.

Mobile x-rays on patients do not reach dose limits established by the national law and by international standards for protection against radiation (Directive 96/29/Euratom), provided that the individuals stay more than 1m away from the centre of the exposure field and measures of radiological protection are applied.

KEY POINTS

- ✓ Patients and staff require radiation protection during mobile x-ray examinations
- ✓ National and international (Directive 96/29/Euratom) dose limits for exposed workers are not exceeded
- ✓ Radiographers should use personal dosimeters, employ protective measures and stand behind the mobile equipment



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CT And MRI Market in Cyprus

An Overview



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It can be said that the diagnostic imaging sector in Cyprus could observe constant growth in the coming years despite the negative impacts of the economic crisis, given no changes in the healthcare scene. That view, coupled with the universal and constant demand for improved diagnostic tools, creates the premise for reviewing the current market of advanced diagnostic imaging (ADI) comprised of MRI and CT in Cyprus.

Cyprus is one of the leaders in numbers of CT and MRI scanners per 100,000 inhabitants (3.2 CT and 2.0 MRI scanners vs. 2.2 and 1.2 in the EU respectively). At first glance, it can be argued that this market is fully saturated; however, no data exist to support this claim. The only existing data in the Eurostat 2016 database involves only public sector activity showing disproportionately low usage.

Method

The purpose of this study was to provide an analysis of the current and future trends of the CT and MRI market in Cyprus, which can be used as a tool for strategic decision making in the field.

The study followed a twofold methodological process. Its first part consisted of an extensive review of the relevant literature followed by a field analysis, which included data collected from public services and private sources.

In order to obtain valid information regarding the current situation as well as the nature and magnitude of the activity in this

particular area, key informants and major stakeholders of the sector were contacted. This approach helped us to extract extensive information on the matter, which was in many cases cross-checked with two or more key informants during this process.

Findings

CT and MRI Facilities

Cyprus is a leading country in numbers of CT and MRI scanners per 100,000 inhabitants (**Table 1**) (Eurostat 2016). Despite the fact that Cyprus was among the top countries in MRI units, it reported one of the lowest ratios in numbers of MRI scans (below 1,000 scans) per 100,000 inhabitants.

However, this view is inaccurate since the only examinations counted are those at the only MRI unit in the public sector, which are then related in a ratio with the total number of MRI units in both the private and the public sectors yielding a dramatically low and inaccurate ratio.

Table 2 presents the numbers of CT and MRI scanners for the period 2005-2016. At present there are 18 MRI units and 29 CT scanners in Cyprus. Cyprus had the highest percentage of ageing CT scanners in 2013 and did significantly better with respect to MRI units compared to the rest of the European countries (**Table 3**).

Although medical technology older than 10 years is considered outdated and difficult to maintain and repair, there is a trend in

the private sector in Cyprus to acquire and commission used CT and MRI scanners. The situation is still controlled for MRI as a few of them are reconditioned, while others are upgraded after some years in operation. Concerning CT scanners, the situation is much worse, since there were some really old scanners at the time (2013) both in the public and private sectors.

CT and MRI Activity

CT and MRI examinations carried out in the public sector (**Table 4**) are recorded by the Statistical Service (Republic of Cyprus Statistical Service 2016).

The figures were estimated by compiling 2014 data from the Ministry of Health regarding the public sector and data collected for the private sector. Consequently this picture of the private sector should be evaluated as a rough overall indication, since there are no official statistics. The level of uncertainty on these figures cannot be calculated.

It was estimated that the annual activity (public + private) of MRI is approximately 50,000 examinations (89% private and 11% public) (Figure 1), while the corresponding activity of CTs is approximately 123,000 examinations (23% private and 77% public) (Figure 2). This estimation is slightly higher than the EU mean, showing an underutilisation of diagnostic imaging in private sector (Eurostat 2016).



Country	CT scanners ratio per 100,000 inhabitants	MRI scanners ratio per 100,000 inhabitants
Bulgaria	3.4	0.7
Croatia	1.6	1.1
Cyprus	3.2	2.0
Greece	3.5	2.3
Hungary	0.8	0.2
Ireland	1.8	1.3
Italy	3.3	2.4
Lithuania	2.3	1.1
Poland	1.7	0.7
Portugal	2.1	0.7
EU mean	2.2	1.2

Table 1. Ratios per 100,000 inhabitants in CT & MRI scanners (2013) Source: Eurostat, 2016

The MRI market is dominated by the private sector while the CT market by the public sector since the latter possesses only one MRI scanner. CT examinations in their vast majority concern referrals of public sector beneficiaries served by the six CT scanners of the public sector. This portrayal indicates an underutilisation of CT scanners in the private sector. Regarding the private sector, it can be noted that there is a concentration in MRI activity of more than 70% at 7 private providers while the remaining 11 are operating well below their capacity.

“ THE PRICE OF THE EXAMINATION IS PROBABLY THE MOST DECISIVE FACTOR FOR THE PATIENTS AND SEEMS TO DRIVE COMPETITION ”

The price for a common and simple MRI examination can be as low as €190 today, whereas ten years ago it was nearly double this amount. This is attributed mainly

CT																							
2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		2015		2016	
15		15		28		28		27		27		27		27		28		28		28		29	
Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr
5	10	5	10	5	23	5	23	5	23	5	23	5	23	5	23	5	23	5	23	5	23	5	23
MRI																							
2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		2015		2016	
5		5		7		13		5		5		5		5		5		5		5		5	
Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr
1	4	1	4	1	6	1	12	1	14	1	15	1	16	1	16	1	16	1	16	1	16	1	17

Table 2. Changes in CT and MRI scanners numbers 2005-2016 (Pu=public sector, Pr=private sector) Source: Eurostat (2016) ¹From the field research

to two factors: (a) the entrance of new ‘players’ with older units hence lower depreciation costs and (b) the gradual deterioration of the economy during recent years that has limited consumer purchasing power and exerted pressure over the market to lower its prices.

CT and MRI Market Drivers

The absence of an integrated national health system affects the market in various ways. Shortcomings such as an unregulated market, lack of quality assurance and referral systems, induced demand practices, high prices, out-of-pocket payments, long waiting lists etc. could more easily be handled in a well-organised health system. In the current system, the majority of the public health beneficiaries choose to pay for imaging services in the private sector due to the shortcomings of the public sector. A significant number of patients opt for out-of-pocket private sector imaging services while some patients are privately insured.

The absence of control over the private sector by the state in conjunction with the lack of national guidelines and protocols regarding the referral of patients for diagnostic imaging investigations create favourable conditions for excessive use of such services and creation of artificial demand, based on the perceived need by the consumer and the opinion of treating physicians. In other words, it is relatively easy for a patient who feels it is necessary to have an imaging examination to obtain a referral by a private sector physician based only on his or her perceived need. Moreover, a physician can easily request an imaging examination without considering all alternative options available.

Many private sector providers that operate in this market environment have emerged in the last decade. One distinct category of those private providers is that of physicians and other clinicians who collaborate by referring their patients to specific providers. Some of them are also major shareholders in these small or

Age profile	CT scanners		MRI scanners	
	Cyprus	Europe	Cyprus	Europe
1-5 years	~30%	~50%	~50%	~40%
6-10 years	~30%	~40%	~30%	~40%
10+ years	~30%	~10%	~20%	~20%

Table 3. Cyprus age profile: CT and MRI scanners in 2013
Source: COCIR (2013)

	2006	2007	2008	2009	2010	2011	2012	2013	2014
CT	51,887	55,702	67,842	75,157	83,536	85,709	91,184	96 265	94 491
MRI	--	116	6,500	5,660	5,191	6,261	6,207	5,939	5,535

Table 4. CT and MRI examinations, public sector 2006-2014
Source: Statistical Service, Republic of Cyprus (2014)

large private hospitals where the facilities are found. There can also be physicians with their own private practices who are shareholders in a certain facility or simply ‘join forces’ in supporting these facilities. The financial viability of these facilities is supported and, to an extent, ensured through the creation of a strong network of referring clinicians. One other distinct category of private sector providers is that of the relatively new entrants in the market of diagnostic imaging, who focused on the pricing parameter, offering the lowest prices on the market for almost all types of imaging examinations.

Today consumer attention lies with price; this has caused all providers to lower prices or offer discounts. For MRI the prices have been reduced by €100-150, depending on the examination.

Regardless of the provider category, there is an informal system of ‘premium granting’ to clinicians referring their patients to the various providers of

the private sector. This premium granting to referring clinicians is commonly referred to as ‘provision of medical services’ and is basically a payment of 10-30% commission on the price of the examination, depending on the type of examination requested. Although this activity does not appear to be illegal, it can be argued that it damages fair competition as it introduces a form of financial incentive for the referring clinicians and this can often not be in the patients’ best interest.

Conclusions

Cyprus has too many MRI and CT units in relation to its population and its needs. Despite the existence of a detailed legal framework, in practice there is significant flexibility. The absence of specific legislation regarding MRI units has created conditions for their installation without any indication.

The complete lack of activity data forced us to look for ways of measuring the CT and MRI activity, conducting field research by visiting diagnostic centres,

using personal contacts and key informants. Despite the practical difficulties, enough data was gathered on the activity of the private sector, although some was based on estimates by market experts.

Currently there is no monitoring and control over the clinical activity of the private sector. There are no referral protocols being utilised. This creates conditions for the rise in ‘artificial demand’.

The market seems to be driven by the prices as well as by the establishment of ‘alliances’ and the creation of physician referral networks. Despite the fact that these units operate well below their capacities, they still remain in the market without presenting any loss.

The introduction of a national health system in the near future is expected to have a positive effect on these shortcomings and hopefully introduce reforms needed in order to improve the current market environment.

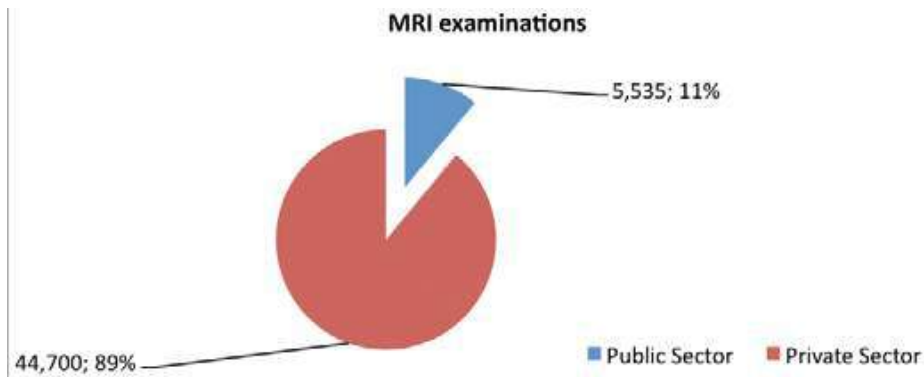


Figure 1. Estimated MRI activity, public - private (2014)

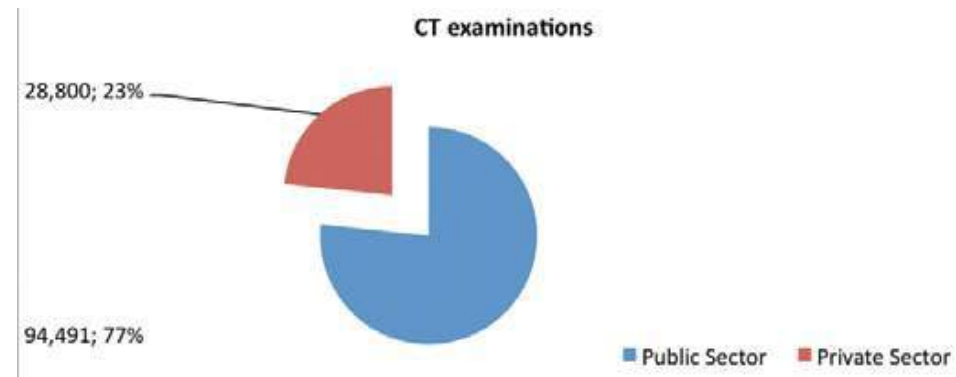


Figure 2. Estimated CT activity, public - private (2014)

KEY POINTS



- ✓ CT and MRI market in Cyprus: trends and important characteristics of the public and private sectors
- ✓ CT and MRI Facilities in Cyprus: numbers, types and age profiles of all modalities found in Cyprus
- ✓ CT and MRI Activity in Cyprus: estimated number of examinations in both sectors and factors affecting demand



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Apps for Cardiovascular Disease

The Role of Avatars in Personalisation



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How do we help people to improve their health after a heart event? Current guidelines recommend that people with heart disease attend a programme of cardiac rehabilitation (European Society of Cardiology [ESC] 2016). High-quality evidence shows that attendance at cardiac rehabilitation decreases the likelihood of a further cardiac event or death, and improves quality of life (Taylor et al. 2015). The precise content of cardiac rehabilitation programmes varies, but usually includes components of exercise, education, and attention to psychosocial problems (ESC 2016). Behaviour change such as improving diet, increasing regular exercise, taking medications, and reducing stress is a key focus of cardiac rehabilitation (ESC 2016). Cardiac rehabilitation includes formation of a ‘therapeutic alliance’ with the healthcare provider (Woodruffe et al. 2015), and this strong relationship may be central to successful behaviour change. Unfortunately, less than half of the people who could benefit from cardiac rehabilitation attend. Some groups have particularly low attendance, such as women, and those from ethnic minority groups (Clark et al. 2013).

So why don’t people go to cardiac rehabilitation? Cardiac rehabilitation is typically time-limited, conducted in groups and requires people to visit a hospital or community centre (Clark et al. 2013). Distance to the facility, dislike of participating in groups, and the timing of the programmes, which are

frequently conducted during working hours, may deter people from attending (Clark et al. 2013).

Mobile Apps

The explosion of digital technologies gives hope that mobile applications (apps) might be able to deliver cardiac rehabilitation at a time, place and in a mode more convenient to individuals (Neubeck et al. 2015). Studies of programmes which deliver services remotely show some promise (Albarran et al. 2007). For example, the TEXT ME study, that used automatically generated text messages to give cardiovascular health advice, was successful at improving multiple cardiovascular risk factors in the 352 patients who received them (Chow et al. 2015).

Personalisation appears to be a critical element of the success of apps in this field. When researchers from the TEXT ME study interviewed participants, they found that the participants imagined that the friendly research assistant who had recruited them was personally sending individual text messages (Redfern et al. 2016). It seems that the more apps can be personalised, the more relevant and meaningful they become to us (Neubeck et al. 2015).

Digital Avatars and Gaming

Digital avatars are theorised as a way to increase the sense of personalisation. The word ‘avatar’ comes from a Sanskrit word

meaning descent. In Hinduism, an avatar was the manifestation of a god on earth. In digital terms, an avatar is the graphical representation of the user in a digital environment. Avatars can be anything from simple two-dimensional icons to complex three-dimensional images. Avatars are frequently, and successfully, used in gaming (McGonigal 2011).

Gaming apps make up a large proportion of time spent online. At least 70 percent of people in the UK have a gaming app on their phone, and women of all ages now game more than men (Neubeck et al. 2015). This is particularly important, because women are less likely to go to cardiac rehabilitation, but may use an app more readily. Apps make games less threatening, and gamification has been successfully used to improve health (Neubeck et al. 2015).

**“WOMEN ARE LESS LIKELY
TO GO TO CARDIAC
REHABILITATION , BUT MAY USE
AN APP MORE READILY”**

For a short time in 2016, headlines were filled with stories of Pokémon Go—the good, the bad, and the ugly. On the one hand, people were reported to increase their physical activity exponentially, with success stories of weight loss, increased fitness, increased interest and engagement with other players (Clark and Clark 2016). On the other hand,



Figure 1. MyHeartMate digital game

traffic was stopped as players swarmed the streets in search of an elusive Pokémon, people risked their lives on train tracks, and parents were cautioned about the safety of their children (Clark and Clark 2016).

At this stage, the research hasn't been completed to show whether the use of avatars or gaming will be able to augment traditional cardiac rehabilitation services. However, lessons learned from other apps help to highlight some important considerations. Researchers are now testing different models of avatars to prevent and manage chronic disease. Keele University in the UK launched an app called 'Manage Your Health' in January 2016 (<https://iii.hm/7q4>). The aims are to offer support to people with asthma, COPD, diabetes, and back pain. This app uses an avatar of a health professional to demonstrate key points, like how to use an inhaler correctly. If successful, this could reduce time spent on demonstrating techniques, while offering the opportunity for users to regularly remind themselves of key points.

Another avatar that was launched this year is the MyHeartMate app (Figure 1) (Neubeck et al. 2016). It was designed as a game, where the actions taken in the real world improve the heart avatar in the game. Players look after their heart avatar and their own heart health by undertaking good health behaviours. Points are earned through health quests and fun games and then spent on their heart through exercise, managing stress, eating a healthy diet and taking medications. If you are not looking after your real heart, your virtual heart looks increasingly unwell. Manage Your Health and MyHeartMate have been developed in English, and although one stated benefit is that apps are readily translated into other languages, these apps have not yet tested that.

Cultural Considerations

Cultural relevance is extremely important. It is easy to dismiss information if the people who give it are perceived as 'not like me'. Avatars have the advantage of being tailored to be culturally relevant. Researchers in Stirling recently developed an animation using avatars to encourage young people with asthma to be more physically active (Murray et al. 2016). Avatars varied in relation to gender and skin colour so that users could select the avatar that appealed to them most. Young people were also involved from the beginning in designing the intervention, something the authors conclude was essential to making the final intervention acceptable to those it was designed for. In the digital age language can be quickly translated, but literal translation can bring about some startling results. It is imperative that when apps are developed for diverse cultural backgrounds, people of the

relevant culture are involved throughout to avoid translations that are in the best case laughable, or in the worst case inappropriate or offensive.

One app for people with heart disease that hopes to address this is the Flinders University 'Cora' app (Figure 2). Cora is the avatar of a healthcare professional that advises people on how to manage their chest pain. She has been developed to be as universally appealing as possible. Extensive research went into the look and content of the avatar, and eventually the researchers will be able to let users customise the avatar even further (Clark et al. 2014). Patients provided feedback on the look and feel of the app and reported a high level of satisfaction. Importantly, the patients also felt they had gained a better understanding of how to recognise and respond to symptoms of a heart attack. Now the researchers are testing their findings in a large randomised controlled trial: "A Simple avatarbased Application for improving heart attack education: SAVE" (<https://iii.hm/7q6>).

Another study addressing patients' response to heart symptoms has used animated characters and a 'storytelling' approach to illustrate different scenarios



Figure 2. Nurse "Cora", An AVATAR App for Teaching Recognition and Response to Chest Pain

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and experiences (Farquharson et al. 2016). This intervention has systematically included behaviour-change techniques (Michie et al. 2013), highlighting the potential to incorporate existing theories and evidence about what changes behaviour into the new digital modalities. This will hopefully increase effectiveness.

Conclusion

The role of avatars in apps is hypothesised to be important from the point of view of personalisation and engagement. Although extensive work is going on in this area, it is too soon to say if this will generate better healthcare outcomes for patients. Although something as simple as text messaging has been successful in achieving improved cardiovascular risk factors, it is critical to understand that a person-centred element is likely to be important in ongoing success and is critical in delivering healthcare interventions. It is possible that avatars could convey a sense of that person-centred support. The results of future studies are eagerly awaited.



Figure 3. Storytelling to Engage People with Recognising Heart Pain



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Does Technology Gap Cause Medical Errors?



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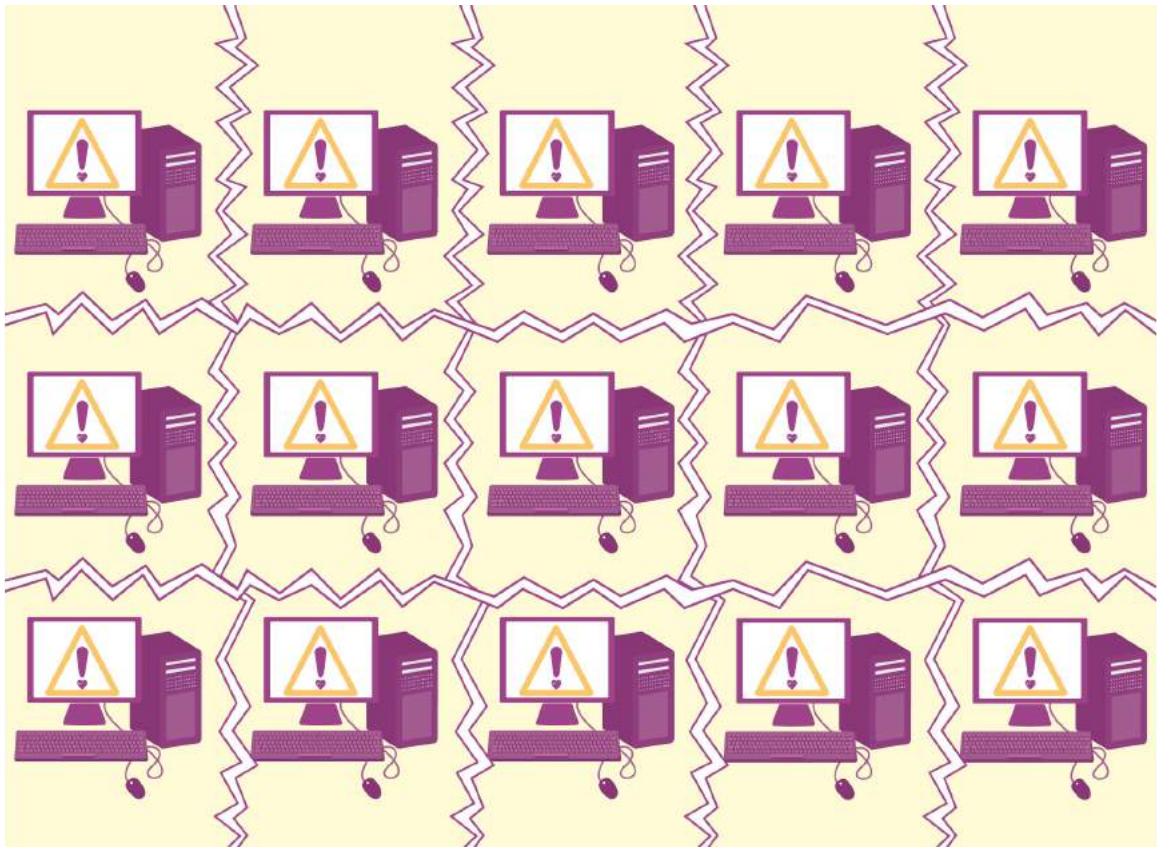
aultman.org

Hardly a day goes by without some new revelation of an information technology mess in the U.S. - whether nuclear weapons updated with floppy disks to needless deaths from medical errors, many of which are caused by preventable interoperability communication errors.

According to a report released to Congress, the Government Accountability Office (GAO) has found that last year the US government spent 75 percent of its technology budget just maintaining ageing computers (U.S. GAO 2016). In a previous report, (GAO -15-817; September 16, 2015) the GAO outlines the lack of health IT interoperability (U.S. GAO 2015), a major factor behind the deaths of hundreds of thousands of patients every year as a result of medical errors. A study from the British Medical Journal (Makary and Daniel 2016) cites medical errors as the third leading cause of death in the U.S., after heart disease and cancer.

The GAO report *Electronic health records: nonfederal efforts to help achieve health information interoperability* (2015) details the status of efforts to develop infrastructure that could lead to nationwide interoperability of health information. The report describes a variety of efforts being undertaken to facilitate interoperability and concludes that most of these efforts remain works in progress, identifying five barriers:

- Insufficiencies in health data standards;
- Variation in state privacy rules;
- Difficulty in accurately matching all the right records to the right patient;
- The costs involved in achieving the goals;
- The need for governance and trust among entities to facilitate sharing health information.



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CMS Pushing for ‘Plug and Play’ Interoperability Tools that Already Exist

Meanwhile in an interview with the Massachusetts Medical Society (MMS) blog, Andrew Slavitt, Acting Administrator of the Centers for Medicare & Medicaid Services’ (CMS) acknowledges in the CMS interoperability effort “we are not sending a man to the moon” (MMS 2016).

“We are actually expecting (healthcare) technology to do the things that it already does for us every day. So there must be other reasons why technology and information aren’t flowing in ways that match patient care. Partly, I believe some of the reasons are actually due to bad business practices. But, I think some of the technology will improve through the better use of standards and compliance. And I think we’ll make significant progress through the implementation of API ’s in the next version of EHR s, which will spur innovation by allowing for plug-and-play capability. The private sector has to essentially change or evolve their business practices so that they don’t subvert this intent. If you are a customer of a piece of technology that doesn’t do what you want, it’s time to raise your voice,” said Slavitt.

“ AS GOVERNMENT OFFICIALS FAIL TO TAKEA LEADERSHIP ROLE IN SOLVING INTEROPERABILITY, HEALTH SYSTEMS OPERATORS CAN STEP UP ”

Slavitt then states that CMS has “very few higher priorities” other than interoperability. In addition to Slavitt, two other government entities point their fingers at interoperability as the highest priority. That said, ‘plug and play’ API solutions have been available through middleware integration for years. These are the same technologies that are successfully used in the retail, banking, airline, hotel, and auto rental industries, among many. I will discuss the solution below, but first



I would like to address the consequences of lack of interoperability.

Medical Errors Third Leading Cause of Death in US

The BMJ recently reported that medical error is the third leading cause of death in the United States, after heart disease and cancer and as such, medical errors should be a top priority for research and resources (Makar y and Daniel 2016). However, accu rate, transparent information about errors is not captured on death certificates which are the documents the Center for Disease Control and Prevention (CDC) uses for ranking causes of death and setting health priorities. Death certificates depend on International Classification of Diseases (ICD) codes for cause of death, but causes such as human and EHR errors are not recorded on them.

“It is also interesting that government entities point their fingers at interoperability while technology like middleware, successfully used in the retail, banking and hospitality industries, has been around for years,” says Doug Brown, CEO , Black Book Research. Black Book Research even listed the top middleware players

in a recent report: Zoeticx, HealthMark, Arcadia Healthcare Solutions, Extension Healthcare, Solace Systems, Oracle, Catavolt, Microsoft, SAP and Kidozen (Black Book Research 2016).

The Root Cause of Many Patient Errors

“Better coding and reporting is a no-brainer and should be required to get to the bottom of the errors so they can be identified and resolved. Unfortunately, the vast majority of medical devices, from EHR s to other healthcare IT components, lack interoperability, with interoperability meaning a built-in or integrated platform that can exchange information across vendors, settings, and device types,” adds Brown (Black Book Research 2016).

Various systems and equipment are typically purchased from different manufacturers. Each comes with its own proprietary operating system and its own interface technologies. Moreover, hospitals often must invest in separate systems to pull together all these disparate pieces of technology to feed data from bedside devices to EHR systems, data warehouses, and other applications that aid in clinical decision-making, research and analytics. Many bedside devices, especially older ones, do not even connect to computers and require manual reading and data entry.

The nation’s largest health systems employ thousands of people dedicated to dealing with “non-interoperability.” The abundance of proprietary protocols and interfaces that restrict healthcare data exchange takes a huge toll on productivity. In addition to EHR’s physical inability, tactics such as data blocking and hospital IT contracts that prevent data sharing by EHR vendors are also used to prevent interoperability.

The Devil is in the Data Distribution

There are numerous areas in hospitals that are particularly vulnerable to deadly errors, such as acute



care settings that require a complexity of care, time critical interventions, staffing and the systems that are relied upon to tie these many IT resources together. However, due to the complexities and differences between health data systems, medical professionals are constantly presented with different user interfaces that must be consciously thought about to appropriately gather data as well as capture their decisions and treatment plans.

“ WHILE THE US TECHNOLOGY GAP WILL MOST LIKELY CONTINUE, ACTIONS CAN BE TAKEN TODAY TO END THE NEEDLESS MEDICAL DEATHS ”

It is equally important to look at how the data stored in these disconnected, disparate systems is used. Much of the collection of patient, process, quality

and financial data in medicine looks like a large jigsaw puzzle with raw data and information fragmented across numerous non-operable EHRs. Connecting these pieces has focused primarily on the transfer of the information to those who request it, a manual and error-prone process that is compounded by lack of interoperability.

Dynamic Data Flow Extends Healthcare IT

Extending the power of health IT depends on understanding the idea of data flow which is critical to the management of entire populations of patients, either within a single clinic, hospital, health system or entire community. We need dynamic data flow connected through ‘smart’ interoperable pipes using middleware technology so we can improve on the care delivered. The flow of data can be as important, or even more important, than the individual data points.

Data flows contain signals and streams which allow automation to take place. When we think of healthcare information technology from the perspective of data flow, we can focus on the overall flow of the patient through the healthcare system. This allows for the design of complex analysis, automation and understanding of data.

While the US technology gap will most likely continue, actions can be taken today to end the needless medical deaths. As government officials continue to fail in taking a leadership role in solving interoperability, health systems operators can easily step up. Integrating EHR s with middleware-driven IT healthcare systems can begin today.



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U.S. Healthcare to be Trumped UP!

(even more so than under Obamacare)

Now approaching 20% of gross domestic product (GDP), healthcare is a crucial economic concern, while it remains politically tenuous. Americans are troubled as to what lies ahead under Trump, matched by despair as the Republicans seek to dismantle most of Obama's healthcare achievements. U.S. healthcare faces major uncertainties in the near future. What happens this year and next will define the nature of the next decades' health system.



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The End of Affordable Care?

As his first act as President, Trump signed an Executive Order to prohibit federal agencies from actions related to the Affordable Care Act (ACA), known as Obamacare (Associated Press 2017). This ends the individual mandate for purchasing insurance, and gives States greater flexibility in implementation. Trump's promise to "repeal and replace Obamacare" must now pass Congress (Meyer 2016). However, total repeal will not get much support given the corporate interests of the medical-industrial complex (Salmon 1990;1994; Relman 1980) (Table 1 - see supplement online) and the law's complexity embedded into the healthcare system.

Even with a Democrat in the White House, the healthcare system was destined for a major crisis, with imploding health insurance exchanges (HIEs) and provider scale-backs amidst premium raises up to 70% in some places (Kaiser 2016); many counties have only one insurance carrier. The numbers struggling to pay medical bills and avoid bankruptcy did come down, but the out-of-pocket burden on consumers became politically painful. Physicians expanded their practices, hospitals found new revenues for their previously self-pay patients, insurance firms reaped added profits, and a plethora of

private consulting firms cropped up to assist in implementation. States that accepted the Medicaid expansion benefited greatly in reducing their uninsured cohorts, which safety-net hospitals and community health centres appreciated (Kaiser Health 2017). Republican governors now worry about repeal because of the fiscal whammy their budgets may have to endure (and the provider uproar) if they cannot replace lost federal revenues (Beaumont 2017).

The ACA did not bring affordability or universal coverage. Many newly insured people have yet to secure a primary care physician relationship. Almost 9 million post-election signups for coverage reflect popular anxiety over what is to come (Schencker 2016a; Tracer 2017). Ten percent are still uninsured, and the Centers for Medicare and Medicaid Services (CMS)'s favouring of primary care physicians in value-based payment and forcing specialists into mandated bundled reimbursements has driven much doctor ire. It's reported that 359,000 physicians are under alternative payments mechanisms beginning in 2017 (Haefner 2017). While a minority of physicians favour repeal (40% in one informal survey; 15.1% in a survey published in the NEJM); most identify some merit in the law (Pollack et al. 2017).

The Republican Party will seek to trim benefits, force greater cost-sharing, and roll back protective regulations (Edney et al. 2016). A New York Times piece "Where Trump won, many want to keep healthcare" should trigger pause to Trump's populist image (Goodnough 2016). Eighty rural hospitals closed last year, with more dangling on bankruptcy if reimbursements are lowered and patients are dis-enrolled (Ellison 2016); this is Trump territory! Physicians serving folks who lose coverage will face an ethical dilemma over discontinuing care without any or diminished reimbursement.

Repeal will affect coverage for 156 million employees (ie, children on parents' insurance, pre-existing conditions, mental health and disability benefits, preventive medicine guarantees, etc.) (Schencker 2016b). Trump and Congress must work through a minefield of regulatory changes beyond financing, and craft the complicated legislative language that acknowledges not only criticisms, but the expected heavy disruption to the entire healthcare system. The Republican agenda must speak to access, benefit design, consumer choice, and specifics on flexibility for the States. State governments (the majority Republican-controlled) are not eager for reduced Medicaid funding under block

grants (Sommers and Epstein 2017); nor will consumers be easily satisfied since the public remains split on favouring the ACA.

Key Health Appointments

Key among Trump's appointments is the now-confirmed Health and Human Services Secretary, Representative Tom Price of Georgia—one of the foremost critics of Obamacare. Seema Verma will be nominated to head the Centers for Medicare and Medicaid Services (CMS), while the FDA commissioner, NIH director and CDC director are still to be named.

Hearings on Price offered little on how he would replace the ACA. Price was an orthopaedic surgeon for 20 years, which may have charged him up against Obama's bureaucrats; CMS actions became unappreciated by a large segment of the medical profession over implementation of the Medicare Access and CHIP Reauthorization (MACRA) Act of 2015 and the Merit-based Incentive Payment System (MIPS). Besides electronic health records, an alphabet soup of MU, ICD-10, QPP, AP Ms, and other quality and cost requirements have been felt to be fencing in physicians. Private corporate providers and insurance firms have followed suit to restrict physician autonomy, which has fostered what is thought to be growing physician burnout (Salmon and Thompson 2017).

As to ethics, Price's portfolio holds substantial insurance, pharmaceutical, and corporate hospital chain stocks. The Wall Street Journal reported that he traded \$300,000 in shares in numerous healthcare companies while pursuing legislation that could impact them (Grimaldi and Hackman 2016). Price announced that he would divest from 43 firms if confirmed, and maintained that his broker made trades without his direct knowledge, leading Democratic Senator Al Franken, to comment that he found Price's response "begs credulity."

Price and colleagues also want to better protect doctors from malpractice claims, which maintain "toohigh" premiums leading him to seek federal tort

reform. He wants the federal government to supplant States with required medical tribunals to decide malpractice disputes and not leave it up to the State civil courts. He favours caps on compensation to patients who have been harmed so that "costs can be reduced."

The real issue is how to better address medical mistakes and errors, which are the real cost drivers resulting from use of risky technologies and the burgeoning bureaucratic sanctions squeezing doctors these days (Salmon and Thompson 2017). Defensive medicine (excess services doctors order to supposedly avoid malpractice) can also be cost-problematic, both of which Price may try to champion against (Teller 2017).

“ WHATEVER THE FLAWS [OF THE ACA] THE NEW TRUMP ADMINISTRATION IS TRYING TO PULL OFF A CON BY OFFERING AMERICANS COVERAGE THAT IS LIKELY TO BE SO MUCH WORSE THAT IT BARELY DESERVES THE NAME INSURANCE (THE REPUBLICAN HEALTH CARE CON 2017) ”

Price has been unspecific on addressing "the most vulnerable" of the American population, who are generally socially and economically unfortunate and who suffer from greater pain from chronic diseases. CMS has not had the best track record in developing and funding "risk corridors" of patient groups who turned out to be the sickest, heavy utilisers. This policy dilemma must be adroitly addressed to guarantee financial stability for insurers to keep them in the federal programme. Doing away with the mandate relieves insurance providers from enrolling the younger, healthier cohorts whose premiums subsidise those who suffer from expensive diseases. Under Obama, there was a budget shortfall for risk corridors, so providers and insurance companies rose up in arms seeking bailouts.

Management of the Health Insurance Exchanges remains again technically and politically, problematic. Some State exchanges may no longer be viable, and

the consumer cooperatives formed under the ACA have faced closures and huge financial downfalls also.

Mergers and acquisitions (M&As) across the entire insurance, pharmaceutical, pharmacy benefit managers, drugstore chains, as well as a host of hospital systems and other entities in the medical-industrial complex are predicted to surge to increase the scale of operations to compete in a challenging healthcare system. This will lead to greater political influence well beyond what physicians and the nonprofit segment can muster. This M&A set of dynamics is key within the policymaking process that lies ahead for the next four years under Republican rule and continues to challenge the medical profession (Salmon and Thompson 2017).

In witnessing the Congressional agenda on access, benefit design, consumer choice, financing, and flexibility for the States, one might speculate that benefits under the ACA may be lessened, consumer cost-sharing may go up, and "choices" that confront the poor, less literate, high users, and the sickest among us, will become challenging. One fears unplanned results in a haphazard delayed strategy, which may ultimately fail for improving our overall population health.

Looks like Repeal and "Repair" now

The conservative belief that "intense competition" in the medical marketplace will bring down costs and stimulate innovation in benefit design and delivery systems has yet to be proven. Price prefers relying on individual tax relief for insurance purchases and high-deductible Health Savings Accounts that primarily work best for younger, middle class, healthy individuals, not the sick (Kodjak 2016). However, aiming for a much more simplified consumer-friendly form of health coverage could be a beneficial reform over the present. Mounting administrative obfuscation for choosing a health plan and a suitable benefit package in American healthcare requires a well-informed, educated populace with the key criteria being more clinical than financial (Aruru and Salmon 2015). Only a few ACOs are beginning to examine

the social determinants of health that may truly enable for some cost reductions.

Many observers fear that Medicare and Medicaid will also become vulnerable under Price (Dickson 2017). Medicaid has the vast majority of the 20 million newly enrolled under the ACA. The discussion of “essential benefits” and federal optional additions to Medicaid are absolutely key to watch in the policymaking process and what will be the actual “replace” with Price in charge (Radelat 2017).

Planned Parenthood funding is gone with the Republican Congress so women’s health remains in danger, one impetus to stimulate the millions participating in the women’s march after the Inauguration. The recent Congressional budget, which Trump’s Office of Management and Budget nominee, Mick Mulvaney, supports, cuts entitlements (Fleming 2017). Medicare is being slashed \$449 billion and Medicaid by \$1 trillion over the years to come. Trump campaigned on no cuts to these programmes.

Under Obama, the CMS—with their private insurance company cohorts and the corporate provider sector—moved to squeeze doctors’ decision making through requiring and monitoring electronic health records and implementation of the dreaded MACRA and incentives and penalties in payments in MIIPS and the rest of the alphabet soup of other quality and cost control mechanisms (eg, MU, ICD-10, PQRS, VBM, QPP, CQMs, etc.). All of these reviled as well as befuddled the medical profession, take time and add costs to practices, while cuts to reimbursement are on the horizon without compliance. Yet corporate health providers have clearly recognised that controlling doctor behaviour is crucial to enhance their profit levels (White et al. 1994). If a Trump administration yields to demands of the medical industrial complex for maintaining their revenue streams, it is going to be quite difficult for Price to champion the cause of

the practitioners (Salmon and Thompson 2017). Already, Trump’s Executive Order rattled the insurance industry to decry ending the mandate and consumer penalties for no sign-up (Meyer 2017).

It is uncertain whether the trend toward value-based care will continue (Japsen 2017; Jopson 2017). Value-based reimbursement has had strong backing for its cost control intentions (MacDonald 2017). Accountable care organizations (ACOs), which the ACA instituted, propelled hospital systems to steadily implement coordinated care. However, different perspectives remain in the ACO’s details (Salmon 2015; 2016a; 2016b).

Medicaid block grants, which might mandate managed care arrangements, have long been favoured by Republicans. States may be able to make their own decisions about what to do with the money, which might include scaling back benefits to the poor and disabled, cutting mandatory benefits (eg, mental health, substance abuse, etc.), eliminating added subsidies for safety net providers, instituting consumer copayments, and disenrolling clients who use emergency rooms too often, neglect medical regimens, or other strictures). Such would be possible with reworking the numerous federal mandates, adjustments, and waivers, which have historically been part of this programme favoured by the more liberal States. While Republican governors and legislatures (the majority of the States), would appreciate the discretionary authorities, they fear substantial shifts in funds over time, which would cause them to defund and discharge recipients. Currently, State budgets aren’t accounting for any repeal (Quinn 2017).

Conclusion

Summarising the shifting sands around the complex U.S. healthcare system since the election is an elusive exercise. It remains to be seen if the next hundred days—a benchmark for new administrations in D.C.—will be not much more than a trajectory of further uncertainties

amidst intense conflicts. Consensus building within the Trump Administration, as well as between Trump and Congress, at this stage appears rocky (DeBonis 2017). The temperamental, combative, and unapologetic demeanour of Trump from the campaign trail and on Twitter has led some commentators to ponder when he will start acting “Presidential.” Trump’s populist obsession (Costa and Goldstein 2017) may lead him to try to keep his promise of “insurance for everybody”, though Congress will likely water that down fiscally. Trump has evidently noted the ACA retains favour as greater numbers of Americans realise serious qualms about any Republican replacement. Forty-five percent think the ACA law was a good idea, the highest mark since polls began in April 2009 (Radnofsky 2017).

Many smiles and sadness over what is now transpiring in government accompany an outright astonishment for the need for serious health reform for our nation. Professionals must raise their voices to provoke an intelligent and detailed debate to bring better healthcare to all Americans.

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For full references and supplementary table, please email edito@healthmanagement.org or visit the website <https://iii.hm/8b2>



“Try not to become a man of success, but rather try to become a man of value”



LLUÍS DONOSO BACH

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Management Tip

Delegation! It is always worth investing time and resources in helping members of the department to be able to resolve issues as much as possible in their positions.

“Talk to your people”



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Career Highlight: Becoming Chair of Cardiology at the Westgerman Heart- and Vascular Center at the University of Essen, Germany in August 2015.

“Don’t speed too fast as you might miss the crucial turn”



CHRISTIAN MAROLT

EXECUTIVE DIRECTOR, HEALTHMANAGEMENT.ORG SECRETARY-GENERAL OF THE EUROPEAN ASSOCIATION OF HEALTHCARE IT MANAGERS

Career highlight: My latest appointment as Executive Director of HealthManagement; this will allow me to further drive quality and excellence in healthcare.

“Our health is our most precious good and helping people whose health is damaged or at stake is the highest privilege on earth”



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Management Tip

Make everybody happy... and make sure they can take their responsibilities without excessive reliance on your opinion. Buddha said “Do not believe in what I said, but think about it...” I think it is a great principle.



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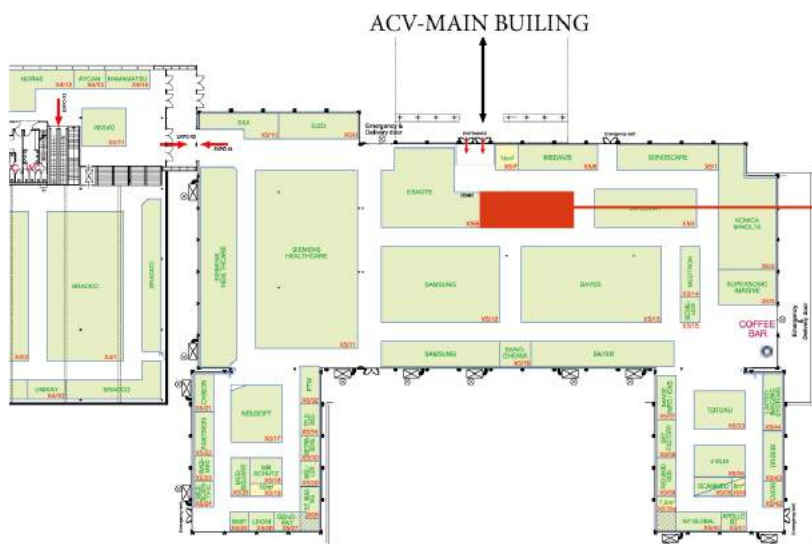
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