Medical Solutions

The Magazine for Healthcare Leadership

May 2010 – US edition

SIEMENS

Medicine in 2050

How today's babies will grow into the future of healthcare

The world needs better and more affordable healthcare. That's why we've developed better technologies and more efficient IT solutions.

With life expectancy on the increase, healthcare is becoming more expensive. We offer innovative solutions to improve the quality of care and streamline hospital processes before, during and after treatment. From imaging and lab systems that help provide more accurate diagnosis to managing hospitals more efficiently, we can save money that can be put to better use – saving lives.

siemens.com/answers

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Hermann Requardt,
Member of the Managing Board of Siemens AG and CEO of the Healthcare Sector

Transforming Healthcare

In a time of unprecedented global focus on healthcare delivery, healthcare systems all over the world seem to have agreed on a common denominator: complete overhaul! Healthcare reforms are being triggered or are already underway in many societies. And, as different as their scopes and debates may be, reforms of healthcare systems are largely driven by the need to increase access to healthcare, improve the quality of care, and decrease costs.

These demands will be both challenged and supported by incisive societal developments and groundbreaking innovations within the next 40 to 50 years. Demographics will change dramatically, medicine will develop from reactive to more preventive care, and medical knowledge will be streamlined and distributed for unlimited access worldwide. As an integrated healthcare company, Siemens is a key driver of this trend. By means of the convergence of imaging, laboratory diagnostics, and healthcare IT, we aim to transform healthcare along the entire continuum of care, working toward personalized medicine – together with you, our customers.

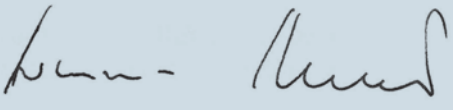
In light of this objective, the cover story in this issue of *Medical Solutions* is devoted to visualizing the future of healthcare up to 2050. Thinking beyond products, we asked healthcare experts for their perspectives: How will patients benefit from medical progress in the future, and what can they expect from their respective healthcare systems? How can healthcare providers integrate advances in medical technology for prevention and early diagnosis while optimizing costs at the same time? From molecular medicine through reimbursement discussions to data management, you will get an exciting, multi-perspective view on healthcare in 2050. Start off with following the fictitious, 2010-born babies Peter and Louise on their journeys through future healthcare systems on page 12.

Further into the magazine, several stories show how our successful customers are already working toward advancing healthcare in their countries.

As an example, the Sourasky Medical Center in Israel (page 42) shows how the organizational convergence between hospitals, technology innovators, and government regulators efficiently supports improving a healthcare system. Together with nine other governmental hospitals, Sourasky Medical Center implemented the hospital information system i.s.h.med in the course of a governmental hospital computerization project. Clinical departments at Sourasky now benefit from the interoperability of a common data platform. Simultaneously, the hospital and the Ministry of Health are already working with Siemens to develop two additional i.s.h.med modules to further incorporate the needs of different healthcare facilities participating in the project.

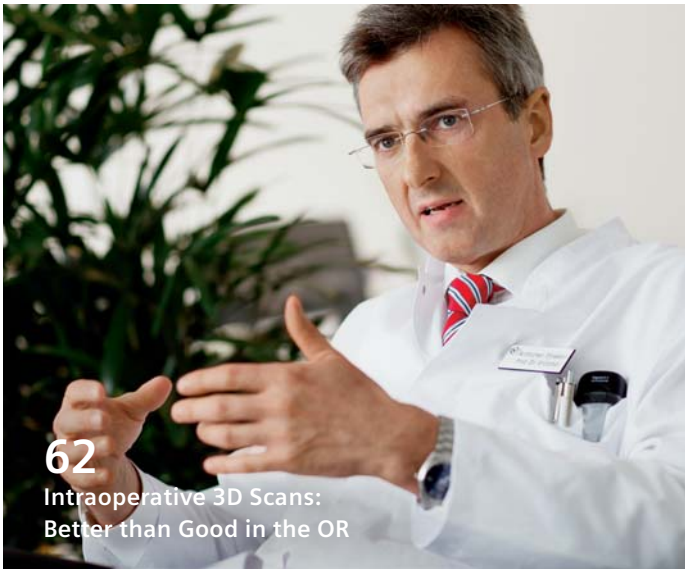
I hope you will enjoy reading this issue as an example of Siemens' true commitment to partnering with our customers in shaping tomorrow's healthcare systems!

Sincerely,



Content

Cover Story



Features

New UROSKOP Visualizes Entire Urinary Tract

The new UROSKOP Omnia workstation with its colorful MoodLight.

At the European Association of Urology's (EAU) Congress 2010 in Barcelona, Spain, Siemens launched UROSKOP® Omnia[1], a new multifunctional workstation for urology that visualizes the entire urinary tract in one image. Dynamic flat detector technology with a large field-of-view, an intelligent design, and an interface for comprehensive connectivity offer a whole new experience of urology and patient care. Keeping the clinical workflow in mind, this highly flexible system is designed for a wide variety of clinical applications, such as transurethral, percutaneous urological, diagnostic urologic, video urodynamic, laparoscopic, or even non-urological procedures.

With a dynamic flat detector of 43 x 43 centimeters (17 x 17 inches) and a large field-of-view, UROSKOP Omnia enables the display of the whole urinary tract with one single shot, thus saving time. Furthermore, the high image resolution of more than 2800 x 2800 pixels increases diagnostic confidence, since it makes detailed zooming possible without any loss in quality. As the system's curved X-ray column allows unrestricted patient access from all four sides – an important factor especially for percutaneous interventions – it is no longer necessary to reposition patients or anesthesia workplaces. As a result, patient care is increased.

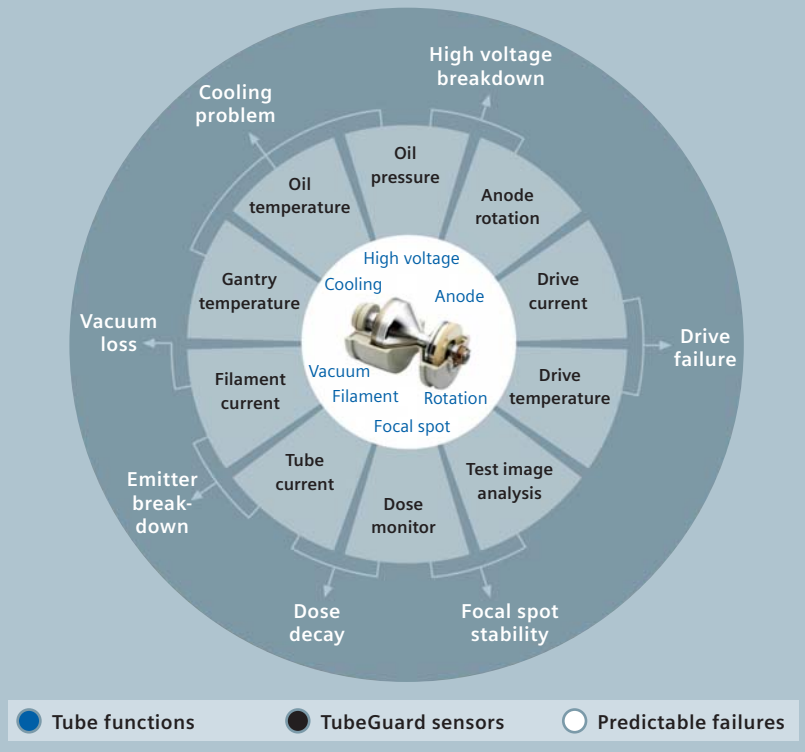
Physicians' work is facilitated by UROSKOP Omnia's excellent interfacing capabilities. The HD VideoManager interfaces with endoscopy or ultrasound devices as well as workstation viewers, enabling physicians to view images from different modalities side-by-side with X-ray. With HD EndoStore, all images can even be stored together in one patient file.

[1] Not available for sale in the U.S.

Continuous Monitoring Supports Planning Reliability

With the Siemens Guardian Program™ including TubeGuard, Calmette Hospital in Lille, France, has experienced how hospitals can rely on Siemens' product and service quality. TubeGuard makes use of more than ten sensors, monitoring the functions of the computed tomography (CT) system's X-ray tubes via a real-time data flow with Siemens Remote Service (SRS).

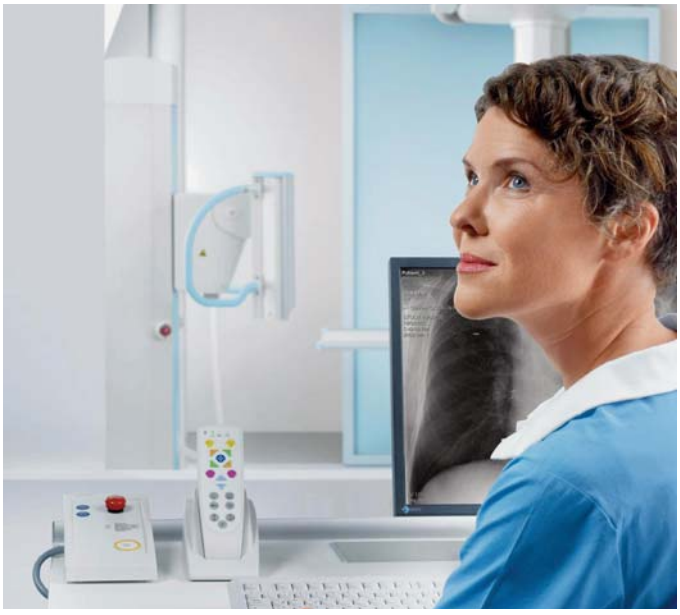
The hospital has been using SOMATOM® Definition, the first Dual Source CT worldwide, in daily clinical routine for years. In early 2009, Patrice Podevins, healthcare executive at the hospital, received a call from the Siemens UPTIME Service Center telling him that both tubes on the SOMATOM Definition were at risk to fail. In view of the detailed documentation sent by the specialists, Podevins decided to have the tubes replaced five days after the call. Thanks to this prediction, appointments were rescheduled and inconveniences were prevented. As evidenced by Calmette Hospital, the Siemens Guardian Program including TubeGuard helps protect a good reputation and enhances the quality of patient care.



Online Subscription for CAD

Expanding the Siemens portfolio of computer-aided detection (CAD) applications, Siemens launched a Software as a Service (SaaS) model for chest X-ray (CXR) at the European Congress of Radiology (ECR). *syngo*® CXR CAD Subscription[1] works in conjunction with digital radiography systems, such as Ysio and AXIOM® Aristos, and allows clinicians to receive CAD results via remote processing.

Similar to receiving an online subscription for a medical journal, the technology is available on demand and at the clinician's convenience. For the initial deployment, *syngo* CXR CAD Subscription will be available with the Ysio for a seamless CAD workflow experience. A separate workstation is no longer required to be installed in a clinic or practice, and offsite processing occurs remotely on a Siemens-owned server. Users will also have automatic access to *syngo* CXR CAD Subscription updates.



"*syngo* CXR CAD Subscription is the next step toward a fully integrated, virtualized imaging environment," said Peter Herzog, MD, attending physician, Amper Kliniken AG, Germany. The client software extracts a CAD Image Signature (CIS) from the digital image, which contains the necessary information for the CAD algorithm to process the image and produce CAD results. The CIS does not contain any private information, such as patient name and date of birth. The CAD results are then transferred back to the clinic or practice, where they are appended to the corresponding patient and stored in an application such as the picture archiving and communication system (PACS). This makes the CAD data available to the doctor as a "second reader" for the detection of lesions.

syngo CXR CAD works as a second reader to help the clinician detect potential lung nodules. Validated for use with computed radiography (CR)/digital radiography (DR) systems, the application is used for the analysis of digital radiographic images of the thorax. *syngo* CXR CAD helps detect potential nodules from eight to 30 millimeters in size.

"When reviewing chest X-ray, CAD helps identify larger nodules that are partially obscured by superimposed structures," said Herzog. "The use of CAD tools can substantially help reduce the number of lesions missed during routine X-ray readings."

With *syngo* CXR CAD Subscription, Siemens provides updates for the CAD algorithms on its servers for improved detection performance. The date of the algorithm release used is shown next to the version number on the resulting radiographic image. Herzog is excited about the new dissemination method for CAD tools. "In the future, the use of CAD will be a standard of care in almost all modalities," he concluded.

[1] Not available for sale in the U.S. For availability in other countries, please check with your Siemens representative.

Cardiology Care in the Heart of Africa

In summer 2009, Francesco Gentile, MD, Director at the Cardiac Hospital Bassini in Milano, Italy, installed a temporary cardiology center in Mambasa, Democratic Republic of the Congo. For his mission, Gentile was provided with the first dedicated personal imaging tool designed to enhance the physical exam – the Siemens ACUSON P10™ ultrasound system, which assisted him in overcoming the tough working conditions in Mambasa.

The ACUSON P10 system revolutionizes clinical assessment at the point of care by improving patient care, workflow, and outcomes in cardiology, emergency medicine, and obstetrics. With a start-up time of only about ten seconds and exceptional image quality, the ACUSON P10 system helps physicians make faster and more confident diagnoses. The system, which only weighs 700 grams, helped Gentile examine almost 200 patients in about 14 days – not only in the hospital center, but also in the surrounding jungle area. Having been informed about the temporary station, the local population made use of Gentile's medical expertise every day from 8:30 a.m. to 4:00 p.m. A broad range of diseases were diagnosed, including high blood pressure and cardiac valve dysfunction. Thanks to Gentile's readiness to help others and with support from Siemens, the mission in Mambasa was a great success.

One Mouse, One Keyboard, One Monitor

After the market introduction of the Artis zee® Large Display for the examination room last year, Siemens now clears up control room space with a new 30-inch (76.2-centimeter) display to control multiple systems during interventions.

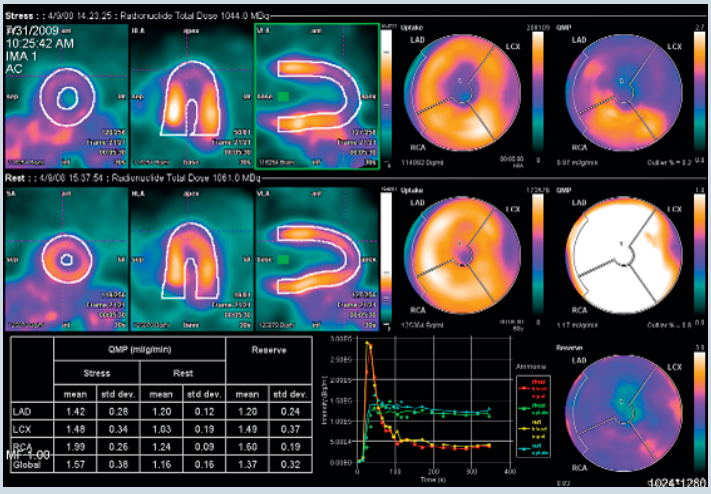
Today's interventional control room is the hub for multiple data sources and systems. With this comes the need to visualize and interact with many different work consoles, leading to numerous monitors, keyboards, and mice. The information these systems provide is vital to support the interventionalist during procedures, but leads to many different points of control – sometimes resulting in a more complex workflow and a cluttered environment.

The new Artis zee Cockpit can put an end to this. It consolidates the various imaging and data signals routed to the control room into one 30-inch medical-grade display. Fast, simple, and user-intuitive operation supports efficient workflows. The user can choose the layout of the display to meet the requirements of the procedure and move the sources around the screen as required. A double click on any screen lets the user take complete control of that system, all with one mouse, one keyboard, and one monitor. And just as important, Artis zee Cockpit frees up valuable space in the department.

The solution is available for use with the Artis zee portfolio of interventional radiology, cardiology, and surgery systems. These are available in biplane, multiaxial, ceiling-mounted, floor-mounted, and multipurpose configurations.

www.siemens.com/artis-zee-cockpit

The 30-inch medical-grade display of the Artis zee Cockpit provides more space in the control room.



	QMP (ml/g/min)				Reserve	
	Stress		Rest			
	mean	std dev.	mean	std dev.	mean	std dev.
LAD	1.42	0.26	1.20	0.12	1.20	0.24
LCX	1.48	0.34	1.03	0.19	1.49	0.37
RCA	1.99	0.26	1.24	0.09	1.60	0.19
Global	1.57	0.38	1.16	0.16	1.37	0.32

Anterior wall myocardial ischemia with reduced blood flow at peak stress period

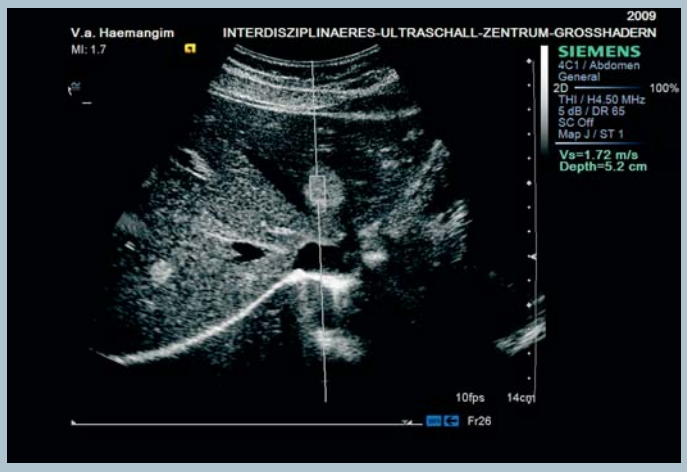
New PET Application Helps Detect Coronary Artery Disease

syngo® Dynamic PET with Myocardial Blood Flow, a new cardiac imaging software application for Siemens' industry-leading Biograph™ PET·CT (positron emission tomography/computed tomography) scanners, may have significant impact on the diagnosis of patients with advanced coronary artery disease (CAD) – specifically, in patients with multivessel disease or in those who are asymptomatic. Offering a new method for quantitatively evaluating the extent of ischemia via high-performance PET/CT imaging and advanced applications, this first software from a major vendor enables the more definitive measurement of myocardial blood flow during PET perfusion studies as compared to regular myocardial perfusion studies[1]. Clinical literature estimates that five to ten percent of CAD patients have balanced vessel disease, and up to eight percent are asymptomatic at-risk patients. Especially within this high-risk group, the new software offers additional diagnostic value. Specific quantification of perfusion levels in each vessel can help improve the identification of multi-vessel disease. According to Britta Fünfstück, CEO Molecular Imaging, Siemens Healthcare, *syngo* Dynamic PET also supports effective cost management: "Technological innovations, such as the ability to quantify blood flow in at-risk patients, continue to reinforce the critical role that molecular imaging can play in the delivery of high-quality, cost-effective healthcare."

[1] Data on file

Taking Ultrasound Imaging to the Next Level

The 2.0 release of the ACUSON S2000™ ultrasound system offers significant advancements. Best-in-class image quality and diagnostic confidence combined with innovative applications and knowledge-based workflow efficiencies provide advanced solutions for the most demanding clinical environments.
Siemens' implementations of Acoustic Radiation Force Imaging (ARFI), Virtual Touch™ Tissue Imaging and Virtual Touch Tissue Quantification[1], have been further optimized on the 2.0 release of the ACUSON S2000 ultrasound system. These exclusive Strain Imaging applications expand the use of ultrasound by allowing a classification of tissue stiffness often associated with pathology.
Furthermore, the system integrates advancements for Cadence™ contrast pulse sequencing technology[2], providing exceptional sensitivity. Knowledge-based applications such as eSieScan™ Workflow Protocols enhance clinical workflows and reduce exam times, enabling better throughput and improved consistency. The new HD Zoom feature enables detailed examination of small anatomical regions, while advanced fourSight™ imaging technology offers comprehensive 3D/4D acquisition, data rendering, and postprocessing.



Virtual Touch Tissue Quantification of a liver hemangioma

[1] Not available in the U.S.
[2] At the time of publication, the U.S. Food and Drug Administration has cleared ultrasound contrast agents only for use in LVO. Check the current regulation for the country in which you are using this system for contrast agent clearance.

Tips and Tricks for MR Orthopedic Imaging

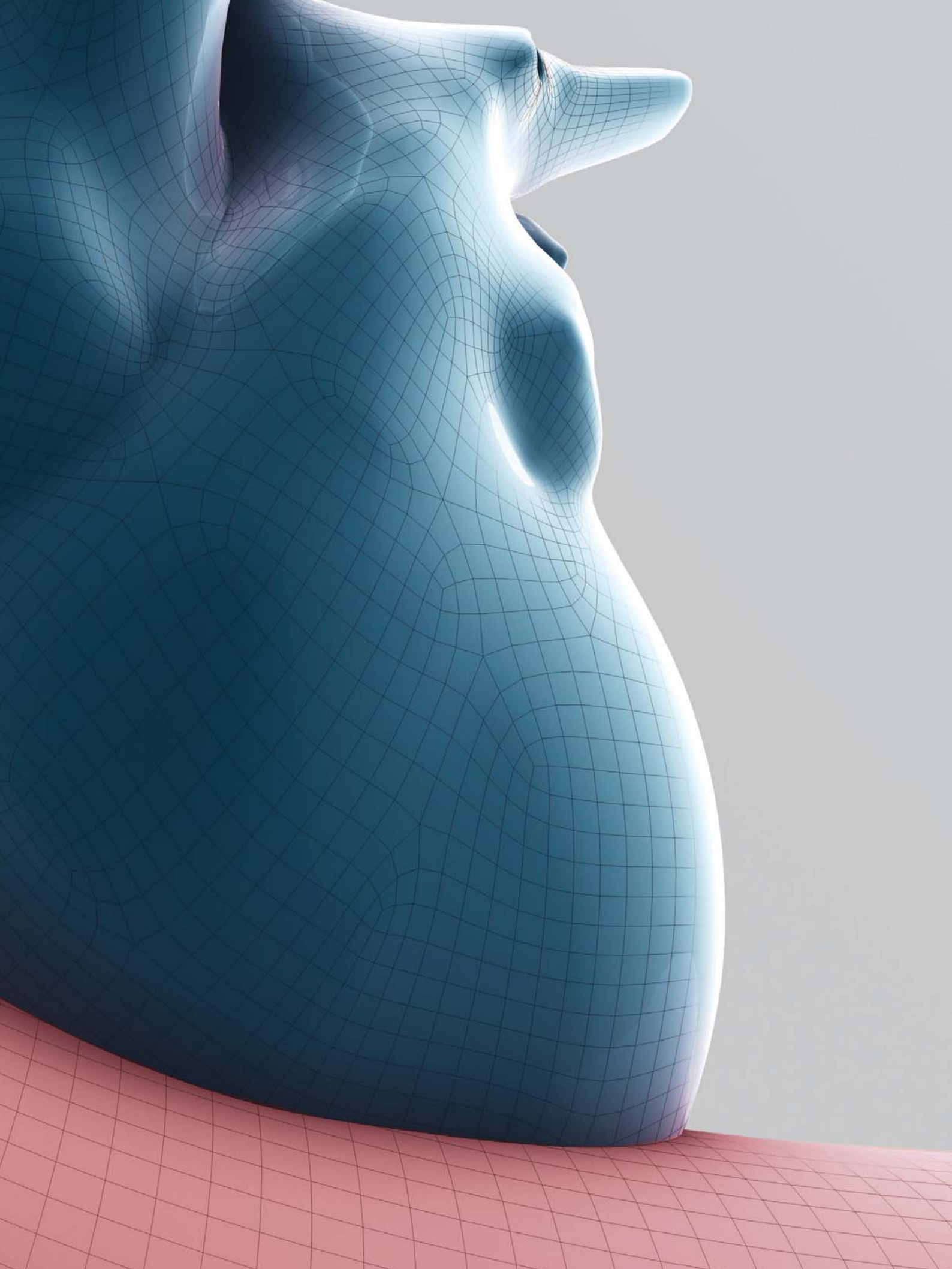
The "Advisory Board Orthopedic Diagnostics" now provides optimized parameters and protocols for Orthopedic and Musculoskeletal (MSK) magnetic resonance imaging (MRI) on the Siemens MAGNETOM® World Website.
Siemens' commitment to innovation in MR technology is not restricted to the development of new products or solutions; it includes the examination of existing MR imaging parameters and protocols. The Advisory Board members – seven top experts in the field of MSK imaging – work with Siemens in order to achieve these goals. During RSNA 2009 (the Radiological Society of North America's 2009 Annual Meeting), they launched their Web presence, offering a unique platform to share insights from daily practice and research experiences with Siemens customers worldwide. Detailed protocols, phoenix images, and application tips including videos are available for ankle, elbow, hip, knee, shoulder, and wrist exams with MAGNETOM Avanto, Trio, and Verio systems.
All board members are open to contacts and happy to answer specific questions. The information provided helps MAGNETOM customers keep up-to-date as well as speed up their examinations. As a result, they might also increase throughput. And in the daily routine, patients benefit from the latest technological advancements. By combining valuable clinical information from Siemens with the Advisory Board's tips and tricks, MAGNETOM World is helping physicians get the best out of their system.

www.siemens.com/magnetom-world

Catching a Glimpse of Healthcare in 2050

Within the next 40 to 50 years, medicine will face many challenges, prospects, and groundbreaking technological developments. Demographics will change dramatically, and medicine will develop from reactive to preventive care. Healthcare systems are already in a state of transition today. What kind of care will today's babies experience as they grow older? *Medical Solutions* takes a step forward and asks experts to look into the future of healthcare.

Overview:



The story of Peter and Louise and their journeys through the changing healthcare systems of the future.

By Linda Brookes

Growing Up Into Preventive Care

In 2010, a girl, let's call her Louise, and a boy, whom we'll call Peter, are born to two families. This is the story of how advances in healthcare could impact the lives of these two babies as they grow up over the coming decades. Both of them are fortunate: their parents live in developed countries that have nationwide healthcare systems intended to cover the whole population. However, the success of these systems in keeping Louise and Peter in good health will depend on a number of factors, including advances in medical and technological research, and how these will be incorporated into future healthcare services.

Despite living in comparatively high-income countries, Louise and Peter may have different experiences within the healthcare system. Louise's family is well-educated and relatively wealthy, with sufficient means of purchasing additional healthcare above the basic services guaranteed by their provider. Peter's access to healthcare is less secure because his family receives its healthcare through his father's temporary employment. If Peter's father loses his job, he could lose access to all but basic healthcare. Louise's parents do not smoke, avoid junk food, moderate their alcohol intake, and exercise regularly; Peter's parents live a less healthy lifestyle. Children usually follow the example of their parents.

Louise's parents are concerned that she may be at risk for breast or ovarian cancer later in life. Genetic testing has revealed Louise's mother has a breast cancer susceptibility gene 1 (BRCA1) mutation. This means her chance to develop breast cancer or ovarian cancer during her lifetime is greatly increased, and she also has a higher risk for other cancers. Louise's mother is screened regularly with ultrasound, mammography, and magnetic resonance imaging (MRI) for breast cancer, as well as transvaginal ultrasound, blood test for CA-125 antigen, and clinical examinations for ovarian cancer. Luckily, no tumors have been identified to date. Louise's parents know that their daughter possesses a very high risk of having inherited the gene variant and are sure to have her tested as well. This used to involve having a blood sample taken by a doctor and sent to a laboratory and waiting several days for the result. Now, this is done using a portable device ("lab-on-a-chip") and the result is available within minutes. It shows that Louise does carry the BRCA1 variant. Her physician assures her parents that counseling will be available for the family and that Louise will have regular cancer screening from age 30 onward.

Lifestyle Diseases

By age ten, Peter is already overweight, like one-third of schoolchildren in

See imprint on page 80 for a listing of experts who provided input for the composition of this scenario.












Direct Interaction Will Define Future Healthcare Brands

By Gil Bashe

During the next 50 years, healthcare providers will face a more challenging competition that will demand perceptible marketing initiatives: health services will be increasingly evaluated and selected autonomously by well-informed, responsible patients – their prospective customers. Moreover, expectations and decisions of these customers will increasingly intertwine with the reimbursement decision-makers' final tabulation or intuitional budget – especially when the 'pay-for-quality' approach will be gaining ground worldwide. After all, social media and patients' immediate ability to connect and influence physicians, payers, and policymakers will be everyday practice.

Look up any given product today – medical devices, treatments, or health services – on the Internet and you can instantly access testimonials, conversations, and debates. Second opinions and crowd-sourcing are available at patients' fingertips, and are a trusted source of information.

Gil Bashe, *Executive Vice President, Health Practice Director at Makovsky + Company, has devoted 30 years to helping health professionals, patients, payers, policymakers, and health-product innovators find common ground. He is coeditor of* Branding Health Services: Defining Yourself in the Marketplace.

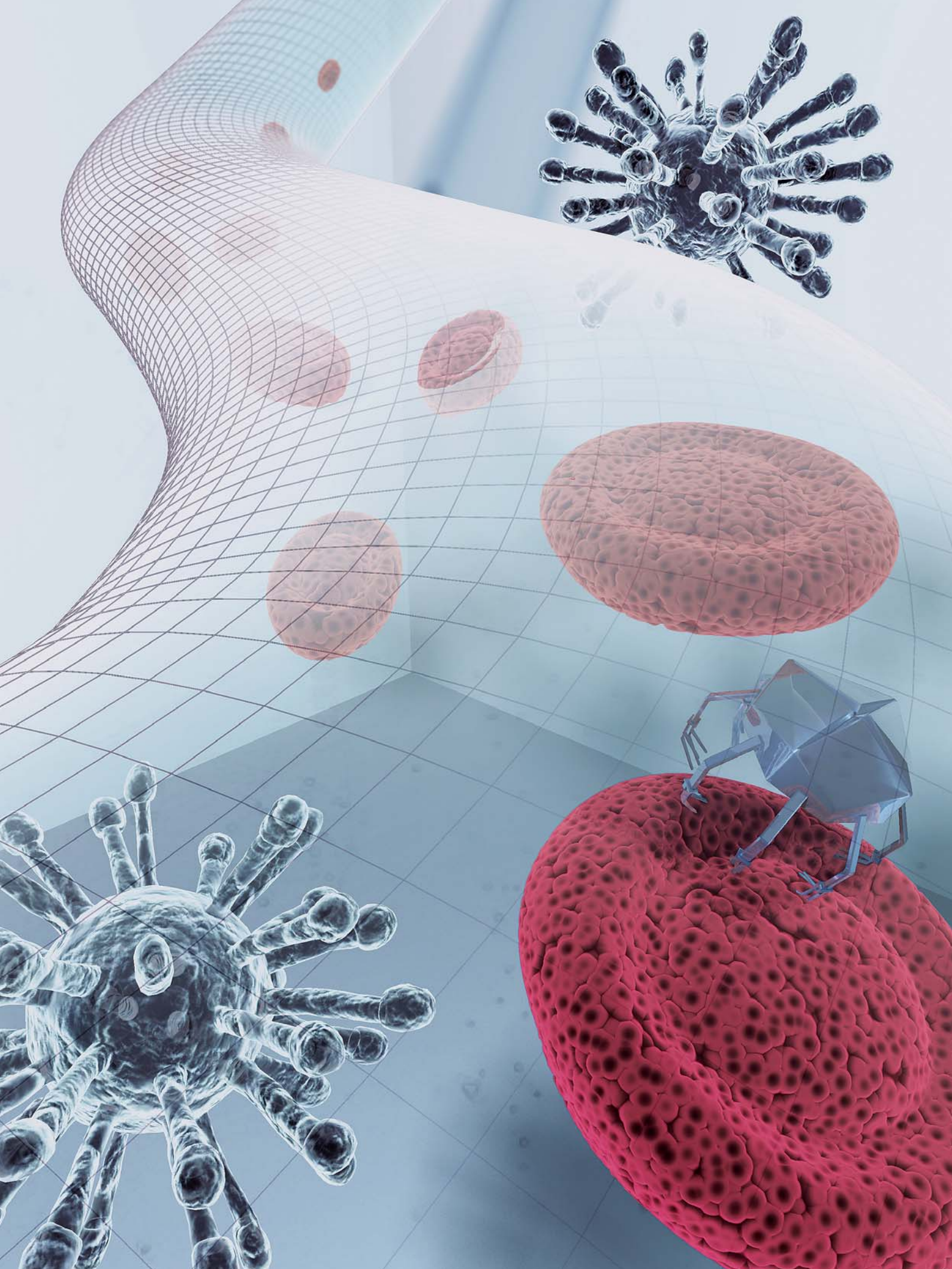
Only the most trusted companies will have a voice in the conversation. Digital communications will not only change the way we interact, they will alter how we act on healthcare needs or wants. Going forward, memorable brands will edge out competitors by incorporating immediate gratification power (e.g., knowledge) into their designs. Whether for women at risk of breast cancer or patients with a cardiovascular disease history: the considerations will be accuracy, speed, cost, transparency, and sustainability.

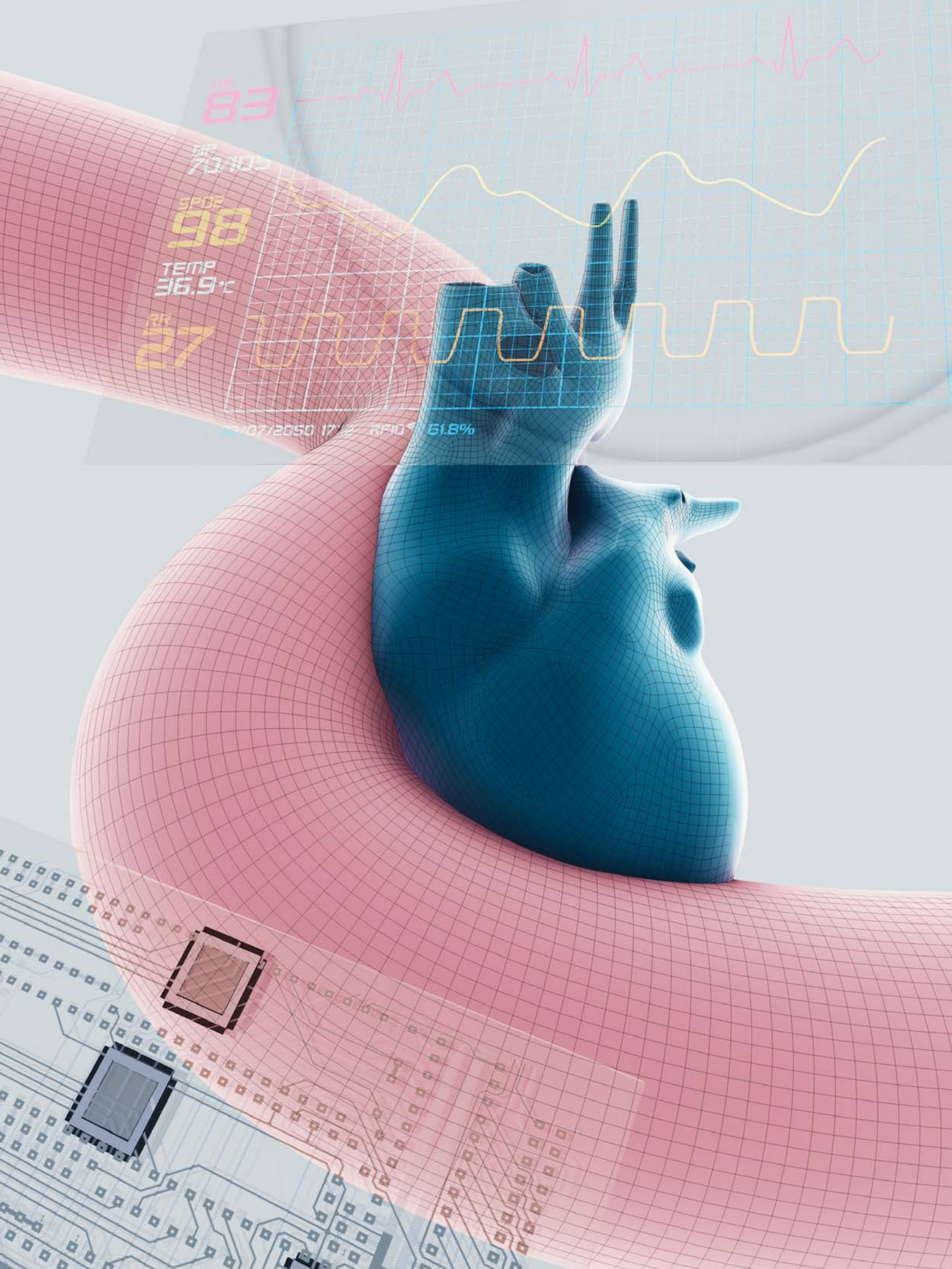
In the future, customers who come in contact with data, diagnosis, and health delivery will be voicing their opinions on the brand publicly and in real-time. Interacting, listening, and responding almost immediately to these patients will be key to ensuring relevancy in their lives. These consumers will want accurate information at eye-blinking speed and will increasingly attach importance to guaranteed sustainability. Personnel desires will weave together with societal concerns.

We will find that as Generation X and Y consumers enter their senior years, healthcare providers and policymakers will be confronted by consumers who react less to flashy bells and whistles and are more interested in engaging in a two-way dialogue. For medical brand builders, the key to good performance lies in the ability to communicate immediately as much as it does in the ability to innovate consistently. It will be all about championing customer expectations – now.

developed countries. This places him at increased risk for future adverse health effects, including hypertension, hyperlipidemia, and diabetes. His grandfather had heart disease, and his father and mother are overweight with a body mass index (BMI) above 25, with high blood pressure, high LDL cholesterol, and type 2 diabetes. Both parents are taking appropriate medications, but are at high risk for cardiovascular disease. By age 20, Peter also is obese and already has high blood pressure, LDL cholesterol, high blood sugar, and high sensitivity C-reactive protein (hs-CRP). "Smart" pill bottles relay information to his doctor and pharmacist about whether he has been adhering to his prescribed medication regimen.

In 2035, Peter's 55-year-old father has chest pain, and an ambulance is called to the small town where he lives. His health data on record has already been accessed by the paramedics in the ambulance as well as the hospital to which he will be taken. With portable technology in the ambulance, the paramedics run an ECG and perform a troponin test along with other biomarkers. The ECG shows that he is having an ST segment elevation myocardial infarction (STEMI) and that he could benefit from interventional revascularization. The area of infarction is identified by 3D echocardiography and relayed to the cardiologist, who now knows exactly where the coronary artery is blocked and where to intervene. Diagnostic tests are used to assess the risk of potential complications, such as bleeding, which can be induced by additive drugs that are




83
98
TEMP
36.9°c
27
61.8%

What Lies Ahead for Electronic Health Records and Information Technology?

In the coming decades, the cost of healthcare will continue to rise as a result of increases in chronic diseases and the aging population. Organizations that fund healthcare will face the challenge of streamlining healthcare services, making them more effective and keeping costs down. A major part of this will be achieved through the global introduction and use of electronic healthcare records (EHRs). In the past, most EHR systems were designed to record occasional clinical encounters between patients and healthcare professionals and/or the diagnosis and treatment of diseases. The next generation of EHRs will include a patient's individual genome, proteome, metabolome, and health data, including results of diagnostic tests, imaging, and treatment history, entered automatically from birth into computerized databases. EHRs are intended to eliminate paper records, although opinions vary as to whether this will actually happen.

Although EHRs will be managed by healthcare organizations, patients will be able to access their own personal information online. Authorized healthcare personnel, including emergency paramedics, will also be able to access patients' EHRs directly, but will require authorization from each patient to do so. Ownership of individual data will remain with the patient. Patients will be able to access their own EHRs from different locations at any time. By 2050, everyone may have an implanted electronic chip containing an access code that allows wireless access to their personal data. Patients could also use electronic devices similar to smart phones to move data from home monitoring devices to their EHRs. EHR databases must be compatible for the generation and exchange of health information and data security worldwide. By 2050, it is anticipated that there will be robust global standards for EHRs based on those currently emerging in the United States and Europe.

The use of the information will drive standards, which is important not only to access information, but for the ability to apply computer-modeled knowledge to it. By 2050, computing power up to 100,000 times greater than exists today will be available to provide the kind of information technology needed for access and security. In order to address concerns about privacy, all the data will be encrypted – by 2050, computing power will be sufficient to achieve this.

The EHR database will also be used as a knowledge engine of best practices by physicians to help them reach diagnoses and prescribe treatment by comparing their own patients with other, similar cases worldwide. The data could also be made available for research – for example, for use in observational follow-up studies of drug treatments. This would afford the opportunity of studying real-life data, as compared with data from clinical trials, to estimate the effectiveness of a specified therapy. Since patients would own their own data, each individual would be able to decide whether or not their personal data would be made available for use in this way.

administerd during interventional revascularization. Peter's father is then treated with percutaneous coronary intervention (PCI) with a stent.

Breast Cancer Treatment

At age 30, Louise is being monitored for breast cancer. Imaging techniques, where tumor-sensitive tracers are applied, specifically mammography, ultrasound, and MRI, are now able to detect tumors up to a decade earlier than tumor markers and with less risk of false-positive results. The screening process is also more comfortable for the patient. Louise's mother has had a positive test and undergoes treatment at a specialist center, which she has located from databases comparing hospitals' success rates in treatment of her type of breast cancer. Her treatment is based on tailored therapy with chemotherapy and radiation delivered by nanotechnological microscopic robots that target malignant tumor cells with high specificity.

By 2040, high-income countries with aging populations, such as those where Louise and Peter live, are having to cope with increased costs for treatment and long-term care. Healthcare payers seek to prevent chronic conditions by lifestyle improvements, and they are reluctant to pay for treatment for "diseases of civilization" such as those previously suffered by Peter and his family.

Taking Personal Responsibility

Affected by this trend, as well as his own tests, including molecular imaging of his atherosclerosis, which shows his own increased risk of myocardial infarction, Peter takes control of his health. With the help of educational material provided by his local healthcare center, he starts bicycling with his son and eating healthier

and at home. He measures his own blood pressure, cholesterol, blood glucose levels, and other risk markers. The results are transmitted wirelessly to his physician and stored as part of his electronic health record by a device he uses at home. All relevant information is automatically transferred to specific databases at local and worldwide servers. When Peter achieves normal readings over a consistent period, his physician receives a 'pay-for-performance' fee.

Both Louise and Peter and their partners decide to have their first children tested with genome sequencing as babies, which is now inexpensive. It reveals the diseases they are most at risk for and also how they would respond to a range of diagnostic tests and treatments. Louise already knows that her baby daughter does not carry the same cancer risk as she and her mother do. She was already screened as an embryo: neither she nor her descendants will face this genetic form of breast cancer or ovarian cancer in their adult lives. Louise's cousin, who carries the same gene mutation, hopes that during her pregnancy, the defective gene can be repaired by gene therapy in utero.

In 2045, new screening methods and imaging techniques have revealed that Peter's mother has early signs of Alzheimer's disease. Although no definite cure is yet available, following early detection and definitive diagnosis, medical treatment is available to slow down the onset of the disease. By 2050, Louise's mother's cancer is still in remission. She has an implantable sensor that can detect tumor markers and relay the information to her so that she can immediately contact her physician and begin treatment, if necessary. A new, more specific urine and gene test for prostate cancer has also allowed Louise's father to have early, cancer-preventive vaccine treatment.

The outlook for Louise and Peter and their children is bright. The children will be part of the first generation to benefit from personalized medicine throughout their lives. Advances in medicine and technology mean that, in their countries, life expectancy in 2050 is more than 90 years for women and more than 85 years for men.

Linda Brookes *is a freelance medical writer and editor who divides her time between London and New York, working for a variety of clients in the healthcare and pharmaceutical fields.*

Further Information

www.siemens.com/personalized-medicine

Reimbursing Quality and Effectiveness

Medical Solutions asked an expert journalist to cast a look into the future of reimbursement. Read why the 'episode-of-care' or 'pay-for-quality' approach will become commonplace across the globe, while personalized medicine will become firmly established during the period 2030 to 2050.

By Anthony Beachey

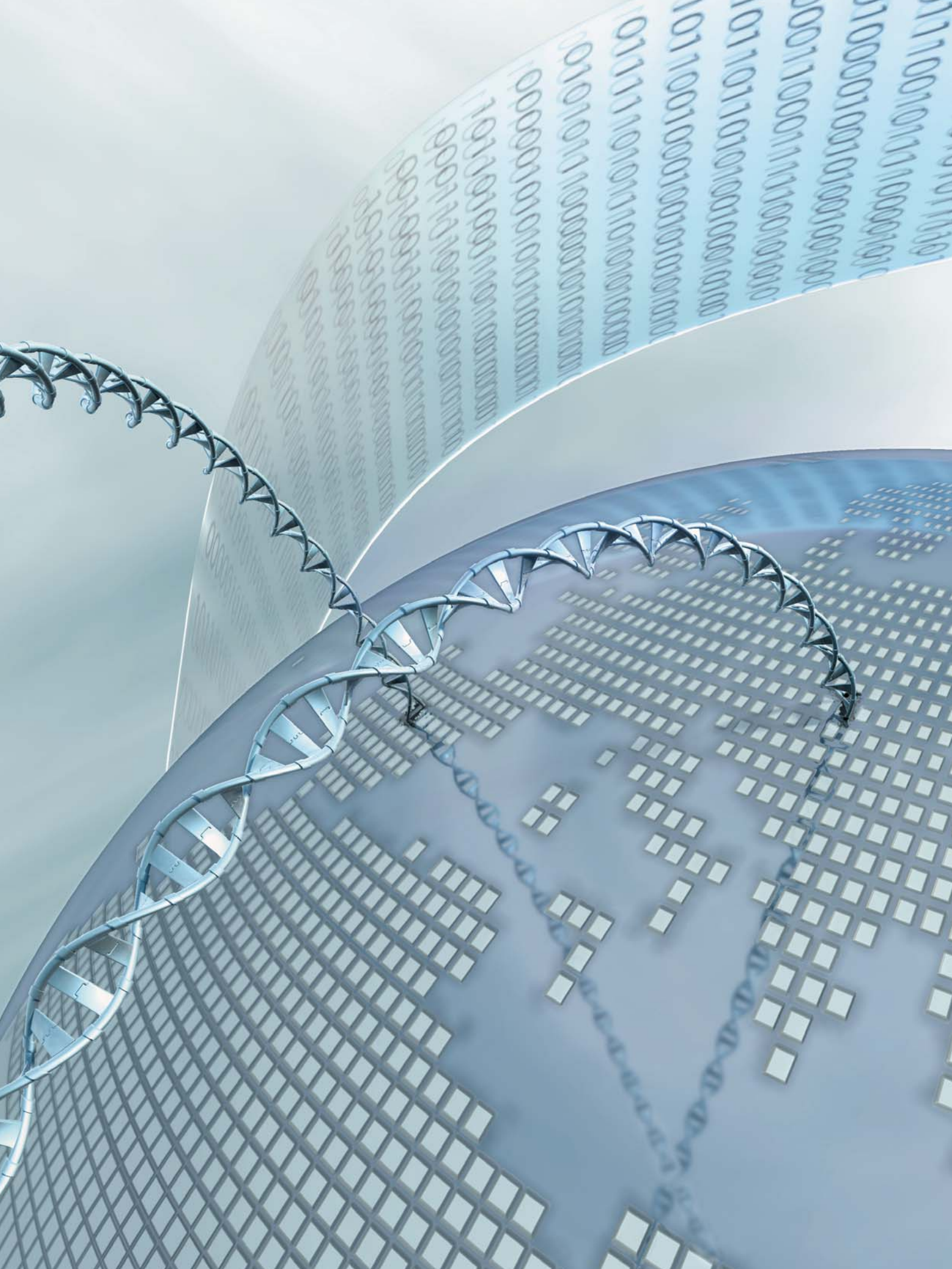
Western European countries and the United States have traditionally reimbursed healthcare providers by using a 'fee-for-service' approach, whereby a payment is received following the provision of a service. However, one of the main drawbacks of this system is that there isn't necessarily a relationship between the actual cost of the service and the amount of money that is reimbursed, which inevitably has implications for cost containment.

What's more, the fee-for-service approach evolved before the advanced economies began to face the increasing healthcare burden associated with aging populations. The epidemiological environment has partly shifted, and the highly sophisticated technology commonplace today had yet to be introduced.

Unsurprisingly, in light of demographic and other changes and its disadvantages in terms of cost containment, the fee-for-service approach is now giving way around the globe to payment of a lump sum for all services related to a condition or a disease. Hence, a provider receives a single, bundled fee for an episode of care, such as a hip implant, a few months' cancer therapy or the treatment of a chronic disease.

Certainly, the lump-sum approach facilitates a more effective containment of costs than the fee-for-service concept. This is even more so with the pay-for-quality approach, where predefined quality indicators are strongly tied to the reimbursement and healthcare providers thus rewarded to deliver high-quality care. By contrast, under fee-for-service, providers are rewarded for fixing problems that better care might have prevented, and there are hardly incentives tied to predefined quality standards.

Episode-of-care was first introduced in the U.S. and Australia and was adopted in Germany in 2003. The U.K. is currently in the process of rolling out episode-of-care reimbursement, and it seems likely that episode-of-care, as well as pay-for-quality, will sweep across the globe in the



coming decades. Pay-for-quality is certainly gaining ground in the USA, where episode-of-care has already gradually taken over from fee-for-service. Indeed, there appears little doubt that, even if the healthcare reform does not run as planned, pay-for-quality will also gain ground and will have certainly become preeminent by 2050.

Pay-for-quality not for Japan?

However, industry analysts that I have spoken to have cast doubt on the prospects of the pay-for-quality approach in Japan. They argue that for cultural reasons, this strategy is less appealing to the Japanese than to the Americans and Europeans. It is certainly true that the Japanese generally do not embrace individual financial incentives (even tipping is rare), and these schemes have had limited success where they have been introduced.

The system of reimbursement of healthcare providers in Japan currently works on a points system, determined by a government-sponsored committee. Points are given for every type of medical procedure or service. Yet year-to-year, the authorities have reduced the number of points awarded in the case of every procedure, as medical costs have risen along with the aging population. So while a private healthcare provider in the U.S. will currently reimburse a patient requiring a magnetic resonance imaging examination at a rate of around US$4,000, a provider of the same service in Japan will receive the equivalent of just US$500. However, it remains questionable whether reducing fees in this manner would work in all countries. Anyone visiting Japan will have encountered the culture of service in that country, and healthcare professionals are no exception. They are dedicated to providing the best possible service in the world (and having the best technology to accomplish this goal), despite falling payment levels.

Japanese governments have also encouraged patients to co-pay for treatment. This sum has increased from around ten percent of a service to 30 percent currently. Authorities hope that as well as reducing the burden on the healthcare budget, this development will encourage patients to question what doctors are doing, and that the country's citizens will no longer visit a doctor unless this is really necessary.

It is always difficult to look far into the future, but I think it is possible to make some predictions with a reasonable degree of certainty. I definitely believe that personalized medicine will become firmly established during the period 2030 to 2050. People will benefit from individual diagnostic tests and treatment and a healthcare path tailored to their needs. Of course, this will require major investments in IT so that a person's healthcare records are available to medical practitioners. Indeed, they will be able to download this information from microchips embedded in the patient.

Research Progress Saves Cost

Technological advances will also have a major impact on healthcare costs and reimbursement strategies in the decades ahead. New products are already being introduced in imaging and other areas, which will boost standards of care and also promote personalized medicine. The potential of stem cell research may have been realized, and stem cell technology could be used to produce replaceable tissues or organs and to repair defective tissues damaged by many of our most devastating diseases during the period 2030 to 2050. Nanotechnology will also have revolutionized the way we detect and treat damage to the human body and disease. Advances in molecular medicine will allow the earlier treatment of many illnesses and lead to new therapeutic regimens and the replacement of defective genes through gene therapy. Combined, these technological breakthroughs should lead to huge cost savings.

Outlook on Demographics

It shouldn't be forgotten that the pattern of aging societies that will characterize developed economies over the next decades will be even more distinct by 2050. The share of the world population older than 65 may even have doubled by then, and this will have an impact on demand for healthcare services. It also means that there will be fewer taxpayers (in absolute terms and relative to the elderly) to pay for the latter's healthcare. This development could have a significant impact on the attitude toward reimbursement regimes in developed economies.

I believe governments will adopt a number of measures during the period 2030 to 2050 to contain the pressure of rising healthcare costs on the public purse. Germany has already adopted the copayment approach taken by Japan, and I believe that this system could expand in other countries in the coming decades, and will have been adopted by most countries by 2050.

Taxing Irresponsibility

Taxes on unhealthy foods and incentives to keep fit, such as lower insurance on people who do not exceed a waistband/height ratio, could also be introduced. There will certainly be an increasing focus on personal responsibility over the next 40 years.

Of course, it is impossible to guess exactly what the world will be like in 2050. But I believe the pay-for-quality reimbursement approach will have conquered most of the world (perhaps with the exception of Japan), the demographic outlook will be far more benign than at present, and individuals will be forced to take greater responsibility for their own healthcare than is currently the case. Moreover, advances in technology will ensure that individuals (and their doctors) will have the information they need to look after themselves and prevent serious illnesses from developing.

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Professor Erich Reinhardt, PhD (left), and Professor Detlev Ganten, MD, PhD, (right) have given impetus to progress in the healthcare industry and medical research for decades.

Discussing Healthcare: Where Will We Be in 40 Years?

Two long-standing representatives from the medical industry and research came together with *Medical Solutions* to talk about their visions of treatment, patient management, and general prospects in future healthcare systems.

By Linda Brookes

In January 2010, Professor Detlev Ganten, MD, PhD, and Professor Erich Reinhardt, PhD – representing the viewpoints of academia and industry, respectively – met at Siemens Healthcare headquarters in Erlangen, Germany, to exchange ideas about how healthcare is likely to develop in the decades ahead. Ganten, formerly CEO of the Charité University Hospital Berlin, is President of the World Health Summit – an annual meeting of political decision-makers, members of the scientific community, and representatives of industry and society from all over the world who come together to discuss global healthcare challenges. Reinhardt is the former CEO and President of Siemens Healthcare, and currently consultant to Siemens. Below, you can read an extract from their discussion.

What do you consider to be the main advances in medicine by 2050?
REINHARDT: I believe that by 2050, because of better understanding of disease, particularly at the molecular level, we will be able to detect diseases at very early stages using innovative technologies based on blood tests or imaging. It will be possible to predict individual response to treatment, which means that we will be able to realize so-called 'personalized medicine'. By 2050, we will have seen significant progress in this field.

GANTEN: Personalized medicine is based on the concept that every individual is unique. It means making a detailed analysis by genetic testing, imaging, and determining biomarkers for an individual patient, which will predict treatment success. However, there is another type of personalized medicine that I always emphasize, which is personal responsibility for health.

"Personal responsibility has to come into play: a healthcare system cannot be expected to continue treating a person for up to 40 years for diseases of civilization."

Professor Detlev Ganten, MD, PhD, CEO of Charité University Hospital Berlin until 2008, Chair of the Charité Foundation, Berlin, Germany

"By 2050, we will be able to detect diseases at very early stages using innovative technologies based on blood tests or imaging."

Professor Erich Reinhardt, PhD, former CEO of Siemens Healthcare, Executive Advisor CEO, Siemens AG, Erlangen, Germany

What do you believe will be the biggest factor driving healthcare by 2050?
GANTEN: In the future, chronic diseases will probably dominate healthcare. With good medical care, acute diseases can be managed and patients do not usually die. Chronic diseases are the bigger challenge, because they require long-term medical care, which is expensive. Again, personal responsibility has to come into play, because a healthcare system cannot be expected to continue to treat a person for up to 40 years for diseases of civilization such as cardiovascular disease, type 2 diabetes, asthma, or chronic liver disease.

Do you think that people born in 2010 have a better chance of avoiding diseases of civilization?
GANTEN: Yes, because they will receive better health education.

REINHARDT: I believe the sum of the problems remains constant, although the diseases may differ.

How will patient data be managed in the year 2050?
GANTEN: All important individual patient data, including the complete genome, proteome, and metabolome, will be entered into a computer and attached physically to each patient. The data will follow patients when they visit a physician or a hospital and in that way, be continuously available for use in making diagnoses and prescribing treatment. Thus, management of disease will be improved.

REINHARDT: By 2050, physicians will have access not only to all their own patients' data, but also to relevant information about similar cases that have been treated worldwide. This will be used to reach the most professional, competent decisions for their patients. It will make life easier for physicians, because it will enable them to be more productive, more efficient, and more effective, and it will allow them to spend more time with patients.

GANTEN: In addition, all the data will be available for research, allowing us to study the real outcomes of specified treatments. At present, treatment recommendations are based on clinical trials, which involve a select group of patients and relatively short observation periods. When we can get data from daily life, we will know what is going on in practice and have better estimates of how effective we are.

How will these data be organized?
REINHARDT: I do not think that one company will own all the data. Although there will be open access for research, I would rather imagine business models for distribution and application of the data.

GANTEN: We need an organization to make the database compatible between insurance systems, academic health centers, clinical companies, and research organizations. Of course, in dealing with patients and diseases, data protection and ethics of handling data are extremely important.

REINHARDT: We will have to ensure that privacy is protected. I believe that by 2050, technical solutions will be available for integration and compatibility in dealing with huge amounts of data while applying high ethical standards.

Are you optimistic or pessimistic about the state of healthcare in 2050?
GANTEN: One of the greatest philosophers of modern times, Karl Popper, said that the future is uncertain. He also said that the more discoveries are made, the more uncertain the future is. I think it is important to keep this in mind when discussing the future of health, medicine, and technology. Many people say that it is pessimistic to believe that the future is uncertain, but the optimistic view is that we have a responsibility for the future, and if you have a personal idea of how the future should be, then you have a responsibility to work for it. Health is a human right, and it is our responsibility to work for this human right. We must do everything we can to improve health not only in wealthy populations that can afford everything available for their own personal health, but also for people who are underprivileged and do not have the same access to healthcare.

REINHARDT: I agree that the future is uncertain, but I think there are opportunities to create the future by developing scenarios for possible alternatives in order to be prepared. A prerequisite is to respond quickly to changes so that they can be integrated into healthcare. I am convinced that we will see significant improvement in knowledge about health. Personally, I am an optimist, so I think that there are very positive opportunities ahead.

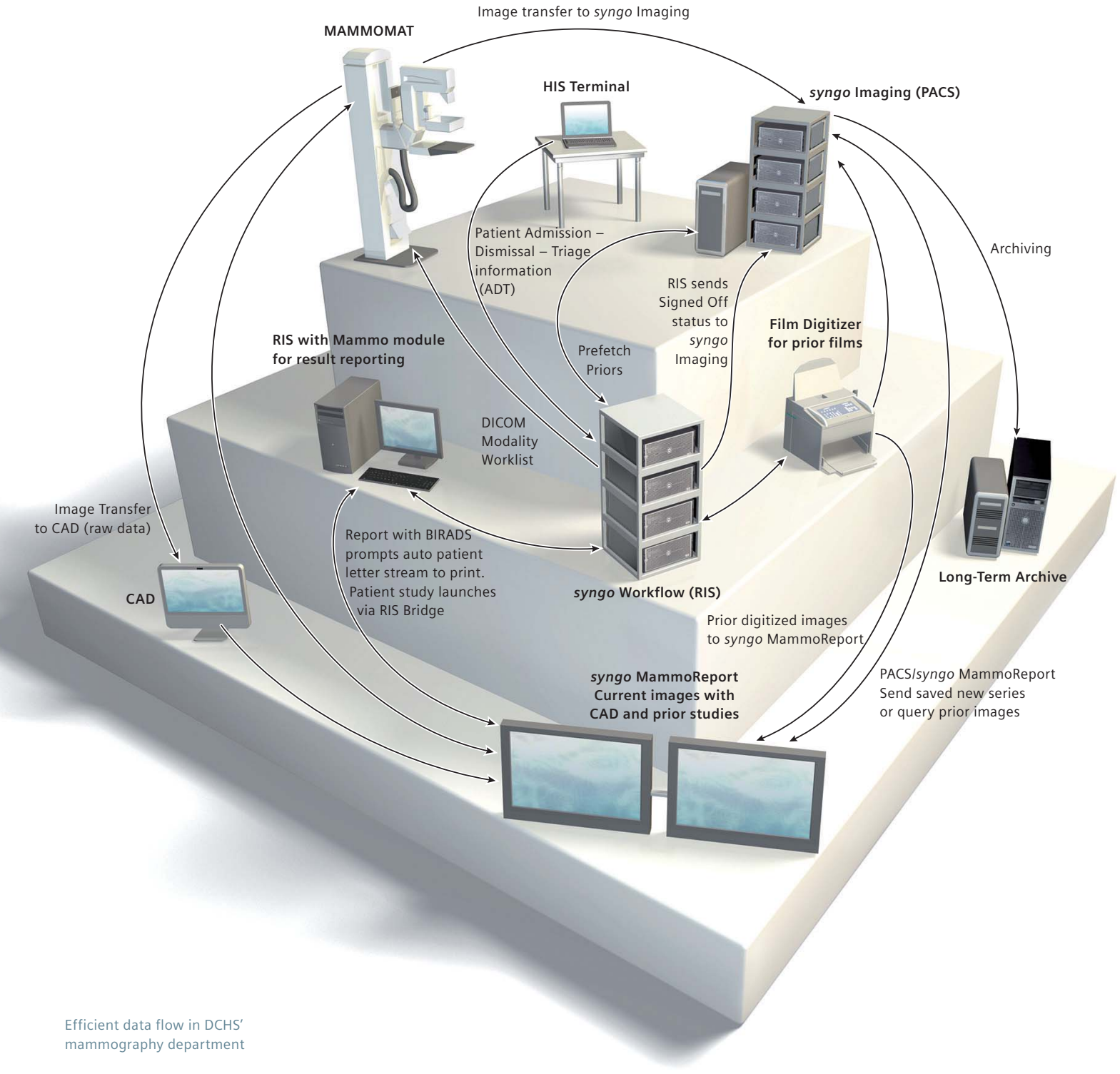
Linda Brookes *is a freelance medical writer and editor who divides her time between London and New York, working for a variety of clients in the healthcare and pharmaceutical fields.*

Summary

Challenge:
- To integrate advances in medical technology for prevention and early diagnosis of disease while streamlining patient services and optimizing costs and reimbursement structures

Solution:
- Understand the patient's disease (imaging, laboratory diagnostics)
- Understand the patient's biology (molecular applications)
- Streamline acquisition, storage, translation, and distribution of all medical data
- Optimize all patients' enrollment in primary and secondary prevention programs
- Assess similar cases from state-of-the-art databases

Result:
- Wider application of personalized medicine
- Optimal knowledge of patients' health states for both patients and healthcare providers
- Minimization of preventable premature morbidity and mortality
- Greater cost effectiveness within healthcare systems



Efficient data flow in DCHS' mammography department

Rural System Takes Mammography to a New Level

While boasting ultra-dedicated physicians and staff, rural healthcare facilities traditionally have taken a backseat to their big city cousins when it comes to state-of-the-art mammography technology and workflow. Then there's Dickinson County Healthcare System.

By Diana Smith

Dickinson County Healthcare System (DCHS) is located in Iron Mountain, Michigan, USA, in the state's Upper Peninsula – a vast region bordered by Canada, Wisconsin, and two Great Lakes. The system serves a rural area comprised primarily of the south-central Upper Peninsula and adjoining counties in neighboring northeastern Wisconsin. All told, approximately 35,000 people live in the area, hardy souls who can endure 100 to 250 inches (250 to 635 centimeters) of snow each year. The closest city to Iron Mountain is two hours away.

The area was once known for its prolific copper and iron ore mining operations. Now, thanks to imaging and workflow technology from Siemens, DCHS is promoting its new "gold" standard: superior, patient-focused, full-field digital mammography. With new technology and improved workflow, patients receive breast care as advanced as that found in any urban setting.

A State-of-the-art Vision

The rural surroundings did not dissuade leaders at the 100-bed hospital, who envisioned nothing less than state-of-the-art mammography services at DCHS. "Two years ago, we decided to transform our mammography services and to become one of the best-in-class mammography service providers, statewide and nationwide," says William (Bill) Johnson, ARRT (American Registered Radiology Technician), RDMS (Registered Diagnostic Medical Sonographer), CRA (certified Clinical Research Associate), Radiology/Imaging Services Manager at DCHS. "We believed that a combination of workflow rethinking and the use of the latest technology in image acquisition, viewing, reporting, and storage were the necessary tools to implement a new mammography paradigm," Johnson explains. "The importance of workflow efficiency is especially evident today with the demands of public awareness and an aging population, which has increased the demand for mammography."

The answer for DCHS was to acquire a full-field digital mammography (FFDM) system to replace analog film-based mammography, says Radiologist Emma DiPonio, MD. At the same time, the team combined the transition to digital mammography with the reengineering of the mammography workflow with the following goals:

- Improving the quality of patient care
- Increasing patient comfort
- Improving efficiency
- Extending outreach
- Lowering total operating cost

Going Digital

To meet these lofty goals, the team turned to Siemens for the latest technology solutions. "We decided to select a RIS-[radiology information system-]driven mammography workflow with images stored in *syngo*® Imaging, our existing PACS [picture archiving and communication system]," says RIS/PACS Administrator Sharleen (Sherry) Koepp, ARRT, RDMS, CIIP (Certified Imaging Informatic Professional), a 30-year veteran of the imaging field. "We purchased the mammography module as an adjunct to our RIS, *syngo* Workflow, in order to electronically store and access patient mammography history and to provide access to prior reports. Siemens' *syngo* MammoReport work-

“We looked at digital imaging for mammography and thought it was just superior and would be much more cost-effective in the long run.”

Sharleen Koepp, ARRT, RDMS, CIIP, RIS/PACS Administrator,
Dickinson County Healthcare System, Iron Mountain, Michigan, USA

station was selected as our solution for reading mammography exams.”
For imaging, the MAMMOMAT® Novation^{DR} full-field digital mammography acquisition system was installed. The all-in-one mammography solution allows for screening, diagnostics, magnification, spot imaging, needle localization, and galactography. It is equipped with a pivoting bucky to enable 100 percent system utilization. “This way, if a patient is in a wheelchair or semi-recumbent, we can get the image at any angle,” Koepp explains. Combined with *syngo* Opdima®, vacuum and core needle biopsy and specimen radiography can be performed.
“We looked at digital imaging for mammography and thought it was just superior and would be much more cost-effective in the long run,” says Koepp. “Certainly, it is a big expense to begin with, but film costs and processing costs with film-based mammography become offset by the digital world, and you eventually recoup those costs. It is also important to be able to share those images with others. Especially if you are in a remote area, as patients do go to other facilities, for example, for reconstructive surgery. Thanks to our digital capabilities, we are able to provide images to those facilities.”

Innovation in the Exam Room and Beyond

The new system resulted in a brand-new workflow paradigm that has increased comfort and peace of mind for patients, while improving images and workflow for physicians and staff. “When a patient arrives in the imaging department, she checks in with central scheduling, and the display screen in the mammography room informs the technician that the patient is in the waiting room,” Koepp reports. The patient is taken into the exam room to change while mammography history data is drawn up on the RIS. After the exam is explained to the patient, the patient is positioned and images are taken. They are available as soon as the exam has been completed. The newly acquired images are viewed by the technologist for quality assurance (QA) purposes, such as checking for the correct patient positioning. This is done on a three-megapixel monitor, while images of prior examinations are viewed on an adjacent 1.5-megapixel monitor. “Those were innovations we insisted upon,” says Koepp. “Normally, an image would be viewed for QA by a tech on a 1.5-megapixel display device. The radiologist reads the image, however, on a five-megapixel display. By having a three-megapixel display for QA, the technologist can view an image that looks much closer to what the physician will see. By also having a 1.5-megapixel display, the technologist can compare images of a prior exam and new images side by side to view similarities and inconsistencies. That is huge. With film, we would put prior and new films side by side on a light box. We wanted to be able to do the same with electronic images.”

Improved Efficiency and Workflow

Upon acceptance, the images are auto-routed to the PACS, *syngo* Workflow, the *syngo* MammoReport workstation, and the computer-aided detection (CAD) system. *syngo* MammoReport, the high-speed workplace for reading and report-

Radiologist Dr. Emma DiPonio reviews studies on DCHS’ customized *syngo* MammoReport workplace. The *syngo* Workflow (RIS) monitor is mounted on the left. When a patient is selected on the RIS worklist, new and prior studies are retrieved from the PACS and appear on the *syngo* MammoReport’s diagnostic display.

ing FFDM mammograms, comes equipped with a keypad designed for the specific requirements of the digital mammography workflow. For example, by pushing the center button on the keypad, the system switches immediately between screening and diagnostic mammograms. The CAD software identifies regions of interest on the mammography images and brings them to the attention of the radiologist. This helps decrease false-negative readings and more effectively identify masses, architectural distortions, and microcalcifications in a diverse screening population.

"Diagnostic exams are reviewed with the radiologist and, if needed, extra views are taken. If the patient is willing to wait, we'll work them in as soon as possible, usually within a few hours or less," says Koepp. "If indicated, an ultrasound or needle biopsy can be done on the same day with notification to the referring physician." If breast magnetic resonance imaging (MRI) is recommended, it is scheduled as soon as possible after insurance pre-authorization is obtained and the physician is notified.

DCHS uses a markable breast diagram to identify clinical findings, and *syngo* Workflow automatically generates the associated result report for review, editing, and signature, according to Koepp. Based on the finding, the system can assign a follow-up letter stream for the patient, factoring in any specific conditions desired. For example, a patient below the age of 40 with a negative screening can be sent a reminder letter in two years, but a 52-year-old patient might receive an annual reminder.

"We use the stored data in *syngo* Workflow for statistical reports for accreditation needs, including positive predictive value [PPV], false positive/negative predictive value, as well as technologist and radiologist productivity, as required for the American College of Radiology [ACR] and the Mammography Quality Standards Act [MQSA]," says Koepp. Prior to the RIS implementation, this information was kept in a binder and had to be compiled manually. Now, reports are generated automatically, resulting in tremendous savings in time and effort.

With 6,000 mammography exams performed each year at DCHS, the new workflow helps provide fast and reliable service for patients and facilitates the workload of the mammography team. Patients experience virtually no waiting times when examinations are scheduled in advance, and the total examination time does not exceed 15 minutes.

Patient-centered Process

Patient comfort is enhanced by the use of a "mammo pad," a foam pad that is attached to the equipment allowing compression to be more tolerable for most patients. Additionally, the health system has added a considerate touch, a comfortable room that is available for confidential discussion with the radiologist when needed. While patients may not realize the improved, stellar quality of their images, they do appreciate the remodeling of the mammography and waiting rooms, which provide improved comfort, privacy, and relaxation.

In 2008, DCHS set out to provide superior mammography services to the residents of Northern Michigan and nearby Wisconsin. Staff members believe they have achieved this through the combination of *syngo* MammoReport, *syngo* Workflow, *syngo* Imaging, and the MAMMOMAT system. Together, these solutions met DCHS's quality and workflow requirements – from patient registration and image acquisition to reading and reporting through final data storage.

"As we have progressed with the conversion to a filmless, all-digital environment, [Siemens] technology has been the best fit for Dickinson and is very reliable," says Johnson. "Siemens products provide the connectivity and high imaging quality that meets the expectations of our patients and their physicians." Even outside the big cities.

Diana Smith *is a freelance writer specializing in medical topics. She is based in Liberty Hill, Texas, USA.*

Further Information

www.siemens.com/breastcare

Summary

Challenge:

- Improve quality of breast cancer screening, diagnosis, and treatment in a rural area to become one of the best-in-class mammography providers nationwide
- Increase patient comfort and physician satisfaction
- Accelerate workflow and increase efficiency
- Decrease total operating cost

Solution:

- A state-of-the-art, full-field digital mammography system from Siemens offering advanced screening, diagnostic, and treatment solutions
- Innovations in mammography for increased patient comfort
- Reengineered, improved workflow increasing efficiency and access to information
- New systems that allow excellent image quality and immediate access to completed exams
- Improved information system that allows for the use of stored data to create statistical reports for accreditation needs

Result:

- Advanced breast care screening and diagnosis, close to home, rendering travel to a large urban center unnecessary
- Increased patient comfort and satisfaction, with virtually no waiting times when scheduled in advance, and exams that do not exceed 15 minutes
- Excellent image quality, increasing diagnostic confidence and guiding treatment and follow-up, available as soon as an exam has been completed
- Seamless integration of multimodality data
- Streamlined processes
- Lower operational costs, increased reimbursement over film screens

A New Aid for Identifying Sepsis

The measurement of BRAHMS procalcitonin, a diagnostic biomarker, aids clinicians in identifying patients with sepsis and has also been shown to reduce unnecessary antibiotic use. The positive outcomes experienced at hospitals such as the Swedish Covenant Hospital in Chicago, Illinois, USA, are confirmed by several clinical trials, including a recent large, multicenter study conducted in Switzerland.

By Sameh Fahmy, MS

A patient in the intensive care unit (ICU) has a fever, a rapid heart rate, an elevated respiratory rate, or an abnormal white blood cell count. These symptoms could herald the onset of sepsis, a life-threatening systemic inflammatory response to infection, or they could be the result of trauma or a host of other conditions. Results from blood cultures have a high rate of false negatives – 40 percent in one study[1] – and will not be available for up to 72 hours. The clock is ticking, and every hour of delayed treatment increases the likelihood of death.[2] Inappropriate antibiotic use can cause adverse side effects for the patient and encourage the development of drug-resistant bacteria.

Fortunately, there is a better option. By measuring serum levels of the protein procalcitonin (PCT), clinicians can identify patients at risk for sepsis early and begin treatment when it is most likely to be effective. The BRAHMS PCT assay is available on the Siemens ADVIA Centaur® XP and ADVIA Centaur CP Immunoassay Systems*. This PCT assay also allows clinicians to monitor response to treatment and tailor antibiotic therapy accordingly.

"PCT gives you more confidence in your decision-making about when to start antibiotics, when antibiotics are not working, and when to stop antibiotics," says Eric Gluck, MD, Director of Critical Care Services at Chicago's Swedish Covenant Hospital and Professor of Medicine at Finch University of Health Sciences/The Chicago Medical School. "Nothing else correlates with those three endpoints as well as PCT does."

Swedish Covenant, a 323-bed academic hospital, has been using the BRAHMS PCT assay on Kryptor® since 2007 and has seen significant decreases in antibiotic usage in the ICU and a decreased average length of stay in patients with sepsis. Performance evaluation trials of

*CE Mark. Not available for sale in the U.S.

BRAHMS PCT on ADVIA Centaur XP were conducted at Swedish Covenant using performance evaluation-only reagents, calibrators, and controls. Several studies[3–8] within the past decade have shown the benefits of BRAHMS PCT guidance in reducing unnecessary antibiotic usage as well as associated adverse side effects, including a large multicenter clinical trial recently published in the *Journal of the American Medical Association (JAMA)*.[9]

> "Patients in the BRAHMS PCT group had a 30-percent reduction in the rate of antibiotic-related side effects."
>
> Philipp Schuetz, MD, Department of Emergency Medicine, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

A Growing Threat

An estimated 215,000 annual deaths are attributed to sepsis in the United States alone, making it more deadly than common cancers such as lung cancer, colon cancer, and breast cancer. Worldwide, 18 million cases occur annually, with an average cost per patient of US$22,100.[10] An aging population and the increasing use of invasive procedures are making sepsis even more common, with the rate of sepsis increasing by an estimated 1.5 percent every year.[10]

A rapid and accurate diagnostic tool is critical, because the prognosis for patients with sepsis is best when the condition is recognized and treated early.[11] If a patient progresses to severe sepsis, defined as sepsis and organ dysfunction, mortality can jump to 52 percent. If a patient enters septic shock, the mortality rate can jump to 82 percent.[12] "The data has demonstrated very clearly that the sooner you start antibiotics, the better the outcomes will be," says Gluck.

Rapid, Accurate Diagnosis

PCT is a protein that is normally produced in small amounts in the thyroid gland. In patients with sepsis, however, the protein is produced in large quantities by the liver, kidney, fat cells, and muscle. Increasing serum PCT concentrations indicate increased severity of infection and a worse prognosis for the patient. Using the ADVIA Centaur XP and ADVIA Centaur CP Systems*, clinicians can receive results in less than 30 minutes. Swedish Covenant began using the BRAHMS PCT assay on Kryptor in 2007 after conducting clinical trials to assess its sensitivity and specificity. "We found that the assay had a sensitivity of 91 percent in the identification of patients who were septic and a specificity of 98 percent to identify patients who do not have sepsis," Gluck said. "And that was better than anything else that we had available to us at the bedside in our hospital – none of the blood tests or physical findings got us anywhere near those kind of results."

Gluck says that in many cases, patients would have received a much later diagnosis of sepsis and would have likely had a worse outcome had it not been for the PCT assay. One patient, for example, was brought to the emergency department by family members after intentionally overdosing on prescription medications. An elevated white blood cell count was thought to be the result of stress of the overdose. However, the treating physician ran a PCT assay to corroborate the finding, now a routine practice at Swedish Covenant. An elevated PCT level strongly suggested infection, so the patient was given antibiotics. When results from blood cultures became available the next day and were followed by an ultrasound, it became clear that the patient had cholecystitis, or inflammation of the gallbladder, accompanied by infection. "In this particular patient, I'm not sure if we would have ever made the diagnosis," Gluck says, "because the patient couldn't give us a history."

Measurable Reductions in Antibiotic Use

A large-scale, multicenter trial recently published in *JAMA,* led by Philipp Schuetz, MD, University Hospital in Basel, Switzerland, showed that the use of BRAHMS PCT can help rule out bacterial infection, especially in patients with chronic obstructive pulmonary disease (COPD) and bronchitis, and reduce the duration of antibiotic use in patients with diagnosed infection. Schuetz says that while previous studies were consistent with these findings, they were not large enough to assess whether patients treated with PCT-based guidelines had comparable rates of disease-related complications. To answer that question, Schuetz and a team of researchers compared treatment based on PCT guidance against standard care in a randomized controlled trial involving more than 1,300 patients with lower respiratory tract infections at six tertiary care hospitals in Switzerland. According to the study's guidelines, antibiotics were strongly discouraged if PCT was less than 0.1 µg/L, discouraged if levels were 0.25 µg/L or lower, encouraged if PCT was higher than 0.25 µg/L and strongly encouraged if levels were above 0.5 µg/L. Overruling of the guidelines was possible by prespecified criteria, such as immediate need for ICU admission or respiratory or hemodynamic instability. In patients given antibiotics, PCT measurements were repeated after three, five, and seven days of treatment. The guidelines recommended stopping antibiotics if PCT levels decreased by 80 percent.

"We found that in patients treated with knowledge of procalcitonin levels and

In a study recently published in *JAMA*, Philipp Schuetz, MD, showed that the measurement of the biomarker BRAHMS PCT can help rule out bacterial infection and reduce the duration of antibiotic use in patients with diagnosed infection.

*CE Mark. Not available for sale in the U.S.

The BRAHMS PCT test is available on the Siemens ADVIA Centaur XP and ADVIA Centaur CP Immunoassay Systems*.

Summary

Challenge:

- Identifying patients with sepsis early, when treatment is most likely to be effective
- Reducing the high cost associated with treating patients with severe sepsis and septic shock
- Differentiating sepsis from other inflammatory diseases, trauma, and other conditions, whose symptoms can mimic sepsis
- Reducing unnecessary antibiotic usage and its associated costs and side effects

Solution:

- Measurement of serum levels of the biomarker BRAHMS procalcitonin, allowing physicians to rapidly identify patients with sepsis
- Early identification of sepsis using procalcitonin, allowing for treatment to be initiated sooner, potentially reducing costly complications associated with sepsis
- Measuring procalcitonin levels, helping rule out bacterial infection in patients whose symptoms mimic those of sepsis
- Negative BRAHMS PCT result indicates that antibiotics may not be necessary; in patients with bacterial infection, serial measurement of PCT helps guide treatment, helping ensure that patients receive optimum duration of antibiotics

Result:

- Patients receive appropriate treatment quickly, improving likelihood of survival[2]
- Early and appropriate treatment for sepsis may result in reduced co-morbidities, with potential cost savings associated with shorter lengths of stay[7]
- Antibiotics given only to patients who need them, and for optimum duration, resulting[5, 6, 7, 9] in reduction of adverse side effects and minimization of potential for the development of drug resistant bacteria[9]
- Inappropriate antibiotic usage dramatically reduced[5, 6, 7, 9], resulting in potential cost savings, fewer adverse side effects[9], and potentially shorter lengths of ICU stay[7]

those treated without knowledge of procalcitonin levels, the risk for adverse events was the same," says Schuetz, who is currently engaged in research at the Department of Emergency Medicine at Beth Israel Deaconess Medical Center in Boston, Massachusetts, USA. "Patients had the same mortality, they had the same ICU admissions rate, and – importantly – they had the same rate of recurrent infections."

Notably, the researchers also found that patients in the procalcitonin group had an average antibiotic exposure nearly 35 percent less than the control group. Schuetz points out that the pattern of reduction varied depending on diagnosis. The study found that patients with pneumonia were treated with fewer days of antibiotics than the control group, while patients with exacerbations of chronic obstructive pulmonary disease (COPD) and bronchitis were less likely to have antibiotics initiated than the control group.

The reduction in antibiotic use also translated to better patient care. Schuetz points out that patients in the PCT group had a 30-percent reduction in the rate of antibiotic-related side effects such as nausea, diarrhea, and rash.

Integrating PCT into Clinical Routines

BRAHMS PCT guidance has also been shown to be useful in reducing antibiotic use in primary care settings, and preliminary data from Gluck and his colleagues suggest that measuring PCT when a patient presents to the emergency department can reduce unnecessary blood cultures.

Administering the assay is inexpensive, Gluck notes, especially when compared to the high cost of treating a septic patient and the potential cost savings from reductions in antibiotic use and shorter lengths of stays.

Although the data regarding the value of PCT guidance are convincing, both Schuetz and Gluck acknowledge that physicians are initially hesitant to alter well-established treatment practices.

*CE Mark. Not available for sale in the U.S.

"By treating patients with antibiotics when they don't need them, you're exposing them to some possibility of harm."

Eric Gluck, MD, Director of Critical Care Services, Swedish Covenant Hospital, Chicago, Illinois, USA

"In the beginning, you have to reassure physicians that the algorithm is safe," Schuetz says, "but once physicians start using it, they realize that what they have been doing for all of these years – overtreating patients with antibiotics – was not necessary."

Gluck introduced his colleagues at the hospital to the BRAHMS Kryptor PCT assay in a large, general instruction session that covered the benefits of the assay and emphasized that it does not replace medical judgment or other diagnostic tests. The assay, he explained, is a tool to help physicians make more informed decisions. An initial utilization in the ICU was later expanded to infectious disease physicians, the emergency department, and eventually to the entire hospital. Gluck says that Swedish Covenant has so much confidence in the assay that it has implemented a hospital-wide policy indicating that physicians should discontinue antibiotics if PCT levels are negative in two measurements 24 hours apart.

"One of the most important dictums in medical ethics is 'do no harm'," Gluck notes. "And by treating patients with antibiotics when they don't need them, you're exposing them to some possibility of harm. So, it makes my conscience much clearer to know that when I leave the hospital, I have significantly reduced the number of patients who receive unnecessary antibiotics. And it also makes me feel comfortable that in the likelihood that the patient needs antibiotics, I will know about it as fast or faster than anybody else practicing critical care medicine."

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Sepsis by the Numbers

Sepsis is not a specific disease, but rather a continuum of events triggered by the body's inflammatory immune response to bacterial, fungal, parasitic, or viral infections. The statistics below demonstrate the high toll it exacts.

- Approximately 18 million sepsis cases estimated yearly worldwide[1]
- Sepsis affects more than 35 percent of ICU patients[1] and manifests in approximately 2/3 of these patients as severe sepsis or septic shock[13]
- Approximately 28.6 percent average overall mortality for sepsis, severe sepsis, and septic shock[12]
- Up to 82 percent mortality for patients with septic shock[12]
- Once a patient is in septic shock, survival rates can drop 7.6 percent for every hour that antibiotic therapy is delayed[2]
- U.S. estimated cost exceeds US$17 billion annually, with average cost per patient of US$22,100[10]
- Incidence of sepsis is increasing by approximately 1.5 percent per year and is expected to continue growing as the population ages[10]

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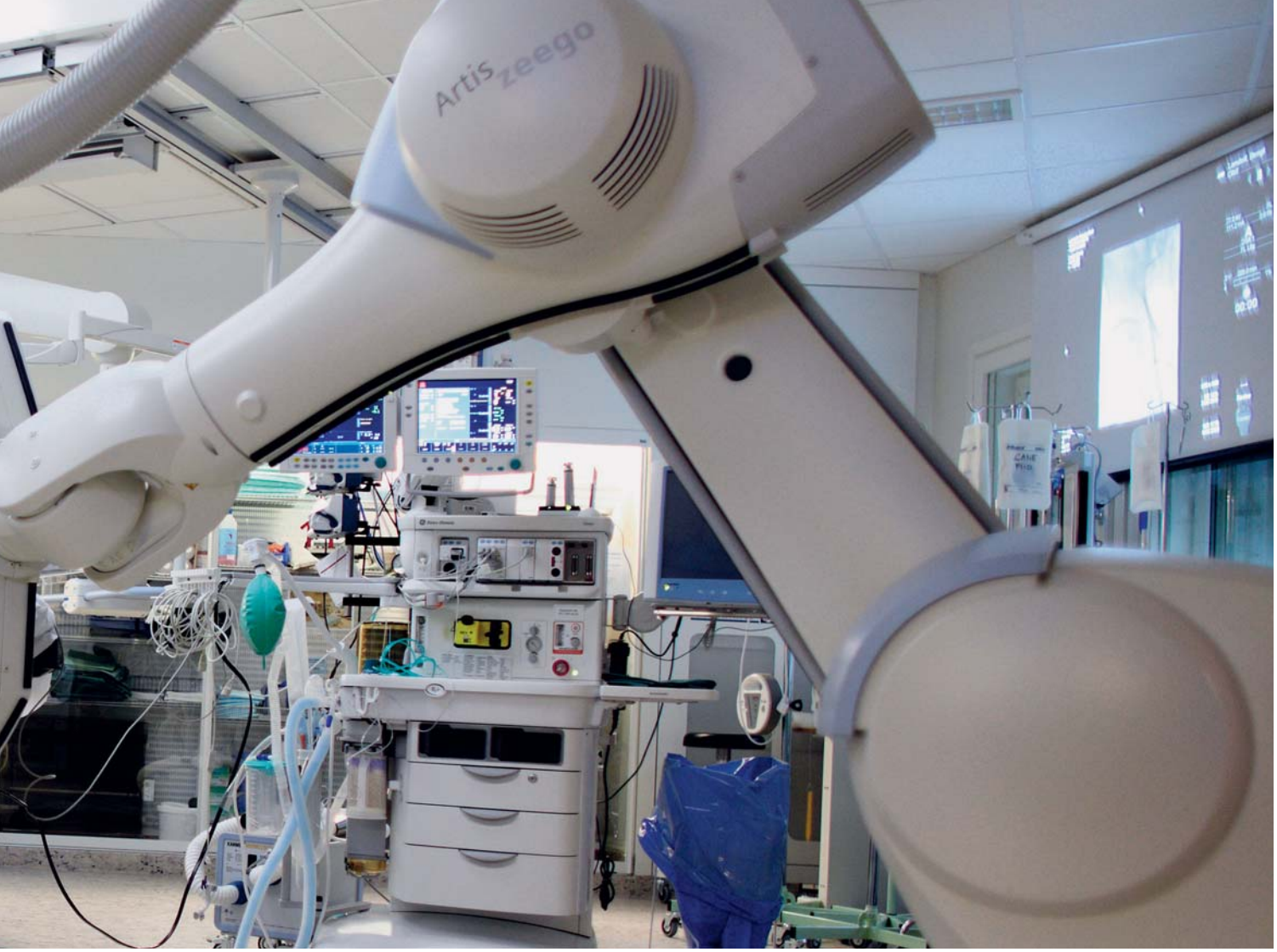
Further Information

www.siemens.com/sepsis

Hybrid Rooms Revolutionize Trauma Treatment in Sweden

Karolinska University Hospital in Stockholm has built one of the world's first hybrid rooms dedicated to treating trauma patients. This was made possible by implementing Artis zeego, the multi-axis C-arm system based on robotic technology from Siemens. The system met all the criteria set up by the hospital: advanced imaging technology, an extremely clean working environment, and a design allowing the staff to move freely.

By Nils Lindstrand



The hybrid room at Karolinska's trauma center simplifies the physicians' choice between interventional technology and surgical procedures and enables them to combine both.

"This is a hybrid room without compromise," says Linus Blohmé, Deputy Head of Vascular Surgery at Karolinska University Hospital in Stockholm. The solution based on Artis zeego® has made it possible to use advanced imaging technology and still create a room where the staff can move around freely.

Artis zeego is an extremely flexible floor-mounted system that does not contain any ceiling-mounted components. The system is, therefore, ideally suited for hybrid rooms, because equipment in the ceiling may contaminate the laminar airflow of the extremely clean environment on which the hospital prides itself. Information technology installed in the hybrid room provides the needed information to the staff taking part in the procedure.

The hybrid room at Karolinska University Hospital is used to treat trauma cases for the entire Stockholm region. This means very high demands, and the room has been designed to meet extremely high standards. "We've raised the bar for hybrid rooms," says Pär Olofsson, retiring Head of Vascular Surgery. The project team got the go-ahead from the hospital in 2006 to build this optimal hybrid room for trauma treatment. The efficiency this room promised convinced the hospital board that this would be a sound investment. Construction work on the hybrid room at Karolinska University Hospital started in the fall of 2008. In the summer of 2009, the room was first used to treat patients.

The former trauma center at Karolinska was designed according to usual standards: a helicopter pad, a triage room with a computed tomography (CT) scan unit, and an operating room (OR). The distance to the operating suite was 20 meters (nearly 66 feet), which is quite good. However, the distance to the interventional suite was about 600 meters (nearly 2,000 feet).

"This distance could still be okay," says Olofsson. "The problem is that, with this distance, you want to be very sure that's where you need to go. You don't want to push a severely traumatized patient that distance and then back again, which might be necessary if you don't have the imaging equipment to make a definite decision between interventional treatment and a surgical one. In practice, this meant that we sometimes probably chose surgery to save a life. With a hybrid room, we can use minimally invasive procedures in many cases."

A few years back, the decision to make Karolinska University Hospital a regional center for the treatment of trauma patients gave further reasons for building a hybrid room. "Before we started

Continuing to Improve Hybrid Interventional Methodologies in Oslo

The hybrid room at Rikshospitalet in Oslo, Norway, one of the first Artis zeego installations in a hybrid environment, was installed in 2007 and has a continuing focus on developing methods for treating patients within a wide range of needs. Moreover, the hybrid room is used to test cutting-edge interventional devices such as stents or valves for endo-vascular use. "Testing methods and devices is made more efficient using the advanced imaging possibilities provided by Artis zeego," says Per Kristian Hol, MD, Manager of Radiology Research at the Interventional Center. "We get fuller and more detailed information by using this technology."

The Interventional Center at Rikshospitalet is an innovative imaging department and a reference facility for a number of hybrid rooms built in recent years, including the Karolinska University Hospital. "Yes, we've experienced a lot of interest from other hospitals," says Hol. "We've had guests from all over the world, mainly from Scandinavia, Europe, and the U.S., but also from China and Japan."

Hol is still very pleased with the features of Artis zeego and the enhanced support that advanced imaging brings to the critical-decision process. "Today, we're using this equipment and the hybrid room to develop a large number of procedures. Cardiology and vascular treatments are still in focus, but we get a lot of interest from other fields such as audiology, where imaging technology is very useful for developing methods for Cochlea implants in the inner ear, for example."

The hybrid room at Rikshospitalet is still being developed in many ways. One is the "stage light" OR lighting concept in which the center is developing a system to provide perfect lighting at any moment of any treatment. "The next challenge will be to develop methods within neurology and neurosurgery," says Hol.

The hybrid room in Oslo continues to meet new challenges through innovative method and device testing.

this project, hybrid rooms were far away from emergency cases," says Blohmé. "They were used for treatment and research primarily in angiography and angioplasty, in well-planned cases. For us, the reason for using a hybrid room was to simplify the choice between interventional technology and surgical procedures, or to combine the two."

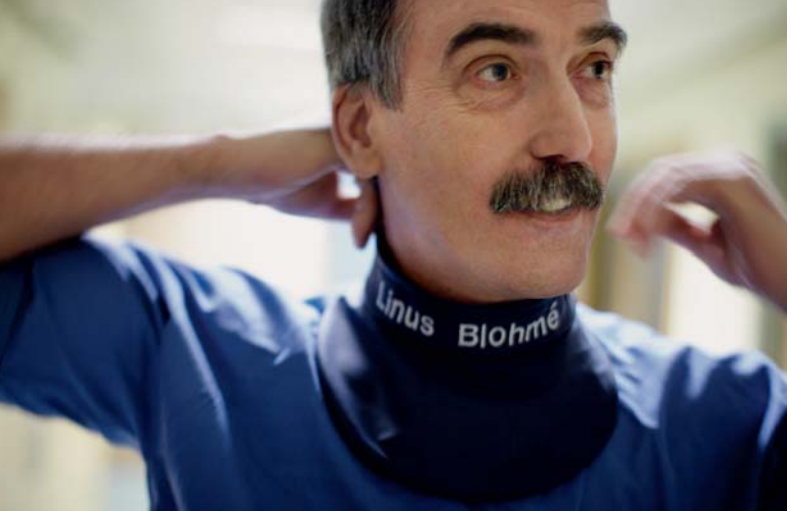
Focus on Trauma Patients

The hybrid room at Karolinska is, therefore, primarily used for trauma patients. But to make the work in the hybrid room efficient, the staff needs to use it as much as possible. This is, of course, also important in order to maintain economic efficiency and to provide patients with the treatment advantages the hybrid room offers.

"The time between recovering from an intervention and from open surgery may be weeks or even months," says Olofsson. This means a great difference in the patient's well-being and also a major difference in economic terms, both for the hospital and for healthcare in general. To be able to choose the right treatment, without increasing any risk for the patient, is a major step forward.

The medical staff was so convinced of the economic efficiency provided by the hybrid room that it wanted to make it an economic unit of its own. "This was not possible, due to the established economic systems of the hospital," says Olofsson. "But we'll monitor the fiscal results as closely as we can to create a good follow-up on the efficiency of the hybrid room as we learn to use it to its full potential."

The decision to go with Siemens and Artis zeego was based on three criteria: the necessity of an extremely clean atmosphere, the staff's need to move around without being hindered by the equipment, and the need for high-quality imaging. "There was alternative technology available that met one of these demands," says Blohmé. "Siemens' Artis zeego solution was, however, the only one that met all of them. Mobile units would have solved the space issue, but the imaging quality was too low. We also looked at solutions with equipment in



Linus Blohmé, Deputy Head of Vascular Surgery (left) and Pär Olofsson, retiring Head of Vascular Surgery (right) appreciate the advantages of a hybrid room for trauma treatment.

the ceiling and on the floor, but they all blocked either the floor space or the clean laminar airflow we wanted to use." Artis zeego made it possible to create a hybrid room with no compromise – advanced imaging with the C-arm thoroughly parked out of the way when not in use and nothing blocking the air supply from the ceiling.

Using a hybrid room for trauma treatment has advantages that may very well save many lives. People with trauma injuries often have major damages to blood vessels. Getting the optimal treatment for injuries like this is vital, and time is often of absolute critical importance.

"Bleeding is not good," says Blohmé, using an obvious truism. "When a patient is bleeding internally, we need to get a good image and find a way to the optimal treatment as fast as possible. The expression 'the golden hour' holds a reality, and the hybrid room means we have a much better chance to save lives and to minimize patient suffering by using advanced imaging to get a picture of damages, allowing us to choose the right treatment."

Major Educational Effort

Responsibility for treating trauma patients from all over the Stockholm region, which consists of more than two million people, obviously means a round-the-clock watch. But even specialist doctors need to sleep, and, at least some nights, preferably in their own homes. To be able to have specialist surgeons and interventional specialists present when they are needed, Karolinska University Hospital has taken on a major educational task to train more of the hospital staff and reduce the reliance on the few certain specialists.

"We are in the process of teaching 300 of the hospital staff to work in the hybrid room," says Blohmé. "Obviously, not all of these 300 will be able to do everything a specialist can do. The aim is to make all these people confident working within the hybrid room, helping the patient to breathe and to limit bleeding. This way, we can push the time limit for specialists to arrive, and also give these doctors a better opportunity to get useful information about the patient as they approach the hospital."

To further enhance the information coming from the hybrid room, all imaging data are distributed to an adjacent control room. This information can also be seen in an observation room close by and in a lecturing hall in the university hospital.

"Congratulations to Stockholm"

Filippa Reinfeldt, Counselor for Health Care in the Stockholm region, said at the inauguration on December 9, 2009, that she wanted to extend her congratulations to the people of Stockholm for now having better healthcare. "This hybrid room is truly technology and science in the service of mankind," said Counselor Reinfeldt. "This is exactly how we want the healthcare system to work."

Nils Lindstrand *is a freelance business and technology writer based in Stockholm, Sweden.*

Summary

Challenge:

- Finding effective and minimally invasive treatments for trauma patients
- Allowing for a large number of people to work on trauma patients without being hindered
- Keeping the air in the hybrid room extremely clean
- Taking care of trauma patients from the entire Stockholm region

Solution:

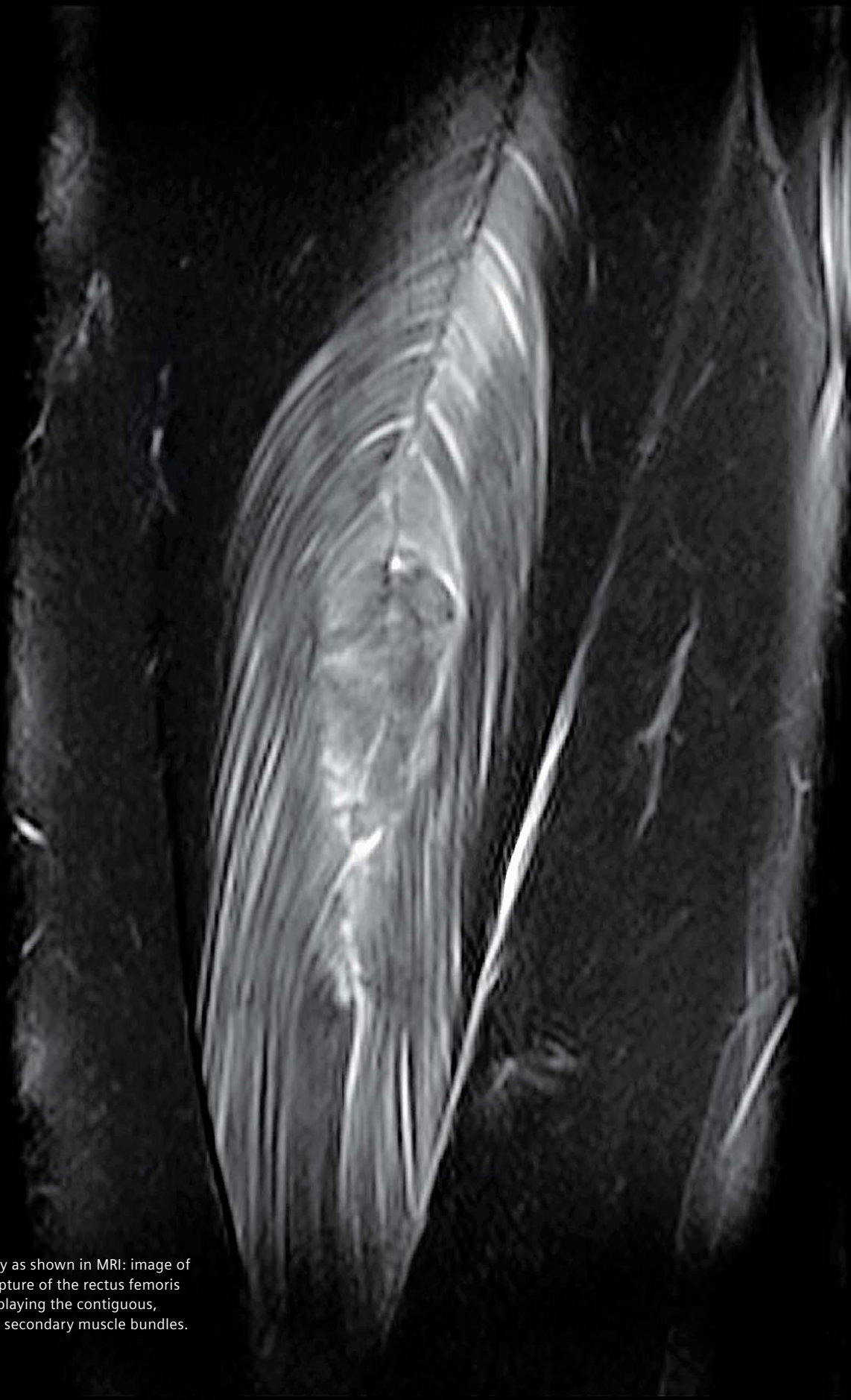
- First-ever hybrid room solution for trauma care with Artis zeego
- Using the Artis zeego C-arm to keep the room space open
- No equipment in the ceiling, thanks to robotic technology used for the C-arm
- Good communication and information systems allow for faster and more accurate decisions

Result:

- No surgical treatment needed if less invasive methods are sufficient
- Extremely efficient workflow thanks to the hybrid room, making it possible to treat patients correctly and without wasting time
- Hybrid room operations work smoothly even in a crowded room
- The air hygiene meets the high standards required by the hospital

Further Information

www.siemens.com/surgery



Sports injury as shown in MRI: image of a bundle rupture of the rectus femoris muscle, displaying the contiguous, non-injured secondary muscle bundles.

Hans-Wilhelm Müller-Wohlfahrt, MD, is dedicated to further standards in the diagnosis of muscle injuries, especially in the field of sports medicine.

Leadership in Sports Medicine

The internationally renowned specialist in orthopedics and sports medicine, Hans-Wilhelm Müller-Wohlfahrt, MD, has established an innovative "micro-clinic" for the diagnosis and treatment of orthopedic and sports-related injuries. With its highly experienced team, the Center is considered a model for the future of medical care. *Medical Solutions* visited the Center to learn more.

By Matthias Manych

Not far from one of Munich's most famous landmarks, the new city hall (Neues Rathaus) on Marienplatz square, the cobbled Dienerstrasse takes visitors a few hundred meters further to the Alter Hof (Old Court) – Louis IV's former imperial residence. The first floor of one of the buildings houses the Center for Orthopedics and Sports Medicine. Stepping through its doors, the visitor leaves the bustle of the center of Munich behind. The lobby is spacious and bright, welcoming visitors. The center's aim to offer patients comprehensive care at the highest possible medical and technical level is evident as soon as you walk in. Moreover, the micro-clinic implements a unique concept, as Müller-Wohlfahrt explains together with his medical colleagues Lutz Hänsel, MD, and Peter Ueblacker, MD. Decades of medical experience and a holistic approach are combined with the latest in imaging diagnostics as well as data management and communications technology. The center maintains fast lines of communication and decision-making, because everything from the magnetic resonance imaging (MRI) system to physiotherapy is located under one roof.

With 35 years of treating top athletes and more than 30,000 muscle injuries, Müller-Wohlfahrt has developed the manual diagnosis of sports-related muscle injuries into a reliable method. As the medical consultant for the German national soccer team and the team doctor for the soccer club FC Bayern München, he is frequently required to make sound medical decisions within just a few minutes. Müller-Wohlfahrt has also successfully applied his method to the treatment of complex, long-term diseases and disorders of the entire musculoskeletal system. His approach focuses on the person as a whole and on examining and treating each patient's health issues in a wider context, including additional

Lutz Hänsel, MD, is a specialist for orthopedics, trauma surgery, and sports medicine.

Franco Renzo is the President and CEO of the MW Group AG, which aims to propagate the center's concept.

Peter Ueblacker, MD, supports the academical verification of the MW Center's medical approaches.

medical factors, rather than symptoms in isolation. In Müller-Wohlfahrt's approach to treatment, the medications used are almost exclusively biological or organic, purely plant-based, or homeopathic. His aim in opening the micro-clinic was to take his experience of sports medicine and the treatments he has developed and standardize them on a scientific basis, making them reproducible for others. "I worked alone for far too long, and my intent was to pass along the methods I had developed to my younger colleagues so that they are not lost," Müller-Wohlfahrt emphasizes.

A Model Facility

Those were the primary factors behind the establishment of the new center. The idea first came up nearly five years ago. Thanks to cooperation with the investor Dietmar Hopp, co-founder of the software company SAP, and with Franco Renzo, currently President and CEO of MW (Müller-Wohlfahrt) Group AG, the Center for Orthopedics and Sports Medicine was able to open just a short while later, in 2008. This micro-clinic is part of the MW Group and serves as the nucleus for further developments for the future: new care structures for the international health market. The MW Group aims to establish additional micro-clinics worldwide to offer high-quality healthcare services in various disciplines. In this context, the Munich center serves as a model. The group's vision, says Renzo, is "not to wait until we see actual patients, but instead to treat people prophylactically before they become ill." The group's goals include ensuring that, in the future, anyone who needs to know is able to get information on his or her current health status via telemedicine anywhere in the world and can access additional information such as specific medical tips.

Cooperative Structures to Benefit Patients

The MW Group AG can rely on a global network of experts for cooperations in various fields, Siemens Healthcare among them. For Renzo, it was evident from the start that "we need a global player – a partner with whom we can turn our ideas into reality." Thus, Siemens Healthcare was the partner for the micro-clinic's radiology hardware and software from the very beginning. First, a 1.5-Tesla MRI system, a radiography system with a digital flat detector, a total of five ultrasound units, and a picture archiving and communication system were installed. A 3-Tesla MRI unit is scheduled to follow soon. The stated aim of the team of physicians is "to offer the best possible solution in the field of orthopedics and sports medicine," Hänsel explains. To have "one-stop" imaging is one of the major factors emphasizing this approach.

A strong interaction with a large medical and scientific network also ensures that patient care is state-of-the-art. For instance, the center has long maintained close contact with the Steadman Hawkins Clinic, one of the leading centers for orthopedic treatment and sports medicine in the United States. And regarding muscle injuries, the center's cooperation with Swedish Professor Jan Ekstrand, MD, is particularly important: he is the head of a large injury study conducted by the European soccer federation UEFA. In the area of fundamental research, the clinic works together with the Department of Osteology and Biomechanics at the University of Hamburg, where Ueblacker has a teaching assignment. The university unit studies the molecular biological mechanisms behind the therapies developed by Müller-Wohlfahrt. In addition, the flow of information is reinforced through participation in conferences and presentations across Europe. Another goal of the MW Center is to find the primary cause of orthopedic and sports medicine-related problems. In pursuit of this aim, the team of physicians

and physical therapists spends far more time on their patients than is customary. And although high patient throughput is not a goal in itself, efficient working processes still play an important role. When treating top athletes, it is crucial for medical providers to be able to pinpoint and solve the problems quickly. The advantage that the clinic can now offer through its cooperation with Siemens is that the results of manual diagnosis can be supplemented with state-of-the-art imaging right away. The clinic's staff has gained experience through its work with top athletes. The methods used for those athletes also benefit the non-athletes who make up approximately 80 percent of the micro-clinic's patients.

Researching Orthopedics and Sports Medicine

Müller-Wohlfahrt is known for his non-invasive methods of diagnosis and treatment. In particular, his ability to detect injuries and ascertain their extent through palpation alone, and his ability to accelerate the healing process with pinpointed injections of medications have earned him the trust of international top athletes and others. His colleagues, Hänsel and Ueblacker, have also perfected these techniques.

Thirty percent of all sports injuries involve muscle damage. Nonetheless, this topic has seldomly been addressed in a systematic way to date. Among the complications in this field, the system of classifying muscle injuries is still very imprecise – the only distinctions drawn are between slight, moderate, and severe injuries. Now, all this stands to change thanks to the scientific work being done at the MW Center in Munich. "The major factor behind our classification system is the empirical findings by Müller-Wohlfahrt. These will now be given additional scientific support through biomolecular methods, the injury study, and the consensus meetings we are calling in order to achieve international agreement," explains Hänsel.

In collaboration with numerous co-authors, the three doctors just recently summarized their entire diagnostic and therapeutic knowledge about muscle injuries in the comprehensive and unique monograph *Muskelverletzungen im Sport* (Muscle Injuries in Sports)[1]. The publication also features a large chapter describing state-of-the-art muscle injury diagnostics with MRI, including numerous case studies.

Focus on MRI

Although MRI scanning will not replace manual examinations of muscles, this is a crucial part of the work performed at the MW Center. As Ueblacker explains, "We aim to set standards for imaging based on our vast manual experience." If technical options, such as sequencing, slice angling, and, where applicable, surface coils are selected optimally at high-field strength, MRI scans can provide good images of muscle injuries. If this is not the case, these injuries are often overexposed, leading to incorrect assessments of their severity. It is also not unusual for a facility to lack the necessary experience in the interpretation of such MRI scans. And that, says Müller-Wohlfahrt, is why "we have taken on the obligation of giving clear, unambiguous recommendations with our standards." To that end, clinical and sonographic findings are correlated with those obtained through MRI. To be able to grasp the full complexity of the musculature and the injuries, a large number of correlatives must be established. That way, Müller-Wohlfahrt and his colleagues are closing a major gap in sports medicine.

But the work performed at the micro-clinic goes beyond muscle injuries. Another area of focus is the connections between problems in the extremities and the spine as their site of origin. The upcoming goals on the three physicians' "wish list" show how important it is for them to keep up with current developments in MRI use: detection of biochemical changes that precede the morphological degeneration in cartilage and optimization of image precision through filter techniques. The close cooperation between the MW Center and Siemens Healthcare is of great importance to achieve these goals. Moreover, comprehensive cardiovascular diagnostics for both professional and amateur athletes is under development.

[1] The German title will be published by Thieme in May 2010. Publication of an English version is planned for the end of 2010.

Matthias Manych *is a biologist and freelance scientific journalist and editor specializing in medicine. He regularly writes about imaging technology, among other topics.*

Summary

Challenge:

- Optimum solutions for orthopedic and sports medicine problems
- Precise MRI images to supplement manual and sonographic findings
- Scientific standardization of Müller-Wohlfahrt's empirical findings

Solution:

- Detailed classification of muscle injuries
- The latest imaging options from a single source
- Use of MRI precision and efficient workflows
- Establishment of standards in MRI diagnosis of muscle injuries
- Global networking with scientific and medical technology partners

Result:

- Micro-clinic with optimized, state-of-the-art holistic care
- Groundbreaking combination of classic orthopedics and sports medicine with methods of scientific research and radiology
- Unique experience in orthopedic and sports medicine provided as standards for physicians worldwide

Further Information

www.siemens.com/sports-medicine

Breaking Down Tower Walls

Serving the more than 360,000 residents of the greater Tel Aviv metropolitan area as well as more than a million people who enter the city daily, the Sourasky Medical Center handles a great deal of medical and administrative information. Back in the 1990s, the center was more like a 'Tower of Babel' with archaic medical and clinical information systems that were unable to speak with each other.

By Abigail Weldon

Sourasky Medical Center in Tel Aviv serves the largest metropolitan area and the commercial center of Israel.

Owned by Israel's Ministry of Health, the Sourasky Medical Center incorporates three hospitals, including 1,100 hospital beds, nearly 60 departments and institutes, and 150 outpatient clinics, which all attest to this large network of possible data sources. Growing competition from other medical facilities further instigated the need to become more effective and efficient in the handling of information. A common platform to support the growing amount of acquired information, providing operational and medical staff with comprehensive and up-to-date information, appeared to be the order of the day.

From the left: Professor Gabriel Barbash, MD, MPH, Esther Saiag, MD, Ronni Gamzu, MD

A Tiger is Conceived

When Professor Gabriel Barbash, MD, MPH, was appointed General Director of Tel Aviv Sourasky Medical Center in 1993, he was immediately confronted with the lack of information for running the medical center. "I found that the IT that supported Sourasky's activity, as well as nine other governmental hospitals, was based on IT that was programmed 34 years ago," says Barbash. After persuading his colleagues and the Israeli Ministry of Health that the hospitals needed to speak a common language and were in need of a common information system,

i.s.h.med helps Sourasky Medical Center benefit from the availability of data and system interoperability.

> "The i.s.h.med system acts as a communication system. We can speak to each other about our patients, preventing mistakes."
>
> Esther Saiag, MD, Director of Information and Computer Systems, Sourasky Medical Center, Tel Aviv, Israel

he was appointed General Director of the Ministry of Health. There, he was able to convince the Ministry of Finance to allocate the financial resources together with the Ministry of Health and governmental hospitals to establish a new IT strategy. This resulted in a new clinical information system.

Barbash's persuasion efforts began to take form in 1999, when Israel's government computerization project was initiated with the aim of computerizing the administrative and operational systems of the 11 governmental hospitals and creating a common, comprehensive IT system. As Barbash notes, "From the outset, we stated that whatever system was implemented should meet the highest requirements of the more complex facilities like ours. A hospital requiring less complexity should be able to use the system and utilize only part of what it offers." The ministries and hospitals decided on developing one system for all of the hospitals, reaching an agreement on what was going to be developed.

Following a public tender, SAP for Healthcare as well as complementing modules of Siemens' i.s.h.med®[1] Hospital Information System (HIS) were chosen. As Barbash reports, "We were looking for a system that can talk to the SAP system, so i.s.h.med was a clear choice." With that, the hospital computerization project called NAMER began – an acronym for the Hebrew words for administration of medical centers, which also means Tiger.

A Tiger is Born

The NAMER project went live at the Tel Aviv Sourasky Medical Center in June 2003 with the installation of the SAP for Healthcare infrastructure. The implementation of i.s.h.med followed in 2004, including the basis and radiology modules, followed by the i.s.h.med surgery module. Implemented in the hospital wards, the basic module streamlines effective order management by finding management and medical documentation, enabling efficient and integrated management of these processes, and providing the infrastructure for additional i.s.h.med modules.

Esther Saiag, MD, Director of Sourasky's Medical Systems Operation and Information and Computer Systems, reports that the implementation expanded with ease to other departments, including angiography and cardiology: "The generic tools, like parameterized documents, make i.s.h.med highly adaptable to our individual requirements at the hospital." Saiag further reports satisfaction in being able to adapt the modules to the center's specific needs. As an example, she lists being able to use the surgery and radiology modules not only in angiography, but in the operating room (OR) as well. Implementation of additional i.s.h.med modules continues to be an ongoing project. In fact, due to the successful experiences with the system, the Sourasky Medical Center – in line with an overall Ministry of Health decision – has decided to acquire all other i.s.h.med modules. Currently, the center is operating under seamless interoperability

[1] i.s.h.med is available in Austria, Belgium, Chile, Colombia, Germany, Hong Kong, Italy, Luxembourg, Mexico, Netherlands, New Zealand, Singapore, South Africa, Spain, and Switzerland by Siemens and in further countries via trusted Partners. Please always consult with Siemens HS EU for availability questions.

between SAP/i.s.h.med and the laboratory system. It is also pursuing the i.s.h.med implementations in various units, such as cardiology and angiography.

A Tiger Runs

With the successful implementation of the NAMER project, Barbash points to the availability of data as being a key benefit. "Whatever I expected – we got it," he says. "The amount of data that today is critical to our management, to our competitive environment, is really a gift."
Clinical and administrative data along with information about reimbursement payments and various hospital activities – now readily available thanks to NAMER – proves to be a vital component to staying competitive in the healthcare environment.
Saiag notes the seamless interoperability between i.s.h.med and other clinical information systems in the hospital. "In various locations in the hospital, i.s.h.med serves as the backbone, while at the same time receiving information from other medical information systems," she says.
In terms of OR efficiency, Ronni Gamzu, MD, Director of the General Hospital at Sourasky, notes the benefits of centrally located screens providing information about specific operating rooms. i.s.h.med's surgery and radiology modules allow the center to produce utility reports based on department, providing information as to who is in the respective operating room and the downtime in each. Gamzu stresses the importance of efficiency: "With limited time in the OR, running the facility in a more efficient way is a must for the hospital manager. i.s.h.med helps leverage your management skills in such a huge complex."

A Tiger Takes Off

As part of a developmental partnership with Siemens, a team comprised of members from Sourasky Medical Center, the Ministry of Health, and other hospitals, is working to develop and shape two new modules with key functionalities in charting and ward support. The partnership's primary focus is enhancing the support of clinical processes and charting. A documentation workstation integrating the various i.s.h.med functionalities, a progress note computerizing patients' courses of treatment, and clinical overviews of key treatment information are all part of the effort to improve clinical processes. As part of the charting focus, the Tel Aviv Sourasky Medical Center is currently cooperating with Siemens to develop the next-generation electronic patient record system, which is planned to be timeline-based with a graphical interface. The new applications will also focus on the various functionalities required for managing inpatient care processes, and be deployed at Sourasky Medical Center in 2010.
Barbash expects the additional i.s.h.med modules to further increase the availability of clinical data and is looking forward to being able to analyze data from both a financial and a quality perspective. He explains, "We will then have a considerable volume of clinical data at our fingertips to allow us to analyze and assess quality. The major benefit is that availability, quality assessment, and efficiency assessment of the hospital are all going to be much, much easier."
And is Sourasky a Tower of Babel no more? Saiag remarks, "The i.s.h.med system acts as a communication system, and we speak to each other about our patients, preventing mistakes." This common language helps the staff perform its daily routines more efficiently and economically. She adds, "Now, we can save money that previously was wasted because of a lack of knowledge, mistakes, and so on. The benefits of i.s.h.med are truly impressive!"

Abigail Weldon *is a member of the* Medical Solutions *editorial team.*

Further Information

www.siemens.com/ishmed

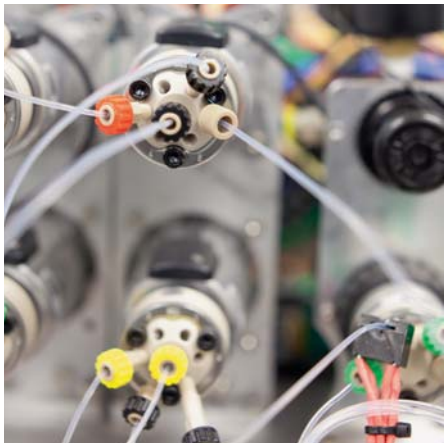
Summary

Challenge:
- Integrating the handling and creation of medical and administrative information
- Modernizing and computerizing outdated medical and clinical systems that are unable to speak with each other
- Incorporating the needs of smaller and larger, more complex facilities into one implementation project

Solution:
- NAMER hospital computerization project encompassing SAP and Siemens i.s.h.med hospital information systems
- i.s.h.med system that is able to talk, correspond, exchange data, and integrate with the SAP system
- Customizable i.s.h.med modules for implementation in various hospital departments

Result:
- Greater availability of data on one common platform
- Seamless interoperability between i.s.h.med and other clinical information systems, enabling various systems to talk to one another
- Greater efficiency, quality, and service


CABLE 2
CABLE 1



The Future of Vulnerable Plaque Diagnosis: Molecular Imaging

Siemens Healthcare and Cedars-Sinai Medical Center in Los Angeles, California, USA, are currently collaborating on studies designed to improve the identification of cardiovascular disease with molecular imaging. While the clinical use of this technology is still years away, the studies are expected to provide valuable insight into how plaque can be diagnosed before it becomes hazardous.

By Robert L. Bard

Hartmuth Kolb, PhD, Vice President of Siemens Molecular Imaging Biomarker Research, is working with Cedars-Sinai Medical Center scientists to evaluate novel molecular biomarkers in cardiovascular disease. Currently, two proprietary positron emission tomography (PET) tracers that have been developed by Siemens are being evaluated, 18F-RGD-K5 (K-5) and 18F-HX-4 (HX-4). Daniel S. Berman, MD, Director of Cardiac Imaging Research, and Balaji Tamarappoo, MD, Research Fellow in Cardiac Imaging, are leading the studies at Cedars-Sinai. The ultimate goal of this line of research is to improve identification and evaluation of cardiovascular disease.

Currently, imaging in cardiovascular medicine is limited to the identification of ischemia or obstruction in the vascular lumen. Even if artherosclerotic plaque in artery walls can be visualized, cardiologists are not yet able to determine how active the disease process is. This problem is particularly important for the heart. As Berman remarks, “In stable heart disease, the most prevalent form of heart

> "Currently, we are chasing plaques that are not rupture-prone."
>
> Daniel S. Berman, MD, Director, Cardiac Imaging Research, Cedars-Sinai Medical Center, Los Angeles, California, USA

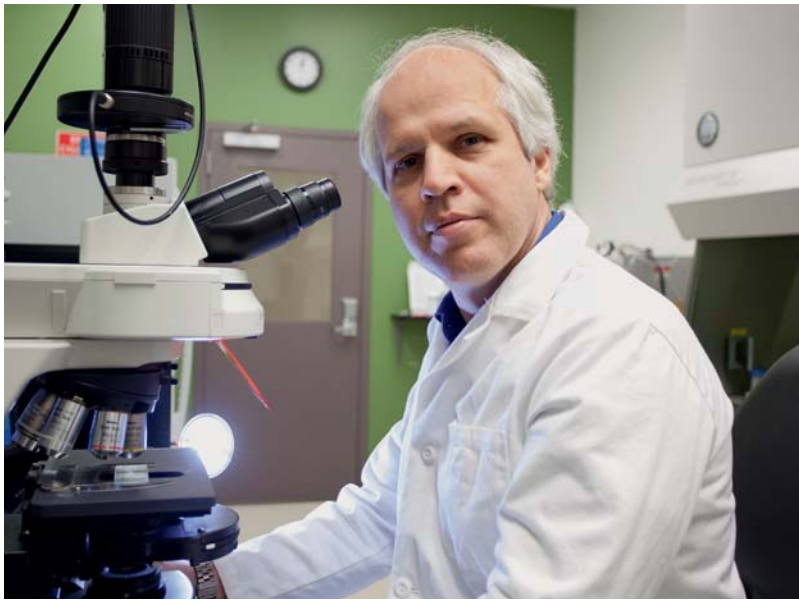
disease, we do not have very good tools to determine who is at the highest risk for a heart attack and, therefore, would need the most specific, aggressive therapy. Currently, we are often performing expensive procedures such as angioplasty or bypass surgery in patients with stable plaques, in whom these procedures may not be necessary."

Imaging Challenges in Cardiovascular Medicine

Berman adds that recent clinical trials show the majority of stable patients will not suffer a cardiac event if they were simply treated medically. "Patients with ischemia and stenoses can go for years without an event while others with no blockages but a vulnerable plaque rupture can have an event."

biomarkers can be incorporated into imaging strategies to identify high-risk patients. Vulnerable plaques exhibit a complex disease biology, comprising an inflammatory component, cap rupture and healing, intraplaque angiogenesis and hemorrhage, calcification, and thrombus formation. A ruptured plaque is dangerous, because it is likely to interrupt the blood flow and cause a heart attack. The K-5 tracer can potentially identify angiogenesis, and it is hypothesized to improve the identification of vulnerable plaques in patients at risk for cardiovascular events.

Tamarappoo further explains that an additional trait of plaques is a lack of oxygen content, or hypoxia, that is directly related to inflammation. The inflammatory response within a vulnerable plaque



Hartmuth Kolb, PhD, of Siemens Molecular Imaging Biomarker Research (left) is working closely

A primary challenge in clinical cardiovascular medicine is 'high-risk plaque identification', or identifying the plaques that are rupture-prone or 'vulnerable'. Siemens has developed molecular biomarkers specific to the characteristics of vulnerable plaques and hopes these

involves the consumption of oxygen, and the HX-4 tracer was specifically designed to identify hypoxic cells. When oxygen is not present, HX-4 will stay within the cell. Therefore, when plaques are imaged, an elevated presence of HX-4 may differentiate those that may be rupture-prone

and thus likely to cause a cardiac event from those that are stable and therefore less likely to be clinically significant. Kolb reports that Phase II clinical studies have found the tracers may be effective for imaging cancerous tumors and that both K-5 and HX-4 are cleared rapidly from the body.

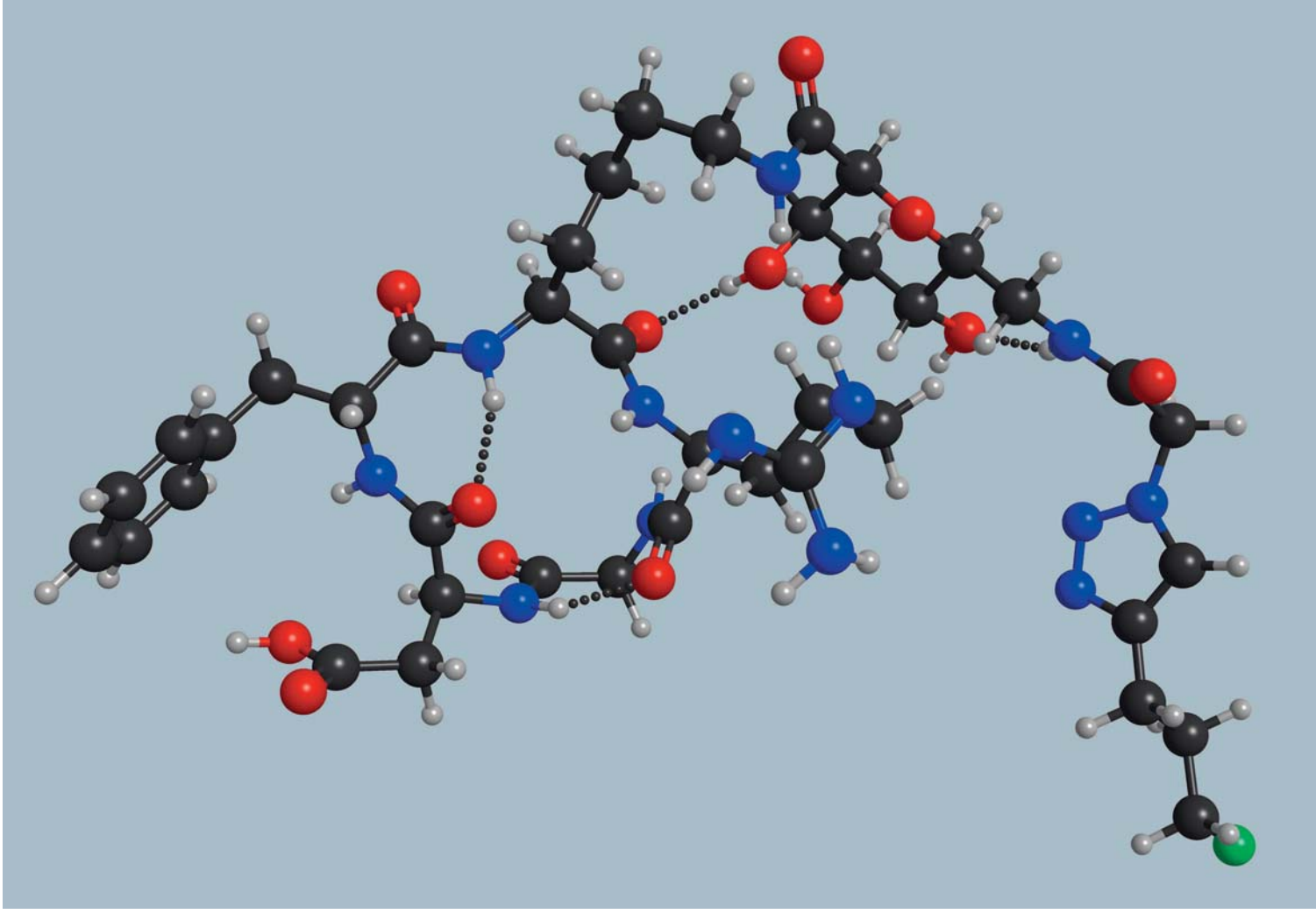
The collaborative studies between Cedars-Sinai and Siemens are the first studies to assess the use of these agents in cardiology. They are also exploring new PET myocardial perfusion agents that are likely to be beneficial because they are taken up linearly across the range of blood flow, unlike current agents that degrade or have a 'roll-off' effect over time. The linear uptake allows for the detection of perfusion deficits that would otherwise not be visualized with the standard SPECT (single photon emission computed tomography) approach. These investigators are also exploring the use of PET scans with FDG (fluorodeoxyglucose). FDG works in a much different manner; it identifies the presence of glucose metabolism and can limit the ability to identify a vulnerable plaque. Current PET scans already use FDG as a tracer for imaging vulnerable plaque. However, vulnerable plaques may be undetectable because the FDG is taken up by both the vulnerable plaque and the myocardium (heart muscle). Thus, the myocardium can mask the signal from a vulnerable plaque. The new tracers are not taken up by the myocardium, potentially circumventing this problem.

Collaborative Studies

Imaging of the coronary vessels has specific challenges related to the size and location of potential lesions. The coronary vessels are located on the surface of the heart, and any potential lesions are moving targets, because the heart is always beating and the patient is always breathing. Furthermore, lesions within the coronary arteries are very small, typically only a few millimeters in length and width. Because of these limitations and the fact that these new tracers have not been evaluated in cardiology, the current studies are focusing on carotid

> "Patients with no blockages but a vulnerable plaque rupture can have an event."
>
> Daniel S. Berman, MD, Director, Cardiac Imaging Research, Cedars-Sinai Medical Center, Los Angeles, California, USA

with Daniel S. Berman, MD, of Cedars-Sinai's cardiac imaging unit (right).



The K-5 tracer may identify angiogenesis and improve the identification of vulnerable plaques in patients at risk for cardiovascular events.

disease as a proof of principle prior to assessments in the coronary arteries. Berman and Tamarappoo are currently evaluating these new molecular biomarkers in a study of 20 patients at Cedars-Sinai Medical Center who have carotid artery disease and require surgical intervention. Prior to the intervention, each patient will have a PET scan with CT (computed tomography); ten patients will be injected with the K-5 tracer and ten patients will be injected with the HX-4 tracer to determine where the radioactivity is localizing. Patients will undergo carotid endarterectomy to remove the plaque, and the plaques will be histologically evaluated with an emphasis on identifying inflammatory markers. The ability of the new scanning techniques to identify inflammatory plaques will then be compared to these inflammatory markers to determine the effect of these agents to identify vulnerable plaques. Siemens and Cedars-Sinai are also collaborating on a preclinical study of the molecular biomarkers to determine whether angiogenesis is increased during the progression of atherosclerosis. These studies are likely to give insight into the ability to identify vulnerable plaques at an earlier stage, potentially identifying a plaque before it becomes hazardous. The study involves apoE (Apolipoprotein E) knockout mice, which is a well-established mouse model for human atherogenesis. These mice are genetically engineered to develop atherosclerosis within 24 weeks. The protocol also involves feeding the mice a high-fat diet to accelerate their plaque development. The mice are given baseline and follow-up PET scans with CT after 14 weeks, and the tracers are expected to bind to the atherosclerotic plaques.

Summary

Challenge:

- Proper risk stratification of patients' likelihood of having an event such as a heart attack
- Poor accuracy of current clinical practice and imaging modalities that focus on the amount of obstruction that a plaque causes within an artery and/or on the amount of ischemia that the obstruction causes
- Often, rupture-prone plaques that are likely to cause a cardiovascular event are not identified

Solution:

- Molecular tracers that are specific to the characteristics of rupture-prone, vulnerable plaque are currently being evaluated

Result:

- Collaboration of Siemens Molecular Imaging Biomarker Research and Cedars-Sinai Medical Center scientists on studies designed specifically to investigate the use of molecular biomarkers in cardiovascular medicine
- A preclinical study is investigating the ability of these tracers to identify not only the presence, but also the progression of atherosclerosis
- Human studies of carotid atherosclerosis are being conducted, where molecular imaging results are being compared to inflammatory markers in the removed plaque
- Thus far, the use of molecular biomarkers is promising for discriminating between plaques that are benign and plaques that are vulnerable and likely to cause a cardiovascular event
- The clinical use of molecular imaging is several years away and pending stringent assessments in multiple human studies in the evaluation of cardiovascular disease

Berman foresees a scenario where molecular biomarkers are more widely used in research projects to identify cardiovascular disease. He also notes that molecular biomarkers would be useful to current studies that involve stem cells.

Future Uses of Molecular Imaging Biomarkers

Current stem cell studies are using magnetic resonance imaging to quantify areas of myocardial injury. In these studies, patients with cardiovascular disease have heart muscle removed by transvenous myocardial biopsy, and the cells are cultured and then injected back into the heart. Berman believes that, if the injected cells are labeled with a molecular biomarker, molecular tracers may provide valuable, specific information to understanding the process. Such tracing may provide mechanistic information associated with the therapeutic response. The clinical use of molecular biomarker imaging is several years away and pending stringent assessments in multiple human studies in the evaluation of cardiovascular disease. But thus far, the use of molecular biomarkers is promising for the discrimination of benign plaques and vulnerable plaques that are likely to cause a cardiovascular event.

***Robert L. Bard** is a freelance medical writer certified by the American Medical Writers Association, who also conducts clinical research at the University of Michigan's Division of Cardiovascular Medicine.*

The Cedars-Sinai Medical Center has a cooperation contract with Siemens Healthcare.

Further Information

www.siemens.com/biomarkers

A Leap into 21st Century Diagnostics

With the National PET Center for medical diagnostics, which was supplied in turnkey condition by Siemens, the Clinical Center of Serbia has made a giant step forward in raising the country's standards of diagnosis and treatment control to those of Western European levels. Vladimir Obradovic, Director of the Institute of Nuclear Medicine, explains the importance of this project against the backdrop of health-care reform in Serbia.

By Andreas Ernst

The Clinical Center of Serbia, located in Belgrade and completed in the mid-1980s, is one of the world's largest hospitals, with 3,500 beds, a staff of 7,500, and 1,200 physicians. The facility has been marked not only by the proud history of the Yugoslavian healthcare system, which led the region in the 1970s, but also by the effects of the Balkan War in the 1990s. Things began to improve again ten years ago when the Serbian healthcare system first started to look like a bustling construction site. Across the board, from financing to training to infrastructure, reform is still in progress, with the aim of helping the Serbian healthcare system catch up to Western European standards. And nowhere more so than in the basement of the Clinical Center, which has been home to the National PET (positron emission tomography) Center since the fall of 2009. When Professor Vladimir Obradovic opens the door to the PET Center for us, he tells us with a smile, "Now we've arrived in the 21st century!" The contrast to the dark corridors in the Clinical Center above us is impressive: The walls of the department, which occupies 700 square meters of space, gleam in a soft pink tone. Behind thick greenish steel-reinforced safety glass is the center's heart – and its pride and joy: a Siemens Biograph™ 64 TruePoint™ PET·CT unit. To help ensure that this system is put to optimum use, Siemens worked together with clinic management and local service providers to develop a comprehensive solution covering everything from the center's integration into the clinic in terms of business administration to construction planning and even the efficient organization of workflows. As a result, employees are offered the best possible working conditions, while the clinic's diagnostic capacity is greatly increased.

Professor Obradovic, what does the new PET Center mean for healthcare in Serbia?
OBRADOVIC: The new PET Center puts us where we want to be: at the forefront of modern diagnostic technology. PET, as a diagnostic method in nuclear medicine, represents a quantum leap in the quality of our healthcare system.

What is your role in this project?
OBRADOVIC: The Ministry of Health appointed me to serve as the president of a project group made up of radiologists, oncologists, and neurologists, in 2005. The group was commissioned with making preparations for the introduction

Biography

Professor Vladimir Obradovic, MD, PhD, is one of the leading nuclear medicine specialists in Serbia. Since 1995, he has been the Director of the Institute of Nuclear Medicine at the Clinical Center of Serbia in Belgrade. After completing his studies of medicine in Belgrade, he earned a second doctorate in natural sciences. He went on to further study in Paris, France, and in Tübingen, Germany, before taking the helm at the Institute of Nuclear Medicine. Since 1996, he has taught at the medical school at the University of Belgrade as a full professor. Obradovic is married to Zorica Petrasinovic, who also works at the Clinical Center of Serbia as an internist and cardiologist.

Siemens in Serbia

Siemens has been active in Serbia since 1887. The company was responsible for building the country's first power plants and for installing the first public lighting systems in the city of Belgrade in 1887. The Yugoslavian division of Siemens AG, based in Zagreb, was founded in what was then the "Kingdom of Serbs, Croats, and Slovenes." The office in Belgrade was responsible for supplying power cars for the streetcar lines in the capital city. A department focusing on medical technology was also founded there in 1929. The Serbian company Siemens Elektrizitäts AG (Electricity Corp.) was founded during the German occupation in 1941. In communist Yugoslavia as well, Siemens remained an important supplier for the state railway and telephone services. Today, the company is responsible for serving Serbia and Montenegro. After the country embraced democracy in 2000, Siemens was involved in rebuilding the country as a leading provider of infrastructure and technology.

of this technology. The focus was not only on the National PET Center, which is ready here, but also on introducing PET throughout the country. Our center is the basis for satellite centers, smaller units located throughout the country that are supposed to provide full-coverage care. The national center has a clinical mandate, but at the same time, it serves to train specialists and is used for research purposes in the area of diagnostics.

What is special about planning and equipment at the National PET Center?
OBRADOVIC: The project has two phases. The first was the construction of a turnkey PET Center by Siemens, which came into operation in the fall of 2009. The center has a hybrid PET/CT unit, which will soon be joined by a second unit. For the next step, we are planning to install a cyclotron so that we can produce the radiolabeled tracers for PET/CT scanning ourselves. Because some of these radionuclides have short half-lives, it is important for us to produce them in close proximity to where they will be used. At the site, we will operate a small factory for radiopharmaceuticals to supply not only our center, but also the satellites throughout the country.

Will your in-house production of radionuclides also yield economic benefits for you?
OBRADOVIC: Yes, it will help us cut costs. Today, the costs of an exam run at about 1,000 euros. If we produce the radionuclides ourselves, we can reduce that figure by about 60 percent. We will be the first center in the region to produce radionuclides. It is a definite possibility that we could produce radionuclides for PET centers in neighboring countries, such as Croatia, Macedonia, or Romania.

Why did you choose Siemens for the implementation of the PET center?
OBRADOVIC: We ran a request for proposals, and Siemens came out with the best results. That was primarily due to the value for the money; the technology offered by the various providers is very similar, but Siemens was also willing to take special technical requests into consideration. In fact, we want to use the systems not only to perform routine examinations, but also to implement research projects. We were also quickly able to reach an agreement regarding how to finance the training of specialists. And finally, there is the fact that Siemens has a very good, longstanding basis in our region. That is advantageous when it comes to service.

How many PET centers does Serbia need?
OBRADOVIC: Each PET unit serves the needs of about a million people. That means that to cover Serbia's population of nearly seven million, we need seven systems. That's the medical side of the equation – whether it can be put into practice, of course, depends on the country's ability to finance it.

What will change for patients thanks to the new center?
OBRADOVIC: We will be able to diagnose common diseases, such as cancers, neurological disorders, and cardiac diseases more quickly and with greater precision. Following a primary diagnosis, which serves as an indication for diagnosis with PET, the process of establishing overall findings will be fast. That helps improve our patients' chances of recovery. The incidence of malignant tumors is on the rise in this country, a fact that is prob-

Turnkey Solution: The National PET Center in Serbia

Siemens doesn't just supply equipment, it offers holistic solutions. "The Clinical Center provided us with 800 square meters in the basement of the facility, and just told us, 'okay, get to work'," explains Ratko Krakovic of Siemens Healthcare. The project management activities included the full planning for the unit in cooperation with architects and engineers. In addition, the company had to coordinate the work performed by nine supplier companies, which had been called in to provide a range of services from radiation protection to computer equipment and furnishings. One extremely important factor was the close cooperation between Siemens and Neimar, a leading construction company in Serbia. Siemens was even able to obtain a building permit – no easy task in Belgrade's bureaucratic jungle – within a very short period. In total, 19 sub-projects were implemented, some of them in parallel, until finally, after just one-and-a-half years, the government-run Institute of Nuclear Sciences for Radiation Protection in the town of Vinca granted its approval for the facility to start work.

ably connected to the many aspects of physical and mental strain that affect us in our postwar society. At present, we examine ten patients per day. Later, when we are producing radiopharmaceuticals ourselves, thanks to the cyclotron and the radiochemical lab, the number will be at least 30 each day.

Serbia's healthcare system was isolated for a long time. What kind of international networks are in place today?
OBRADOVIC: In our field, there is intensive international cooperation with bodies such as the International Atomic Energy Agency, which finances research projects at our institute. We also regularly send specialists abroad for continuing education and training, and experts from elsewhere in Europe, the United States, and Asia visit us as well. These contacts show that Serbia is being integrated more and more into the international research landscape. But Serbia also has its own 50-year tradition of nuclear medicine: The Central Laboratory for Nuclear Medicine was founded in Belgrade in 1958.

What will be the greatest challenges facing the Serbian healthcare sector over the next few years?
OBRADOVIC: A technological shift in diagnostics, such as the one represented by the introduction of the PET method, is critically important. A lot has been done with regard to the infrastructure of our hospitals and institutes – but there is still a long way to go. The pace of reform, of course, depends on the general economic development in the country. Luckily, we still have most of our specialists – at least in my specialty. I hardly know anyone who left during these difficult years. All of us have stayed here, and we are all working enthusiastically on further developing nuclear medicine. Thanks to the cutting-edge technology we have here, and in light of our intensive cooperation with colleagues from all over the world, there's no reason to go anywhere else!

__Andreas Ernst__ is a correspondent for various German-language newspapers. He lives in Belgrade, Serbia.

Further Information

www.siemens.com/biograph

Summary

Challenge:
- Improve diagnosis of oncological, neurological, and cardiological diseases
- Shorten waiting times for patients
- Regionalize high-tech diagnostics

Solution:
- Integral planning and development of a turnkey PET/CT center in cooperation with the clinical facility and suppliers
- Siemens Biograph 64 TruePoint PET·CT for diagnosis, treatment control, and research work
- Independent production of radiopharmaceuticals to reduce costs and for distribution to PET centers in the surrounding area
- Development of satellite units at regional hospitals

Result:
- Faster diagnoses
- Infrastructure not only for clinical application, but also for research and education
- Long-term partnership with Siemens for countrywide development of the diagnostic infrastructure

Service Provides High Availability

When it comes to service for its medical equipment, the Nuremberg Hospital (Klinikum Nürnberg) in Germany relies on the Siemens Guardian Program, as part of which, the TubeGuard option plays an important role.

The availability of medical equipment is one of the most crucial factors affecting economic efficiency at any clinical facility. Unexpected failures and downtimes can quickly lead to gaps in the provision of care and significantly affect the facility's income. With the Guardian Program™, Siemens has put together an extensive service package that continuously remotely analyzes equipment in real time, making it possible to predict failures and downtimes, and, thereby, helps ensure system availability. The Nuremberg Hospital decided on this service as part of a facility-wide service and maintenance agreement.

> "We feel that we are a kind of premium customer for Siemens."
>
> Reinhard Loose, MD,
> Head of the Department of Diagnostic and Interventional Radiology,
> Nuremberg North Hospital, Germany

With nearly 5,600 staff members and about 2,180 beds at two locations in the northern and southern parts of Nuremberg, the hospital serves 90,400 inpatients and 93,300 outpatients each year. At the Center for Healthcare Professionals, about 360 trainees and apprentices are currently learning and being trained in their specialties.

Keeping a major medical facility like this one up and running largely depends on the service and maintenance of its medical equipment. With the aim of ensuring the availability of medical equipment within the facility, the Nuremberg Hospital has now signed an extensive facility-wide service and maintenance agreement with Siemens Healthcare. The agreement is scheduled to run for a five-year term and encompasses all radiological and imaging procedures, which – for the facility in Nuremberg – means computed tomography (CT), magnetic resonance imaging (MRI), and X-ray systems.

The new agreement also covers nuclear medicine. It provides standard services as well as essential maintenance contracts and full-service agreements, covering everything from replacement parts to the availability of Siemens technicians. The agreement was drafted in close cooperation with the Nuremberg Hospital management, so it was possible to take all of the hospital's requests and local particularities into account. "Of course, we have to be able to rely on rapid response from service experts. This works excellently with Siemens," explains Michael Wucherer, PhD, Head of the Department of Medical Physics at the Nuremberg Hospital. "Siemens is an important partner for us, and our experience with them has been excellent, so it was an obvious step for us to sign this agreement with Siemens. It's also a sign of how much trust and confidence we place in them!"

Sensor Readouts via Data Link

The services provided as part of the agreement are grouped into various service options. One of them is the remote monitoring of the medical equipment. As part of this service, the system proactively sends performance data to the Siemens Service Center so that Siemens UPTIME Services is able to detect potential disruptions early on and can eliminate them right away.

Siemens UPTIME Services not only allows technicians to monitor and automatically update system software via data link, but also enables rapid problem analysis and repairs via remote access. This means that the system is able to detect potential disruptions early and eliminate them right away, before they cause any problems. Once an error message is received, the data that have been transmitted are analyzed right away. In the event of an error, the experts at Siemens contact the appropriate service technicians at the Nuremberg Hospital within 15 minutes. If possible, faults are resolved via remote access. If this is not possible, a Siemens technician arrives onsite within just a few hours.

Of course, the appropriate staff members at the Nuremberg Hospital are able to contact Siemens service representatives directly if worst comes to worst. And thanks to the service and maintenance agreement, this service is not limited to

Left to right: Roland Simmler, IT Manager, Reinhard Loose, MD, Head of the Department of Diagnostic and Interventional Radiology, and Michael Wucherer, PhD, Head of the Department of Medical Physics at the Nuremberg Hospital

a specific kind of equipment or subject to different rules: "The different kinds of services have been harmonized. There is a standing rule on how to reach service technicians. This way, we feel that we are a kind of premium customer for Siemens," says Reinhard Loose, MD, a university lecturer with a double doctorate and the Head of the Diagnostic and Interventional Radiology Department at the hospital's Northern site. "I am very happy with the Siemens Service Center because I always have a contact person who understands my problems," Wucherer adds.

Rapid Response Times More Important than Availability

When preparing for the service call as well as during the actual service, the technician can access the monitoring data anytime, which facilitates fast resolution of the issue.

The conditions that apply in a major hospital are, of course, different from those one would find in a smaller practice. Even when medical equipment is guaranteed to be available 97 percent of the time, it does not mean that it will not be down for a couple of days during the year. For cases like these, a medical facility would have to report that the piece of equipment in question – such as a CT unit – is out of service. "I would have to reroute a number of processes, even calling off the helicopters," Loose explains. "If there is an error, it is very important for me to

have the technician arrive onsite quickly and resolve the error." The proactive remote monitoring of the Siemens Guardian Program provides the fastest possible technician response times: Technicians respond within four hours, and the contract guarantees that the error will be resolved within 24 hours.

TubeGuard Monitors CT Units

Another option available through the Siemens Guardian Program is TubeGuard, which is available for Siemens' SOMATOM® Definition computed tomography (CT) scanners. System availability depends, to a crucial degree, on the X-ray tubes used in the unit. Each tube is a part that is subject to replacement for wear and tear, and they see varying levels of use. If their performance deteriorates slowly over time, they may fail at any time, without clear warning signs. The result is an unplanned system failure, termed a 'hard down'. Loose reports, "Any unplanned failure is, of course, a mini-worst-case scenario." With the Guardian Program including TubeGuard, it is now possible to predict critical losses in performance – and thus tube failure – reliably and in due time. The tube can be replaced at the best possible time, resulting in only a 'soft down'. Loose continues, "For us, service downtime has become something we can schedule. This is good for the patients and for our facility on the whole, because we can avoid bottlenecks." More than ten sensors proactively monitor the CT unit's primary functions, such as tube current, anode rotation, and oil temperature. Using this information as a basis, Siemens' experts apply complex algorithms to calculate a tube's remaining life span and determine the likelihood of a failure and when it will occur. Then, the Nuremberg Hospital is promptly notified of the deviating parameters and a date is set for a scheduled tube replacement, for instance, during downtime that has already been scheduled. This minimizes disruptions in the hospital's workflow. "With TubeGuard, Siemens has taken on a pioneering role," Wucherer explains. "With this factor embedded in the service agreement, not only can we plan better, but Siemens can as well. The technicians have to make fewer unscheduled service calls."

The facility-wide service and maintenance agreement yields a number of benefits for the Nuremberg Hospital. The ongoing remote monitoring of medical equipment enhances operational reliability and system availability. Service calls are completed quickly and can be scheduled as needed. This results in fewer system failures and thus, less waiting time and improved patient throughput. The service agreement with the Nuremberg Hospital also includes a reimbursement component. The more service Siemens performs, the greater the discount to the hospital during the billing process. This represents a win-win situation for both partners. "This kind of discount structure was a crucial factor in our decision in favor of this service agreement," Loose explains. "We have service costs of over one million euros a year – so every percentage difference has a definite impact."

Service Agreement for the Nuremberg Hospital

The extensive facility-wide service and maintenance agreement between the Nuremberg Hospital and Siemens Healthcare is scheduled to run for a five-year term and encompasses all radiological and imaging procedures as well as nuclear medicine at the hospital. One important option of the Siemens Guardian Program is TubeGuard, which can be used to reliably predict CT tube failures of SOMATOM® Definition scanners early on, preventing the unscheduled failures known as 'hard downs'. The ability to schedule tube replacements minimizes workflow disruptions, helps schedule patient appointments proactively, and contributes to significant gains in equipment reliability and patient satisfaction.

Summary

Challenge:

- Keeping CT and other imaging equipment up and running with minimum downtime despite heavy wear and tear
- Maintaining patient satisfaction and comfort level
- Tight appointment scheduling at CT, MRI, ultrasound, and angiography systems
- System failure impedes workflow

Solution:

- Siemens Guardian Program including TubeGuard for predicting and proactively avoiding potential CT tube failures
- Ongoing assessment via proactive and real-time remote monitoring with Siemens Remote Service
- Proactive service, for example, faster response and repair time through real-time monitoring of system parameters with the Siemens Guardian Program

Result:

- Reduction of system downtime
- Improved workflow in the radiology department and in the entire hospital
- Ability to have necessary tube changes done during prescheduled service calls
- No breakdowns means no waiting for patients
- Less revenue loss

Further Information

www.siemens.com/guardian-program
www.siemens.com/remote-service

Improving Care, Reducing Costs: Successful CPOE Implementation at Denver Health

Denver Health implemented CPOE ten years ago with the goal of improving patient care, safety, and efficiency. Now, with 95 percent of orders entered electronically, this early adopter is taking its process to the next level by migrating to the Siemens Soarian platform.

By Amy Erickson Vaughan

Denver Health and Hospital Authority, in Denver, Colorado, U.S., ranks in the top five percent of US hospitals in terms of the implementation of health information technology. It provides care to more than 160,000 individual patients – one out of every four people in Denver – annually. The hospital has invested more than US$330 million in healthcare information technology (HIT), and over 250,000 orders per month are generated via Computerized Physician Order Entry (CPOE) capabilities. According to Andrew Steele, MD, Director of Medical Informatics for Denver Health, "The driving force behind Denver Health's implementation of CPOE was to support our initiatives for improving patient safety and the quality, effectiveness, and efficiency of care."

Steele is proud of the many efficiencies gained at Denver Health from applying the CPOE process, including a reduction in the human element in medication errors, a standardization of care, and legible physician orders. The major ancillary departments, like laboratory, radiology, and pharmacy, have bidirectional interfaces, which allow for rapid communication of orders and less transcribing and reentering of data. "A clearly legible, electronic order does not require additional interpretation and results in fewer callbacks for clarification, leading to more timely and efficient care," explains Steele. "With standardized CPOE, we now get complete orders. The clinicians putting

Barcoding helps verify the five patient rights: the right drug in the right dose at the right time given to the right patient via the right route.

in the order have to dot every 'i' and cross every 't'. The computer is not ambiguous."

Patient-Centered Care

Denver Health combined CPOE capabilities with barcoding to create a seamless, interoperable process that promotes continuity of care for each patient throughout the entire course of treatment. "Barcoding and CPOE create a closed-loop medication process," says Steele. "When an order is placed in CPOE by a physician, that order is transmitted to the pharmacy for validation, then released electronically to a large dispensing machine, called a Pyxis, which contains about 80 percent of the medications that nurses commonly use. Then, the nurse uses a hand-held scanner to scan her own identification badge so we know who administered the medication. She also scans the barcode of the medication, as well as a barcode on the patient's wrist band." If the patient and the medication order match, then she administers the drug. "This closed-loop process allows us to confirm that the right drug is given in the right dose at the right time to the right patient via the right route," Steele says.

In addition to more consistent patient-centered care, the CPOE process also offers a significant cost benefit. "When people look at the cost of care, about 80 percent of the cost is controlled by the physician or clinician. It is up to the physician to order an expensive test. The test is not given unless a physician orders it, so the cost and quality of care is in the hands of the ordering physician," explains Steele. At Denver Health, evidence-based assistance for clinicians has been embedded into the CPOE workflow implementation, which gives physicians instant access to best-practice information. Additionally, Steele has the ability to generate individual customizations that save money. For example, in collaboration with the HIT department, he was able to create a solution in four days that reduced misordering of a US$125 test by 82 percent.[1]

Launching CPOE

Dramatic changes have occurred since Denver Health began applying its CPOE process in 2001. According to Steele, before CPOE, lab turnaround time was 142 minutes; following CPOE initiation, turnaround time was 63 minutes. There has been an 83-percent reduction in time between medication order and availability for administration, and a 62-percent reduction in radiology turnaround time.[1] Steele credits the effective rollout of CPOE to careful planning, strong leadership, and having physicians, nurses, pharmacists, and HIT staff involved at many levels to provide ongoing feedback. He also attributes the project's success to Denver Health's partnership with Siemens. "We wanted to have a long-term partner, and in looking at where we wanted to be in ten to 20 years, we selected Siemens. They seemed to be committed to the long term, and that was important to us at Denver Health," says Steele. "We have structured our relationship to make sure the service is there every single day, and I think on the flip side, they truly want to be there for us."

[1] The outcomes achieved by the Siemens customers described herein were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist (e.g., hospital size, case mix, level of IT adoption), there can be no guarantee that others will achieve the same results.

Soarian Migration

As Denver Health celebrates its 150th anniversary this year, the hospital system continues its early adopter status by migrating from INVISION® to a Soarian® platform. "We want to be using the most advanced technology, and moving to the Soarian platform creates better integration for our major clinical applications," says Steele. "The applications all have a similar look and feel. Previously, we had to jump to different applications to see information, but now, with Soarian, we have a more complete view of patient information."

Another advantage of moving to the Soarian platform, according to Steele, is the ability to make changes to the system. "Moving from INVISION to Soarian, we gain enhancements through better technology and can make changes to the system in order to tailor it to Denver Health's needs," he says. "Because Soarian is more integrated with the patient, we will have greater ability to filter the information to give the doctors what they want. It's a much more integrated product compared to what we have currently."

Because of the collaborative nature of the Siemens/Denver Health partnership, solutions found at Denver Health may also help other institutions as they set

up their own CPOE process. "Our partnership with Siemens has allowed us to test a process to convert CPOE order sets from INVISION to Soarian, which will provide a template that can be used by other sites as they transition from INVISION to Soarian," says Steele. "There is now a tool set in development that can help smooth the transition."

American Recovery and Reinvestment Act

The acceptance of CPOE in the U.S. has been relatively slow for reasons such as cost, the need for HIT infrastructure, and physician buy-in. Following last year's debut of the American Recovery and Reinvestment Act (ARRA), stimulus funding could be the key to widespread CPOE use. According to legislation, incentive funds will be provided to U.S. hospitals that achieve "meaningful use" of CPOE technology by 2011. With Denver Health's application of the CPOE process as a blueprint for success, Siemens stands ready to provide hospitals with the HIT platforms needed to receive ARRA funding.

"A clearly legible, electronic order results in fewer callbacks for clarification."

Andrew Steele, MD,
Director of Medical Informatics,
Denver Health and Hospital Authority,
Denver, Colorado, USA

"ARRA has drawn a line in the sand," explains Steele. "It is no longer a decision of what should we do about this, but an argument of when and how to best leverage the technology. The longer you wait, the higher the bar is set. Right now, for early adopters, the bar is lower than, say, in five years, when the standards for meaningful use might be higher."

For those hospital systems gearing up to meet the ARRA guidelines by applying the CPOE process, Steele has two pieces of advice: "One of the major lessons we have learned at Denver Health is that even though you need the HIT department to support the project, ultimately it needs to be turned over to and run by the clinical department. The second lesson is not to think about it as launching a CPOE technology program, but to see it as an opportunity to really readdress and transform the care you are providing," he says.

With the implementation of CPOE a decade ago, Denver Health, supported by Siemens technologies, is a leading example of the success of integrated clinical care. "The real power of CPOE is that it can combine the electronic order process and barcoding with evidence-based best practices to promote the highest quality and most effective care," says Steele. "As we move forward, I envision that people will start sharing their order sets and their best practices for certain conditions, and this could evolve into a higher level of standardized care for all patients across the country."

Amy Erickson Vaughan *is a journalist based in Chicago, Illinois. She has traveled throughout the USA covering a wide variety of health and medical topics. Her work has been published in numerous magazines, including* CURE *and* Nature Medicine.

[1] The outcomes achieved by the Siemens customers described herein were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist (e.g., hospital size, case mix, level of IT adoption) there can be no guarantee that others will achieve the same results.

Summary

Challenge:

- Provide timely, efficient, accurate, and standardized treatment and therapy
- Support an integrated approach to clinical patient care
- Installation of CPOE with 100 percent adoption by clinicians
- Support the organization's patient safety initiatives while offering cost-effective care

Solution:

- The Siemens Soarian platform, which is designed to help physicians, nurses, and pharmacists improve efficiency and accuracy
- The CPOE process, which can reduce the human element in medication errors, standardize care, and provide legible physician orders
- Barcoding and CPOE, which creates a closed-loop medication process that confirms that the right drug is given in the right dose at the right time to the right patient via the right route
- Siemens HIT systems, which are among the best platforms for implementing CPOE to receive ARRA funding

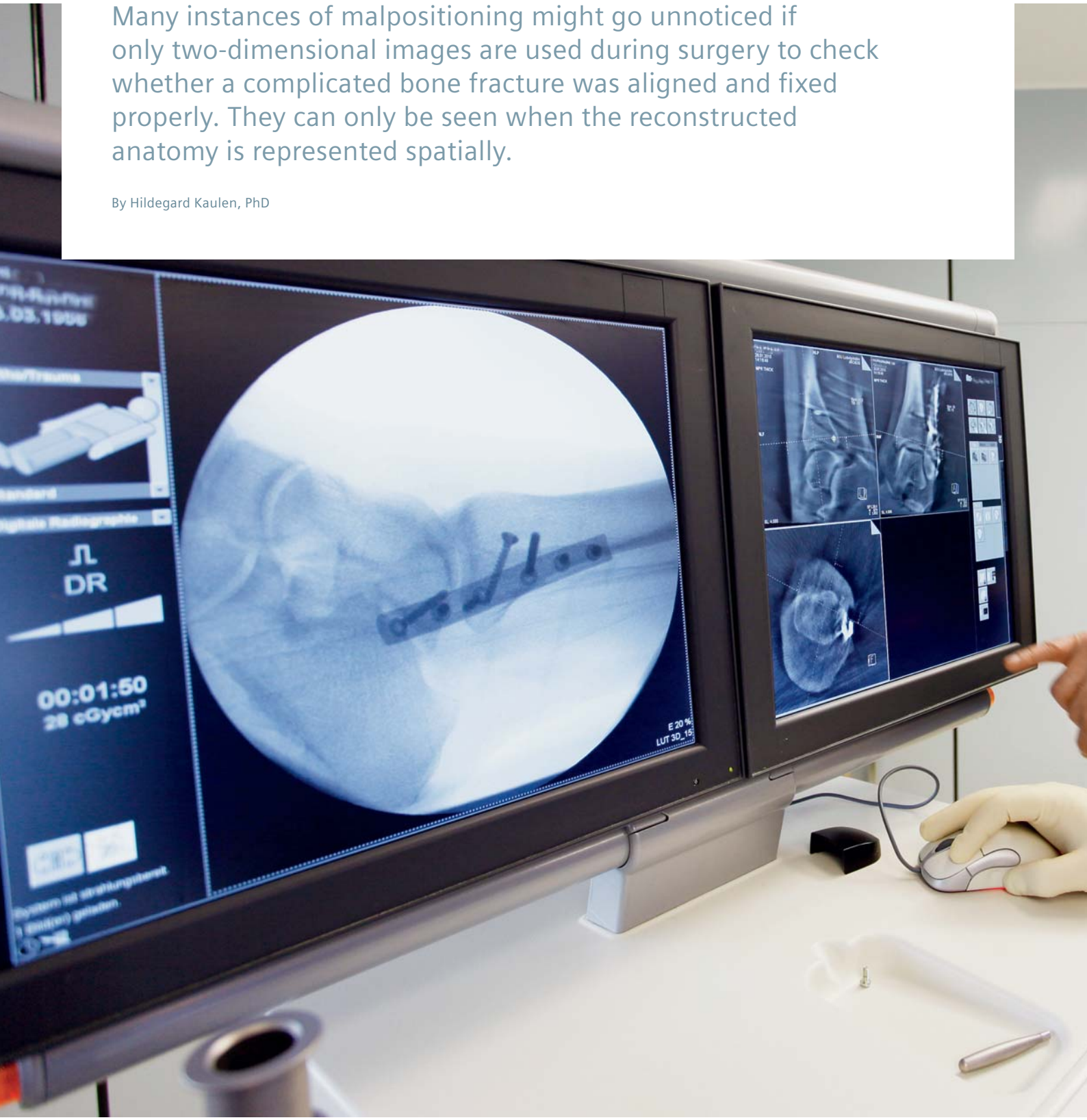
Result:

- Ninety-five percent of orders (250,000 orders per month) generated via the CPOE process at Denver Health
- A complete view of the patient's information, promoting continuity of care through the entire course of treatment and helping the organization ensure that healthcare is delivered in the most cost-effective setting
- After CPOE implementation, Denver Health reports an 83-percent reduction in time between medication order and administration, a 55-percent reduction in laboratory turnaround time, and a 62-percent reduction in radiology turnaround time[1]
- Clearly legible, unambiguous physician orders that do not require additional interpretation or callbacks for clarification

Better than Good: 3D Scans in the OR

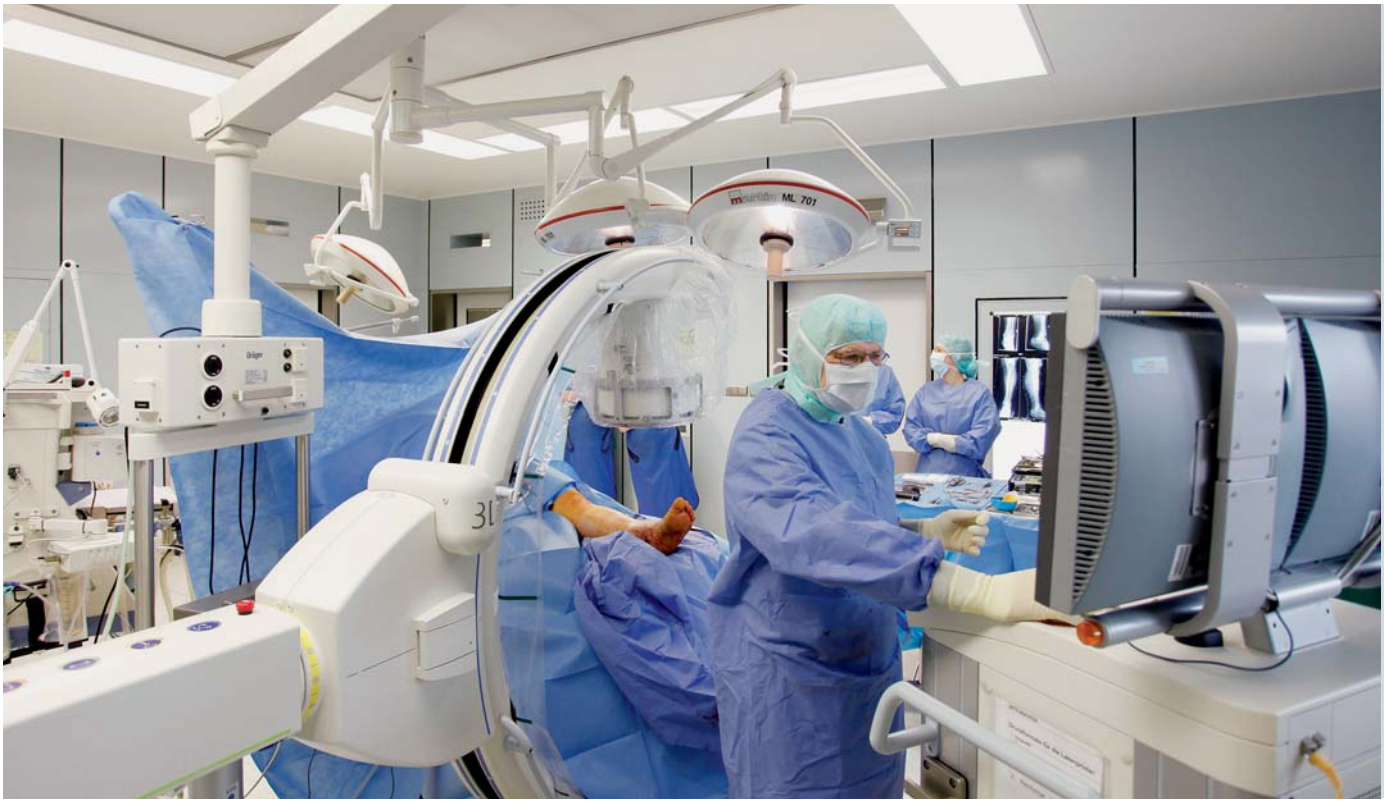
Many instances of malpositioning might go unnoticed if only two-dimensional images are used during surgery to check whether a complicated bone fracture was aligned and fixed properly. They can only be seen when the reconstructed anatomy is represented spatially.

By Hildegard Kaulen, PhD



With 20,000 operations performed each year, the BG Trauma Hospital Ludwigshafen (Berufsgenossenschaftliche Unfallklinik Ludwigshafen) is one of Germany's largest trauma centers. Nearly half of those operations are performed within the Clinic for Trauma Surgery and Orthopedics, which is headed by Professor Paul A. Grützner, MD. The unit has worked with three-dimensional (3D) intraoperative imaging since 2001. The experience gathered by Grützner and his team shows that wherever the correct alignment of complex osteosynthesis is inspected using only two-dimensional (2D) images, malpositioning cannot be avoided. Some articular surfaces and improperly placed fixations can only be seen in 3D images. Many of these errors should actually be corrected in revision surgery, but that isn't always done because the health status of the patient may not allow a second surgery.

Improper positioning is not rare. From 2001 to 2009, Grützner and his colleagues tracked nearly 3,000 intraoperative 3D scans, 1,841 of which were taken after osteosynthesis. One in every five osteosynthesis categorized as correct from 2D images had to be revised after an intraoperative 3D scan. Corrections to the heel bone, the upper ankle joint, and the articulation between the tibia and the ankle joint were necessary. "Wherever we see complex anatomy, where various joint facets have to be rejoined together, 2D images without any spatial depth – and with the overlays of other anatomical structures – are not meaningful enough to be able to assess the reposition of a complicated fracture with sufficient certainty," Grützner says. "Our figures show that with the heel bone, almost half of the intraoperative 3D scans performed led to the correction of osteosynthesis; and the figure was almost a third for the upper ankle joint. These are



Intraoperative 3D imaging helps prevent revision surgery.

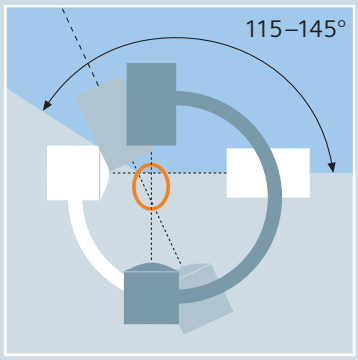
not fringe phenomena, but relevant clinical numbers. That's why we consider intraoperative 3D imaging to be so important. For many indications, we no longer do without it."

Experience not a Substitute for 3D Scan

The eight-year data collected by Grützner and his colleagues also show that the number of revisions performed during surgery itself did not decrease after the introduction of the 3D scan. This figure, therefore, does not depend on the surgeon's level of experience, but rather on the fact that the 2D images simply do not picture complex anatomy correctly. Grützner says, "I can't say it clearly enough: Experience is no substitute for a 3D scan. If anything, it is the experienced surgeons, in particular, who do not want to do without this intra-operative process control. They know very well that by using this method, they achieve better clinical outcomes and prevent postoperative revisions. It is more often the young, inexperienced surgeons who think they can get by without a 3D scan now and then."

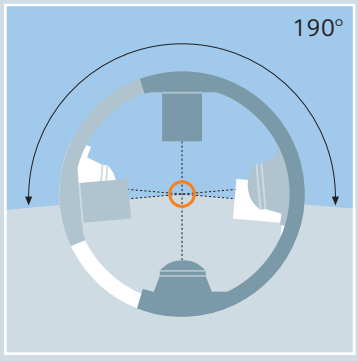
The team at the facility in Ludwigshafen works with two generations of imaging units: SIREMOBIL® Iso-C^{3D}, installed in 2001, which was joined in 2005 by its successor model, ARCADIS® Orbic 3D. Both units have a mobile C-arm with a fixed iso-center and supply computed-tomography-(CT-)like images. In both units, the middle of the connecting line between the radiation source and camera is always focused on one point – the isocenter – during the 190-degree turn. During orbital rotation, 50 or 100 images are taken at fixed angle increments. These individual images are then used to create a cube-shaped volume of data with a length of twelve centimeters to a side. The 3D reconstruction is presented to the surgeon in real time, together with the 2D X-ray images, which take the form of a film sequence. Surgery only has to be interrupted for a few minutes for this process. Grützner and his colleagues use intraoperative 3D scanning especially where complex joint surfaces have to be aligned; such as in the case of the upper ankle joint, the spinal column, and the pelvic ring; but also during surgery, where there is little tolerance for osteosynthesis, such as those involving the cervical spine. The 3D scanning method is not suitable for checking joint replacements, because large amounts of metal in the field of view lead to imaging artifacts.

To Grützner and his colleagues, there is no question about it: intraoperative 3D imaging prevents postoperative revisions. There are, however, no numbers regarding how many of the osteosynthesis cases that are categorized as correct from 2D images, but are in fact improperly placed and have to be corrected later. Grützner avoids these kinds of postoperative revisions by correcting malalignments right away during the surgery itself. He views a prospective randomized study to compare 2D and 3D imaging as unethical because it is clear that 3D



Non-Isocentricity

- The central beam moves out of the isocenter, making repositioning necessary. Repositioning of the C-arm is time-consuming and can lead to additional radiation exposure.
- The distance between the image intensifier or X-ray tube and the body region being imaged varies with each change of the orbital angle. The image size thus varies for different projections.
- The orbital movement is restricted to 25 to 55 degrees of 'overscan', depending on the C-arm model and manufacturer.



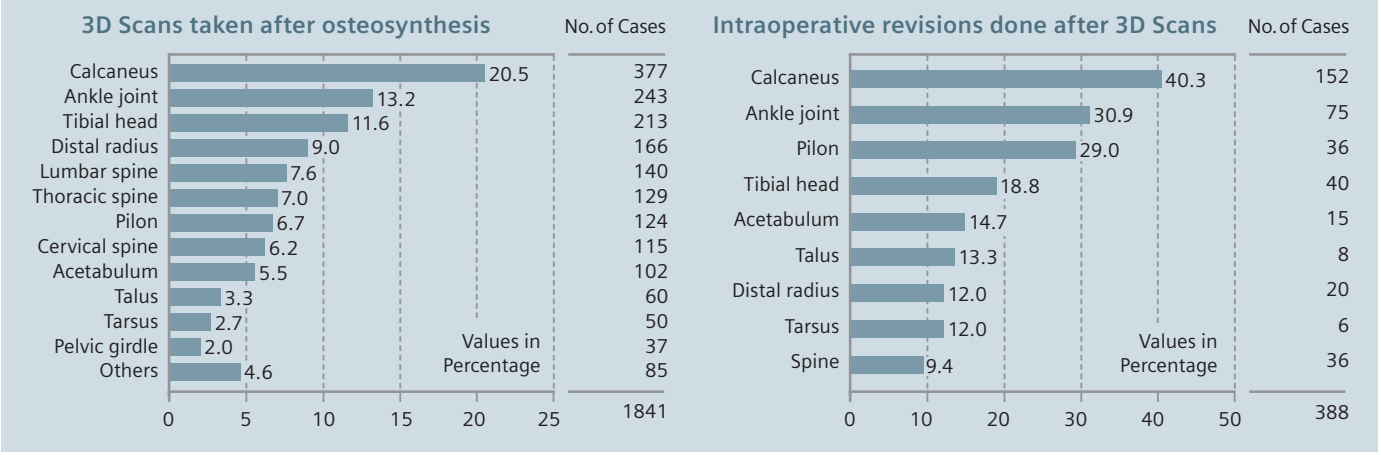
Isocentricity

- The central beam always remains in the isocenter, which eliminates the need for repositioning and enables both time and dose savings.
- The distance between the image intensifier or X-ray tube and the body region being imaged always remains the same, thus ensuring a constant image size with varying projections.
- Large orbital rotation of up to 190 degrees (+95°/-95°).
- Prerequisite for 3D imaging via orbital movement.

intraoperative imaging leads to better clinical outcomes. It is unacceptable to withhold this better quality of treatment from patients.

Faster Decision-making in the OR

The 3D scanning method has even more advantages. Because the 3D images are available quickly in high quality, decisions in the OR can also be made more quickly. And that has a direct effect on the risk of infection, because a patient who undergoes a longer operation is at greater risk of contracting a wound infection than one who undergoes just a short one. Grützner says, "Infections involving osteosynthesis of calcaneal fractures used to be a real problem. Because we are now able to make faster decisions, with greater certainty regarding the quality of the repositioning, we have cut the infection rate for these operations to zero. That's a big accomplishment." To evaluate the 3D scans, Grützner and one of his leading surgeons, Bernd Vock, MD, have developed a standardized procedure. A crucial part of this is that images taken during surgery should correspond to those known from CT. This enables surgeons



Professor Paul Alfred Grützner, MD, studied at the Universities of Mainz, Germany, and Edinburgh, UK. He specializes in trauma surgery and orthopedics, with additional training in emergency medicine and physical therapy. He did his postdoctoral work to qualify as a professor in the field of trauma surgery and has worked at the City Hospital of Worms, the BG Trauma Hospital Ludwigshafen, and the Stuttgart Hospital (Katharinenhospital). Since 2009, he has been the Medical Director at the BG Trauma Hospital Ludwigshafen and the head physician at the facility's Clinic for Trauma Surgery and Orthopedics. Grützner teaches surgery at the University of Heidelberg and performs various roles in German and international industry associations. He also serves as an expert on the mediation committee of the state board of physicians.

to get their bearings quickly, from a spatial point of view, and lets them compare the 3D scan with the CT images taken before surgery. Other, less typical settings are also possible.

Intraoperative imaging is also a high priority in minimally invasive surgery, such as percutaneous screw fixation for bone fractures. In these types of operations, the soft tissue is protected, but the actual site of the operation is barely visible due to the narrow approach. This means that minimally invasive surgery is prone to malpositioning. Therefore, intraoperative 3D scanning is an important process control for minimally invasive surgery, Grützner says. It is also important in computer-assisted navigation. Of the nearly 3,000 scans the team at the Ludwigshafen facility has evaluated over the eight-year period, 14 percent served navigation purposes. The 3D scans can be used directly for navigation, where they then replace the CT images taken before the operation and eliminate the search for landmarks.

In Germany, the public health insurers do not provide separate reimbursement for intraoperative 3D imaging. Hospitals only receive a case-based lump-sum payment for the operation. "The better quality of the outcomes that we achieve without any doubt with the 3D scans is not reflected in the reimbursement of costs. Nonetheless, we have no intention of doing without it anymore," Grützner says. "We do not want to withhold that better outcome quality from the patients. Because we no longer have to perform postoperative control examinations, and because postoperative revisions are also no longer necessary, intraoperative 3D imaging is justified, even with heavy cost pressure."

Hildegard Kaulen, *PhD, is a molecular biologist. After positions at Rockefeller University in New York and the Harvard Medical School in Boston, Massachusetts, USA, she has worked since the mid-1990s as a freelance science journalist for leading newspapers and scientific journals.*

Summary

Challenge:

- When relying on just 2D images in the operating room while aligning complex fractures, one in every five operations will end in a malpositioning that cannot be seen in the 2D images
- Experience is not a substitute for a 3D scan. The fact that the revision rate following 3D scanning remains constant over time has to do with the 2D images inadequately reflecting complex anatomy
- Germany's public health insurers do not acknowledge the better outcome of operations following intraoperative 3D scanning with a higher case-based lump sum

Solution:

- Intraoperative 3D scanning reduces the number of postoperative revisions in the case of complex bone fractures
- In 40 percent of all fractures of the heel bone and one-third of fractures of the upper ankle joint, the 3D scanning method leads to correction of repositions found to be in order in 2D images
- Intraoperative 3D scanning is a high priority in minimally invasive surgery, where surgeons have a limited view of the site of the operation, and in computer-assisted navigation. The 3D dataset can be used directly for navigation purposes, without the need for surgeons to look for landmarks for orientation

Result:

- Corrections initiated while the operation is still in progress lead to better treatment outcomes
- Because intraoperative 3D scanning leads to fewer follow-up examinations and surgical interventions, it is justified even where there is heavy cost pressure
- For many indications, intraoperative 3D imaging is the clinical standard

Further Information

www.siemens.com/surgery

The Diagnosticum Ingolstadt is a bright, spacious, and modern radiology center.

All from One Source

At the new Medical Center at Ingolstadt Hospital, all specializations, from dentistry to ophthalmology, can be found under one roof. It is also home to the Diagnosticum, a state-of-the-art radiology practice equipped with the latest systems from Siemens. The flexible financing options offered by Siemens Finance & Leasing helped make these purchases possible.

By Felix Sparkuhle

Dr. Rudolf Conrad is one of three partners of the practice.

Before moving into the new Medical Center in 2009, the Diagnosticum had two locations in Ingolstadt, Germany – in the old Medical Center and in Ingolstadt Hospital itself. "This was associated with tremendous logistical and financial costs. At that time, we also expanded our team of physicians from six radiologists to eight and were already looking for premises for our practice for this reason," recalls Rudolf Conrad, MD, Managing Partner at the Diagnosticum. Once hospital management had notified the partners at the Diagnosticum of the plans for the construction project, it didn't take long for the practice's physicians to decide in favor of a site in the new complex and thus, in favor of intensifying the cooperation that already existed between their practice and the hospital. It was clear to the radiologists that, in the context of the relocation and upgrading of their equipment, new medical equipment should be purchased as well. Their interest turned to products from Siemens Healthcare. Plans were made to use the 3 Tesla (3T) magnetic resonance imaging (MRI) system MAGNETOM® Verio and the fully digital X-ray system AXIOM® Aristos MX in the future. Not long afterward, however, the question came up as to how to finance the systems. After all, the costly move and the new equipment had already caused significant financial strain.

"Pay as You Earn" – Situational Financing

In this difficult financial situation, a flexible, customized solution was needed. And that is just what Siemens Finance & Leasing (SF&L), the German leasing subsidiary of Siemens Financial Services, put together for the partners in the Diagnosticum in the form of a situational, demand-based financing package. No down-payment was required, and a three-month start-up period with no installment payments helped the radiology practice conserve liquidity during the relocation and the initial phase in the new site. Another three months of particularly low installment payments followed. Based on the "Tech-X-Change" and "medprodynamic" financing models, Siemens was able to put a progressive installment payment structure into place, following the "pay-as-you-earn" principle.

"In addition to the technical and quality factors, the financing service was definitely an important positive aspect that helped us choose Siemens. And our regular bank was also happy to not have to provide us with even more financing, especially because they had a hard time assessing the risk involved in these kinds of investments," Conrad says.

In addition to a digital full-field X-ray system with substantially lower radiation exposure for patients, Conrad and his colleagues are now one of the first teams of physicians in the region to have a 3T MRI system.

Completely New Options

Although the premises of the Diagnosticum are located between a pharmacy and a dialysis ward, the installation of the high-field unit from Siemens was possible without problem. The new MRI system at the radiology practice supplements the examination methods at Ingolstadt Hospital and opens up completely new options for the radiologists – and their patients. "For instance, when it comes to stroke diagnosis, we have gotten faster and, with new features for measuring perfusion, we are now even more precise. This is crucially important when it comes to treatment. When we acquire angiograms with the 3T MRI system, even without the use of contrast agents, we are able to achieve images at a level of sharpness and detail that we have never been able to achieve before. We often also examine patients' hands, and these high-resolution systems help us obtain sharp, detailed images of the many small bones and ligaments," Conrad explains.

When it comes to preventive examinations, cutting-edge Siemens' medical technology is also enabling the physicians in Ingolstadt to break new ground. Starting this year, the physicians at the Diagnosticum will also be offering magnetic resonance spectroscopy (MRS) of the prostate. The Prostate Center at Ingolstadt Hospital has already indicated an interest in cooperating closely with the Diagnosticum in this area. And that means outstanding preventive cancer care for men – in line with the practice's motto, "Committed to the patient." The physicians have officially been committed to this motto for five years now, and

Latest digital X-ray equipment ...

and the 3 Tesla MRI are the highlights of the practice.

it is backed by a certificate in quality management from the German TÜV testing and validation agency.

Enhanced Patient Comfort and More Efficient Workflows

In addition to new diagnostic possibilities, the purchases also have positive impact on patient comfort and a helpful effect on workflow.

The cramped, narrow bores of many MRI systems used to cause a problem for many patients, especially those with claustrophobia. With a diameter of 70 centimeters (27.6 inches), MAGNETOM Verio opens up MRI for a wider range of patients. And if the system, which is relatively short, is also installed in a spacious examination room such as that at the Diagnosticum, patients have a more pleasant experience. Conrad confirms that since the Diagnosticum purchased MAGNETOM Verio, it has had no further issues with claustrophobic patients fearing MRI scans. It also facilitates scanning children, because the large opening lets parents hold a child's hand during the imaging process. And the wide gantry even lets physicians treat obese patients, up to a body weight of 250 kilograms (approximately 550 pounds), with ease.

Furthermore, the shorter scan times offered by MAGNETOM Verio make it possible to scan more patients in the same timeframe. At the Diagnosticum, physicians plan to use the time freed up by the new unit to improve their service by establishing open periods so that they can react more flexibly to emergencies. As for workflow, the usability of the IT systems was another crucial factor for Conrad and his team. The physicians have been working with Siemens systems in their practices since 1992. The latest purchases for the Ingolstadt facility also feature the current *syngo*® software, which is already familiar to the staff. "When we moved, it was not just the flexible financing service, but also the established IT systems that helped us to save on costs. A new user interface would have required retraining all 16 of our radiology assistants. In this way, we were able to upgrade our equipment without tremendous expense or risk."

Felix Sparkuhle *has a degree in political science with political economics. He works for Siemens Corporate Communications and Government Affairs.*

Summary

Challenge:

- Cutting-edge technology is an important unique selling point when competing with other providers
- Time and cost pressures in radiology
- Pressure to modernize equipment

Solution:

- SF&L financing makes it possible to use the latest in Siemens technology
- Flexible installment payment structures
- Pay as you earn

Result:

- Latest technology
- Enhanced image quality, better detail
- Liquidity secured during the start-up phase
- Shorter waiting times for patients
- Greater flexibility in appointment management
- High levels of patient comfort

Further Information

www.siemens.com/sfs

Healthcare in Germany: Great Leeway for Major Players

by Jürgen Wasem, Alfred Krupp von Bohlen und Halbach Foundation Endowed Chair for Medicine Management, University of Duisburg-Essen, Germany

"Reform is dead. Long live reform." It is a sentiment heard time and again throughout the German healthcare sector. After all, the past 35 years have seen the country enact six sweeping reform packages and an array of smaller ones. The new government majority under Chancellor Angela Merkel that emerged in the last parliamentary elections in September 2009 announced in its coalition agreement that it planned to enact another healthcare reform, this one scheduled to take effect in 2011.

Financial Development as a Driver of Healthcare Reform

In my opinion, a reform of the financing structure of Germany's statutory health insurance system is urgently needed. The new federal government intends on adding contributions that are independent of income levels (flat per-capita contributions) to the existing system of income-dependent contributions. A model that combines these two kinds of contributions is in place in some other countries, such as the Netherlands. I consider this a sensible step. It will help ensure that the healthcare system is financed more sustainably. If enacted, however, a form of social compensation would be needed, financed through taxes, for insured parties with low incomes. Because the government is also determined to cut its income from taxes via a major tax overhaul, it is entirely possible that we will lack the tax revenue needed to pay for this social compensation. I therefore believe our policymakers will need to choose between tax reform and reforming the financing of our healthcare sector.

There is a contentious debate regarding whether our high healthcare expenditures yield proportionate benefits. According to various international studies (such as the OECD Health Care Quality Indicators Project or the measurements taken under the European Union's Open Method of Coordination), the German healthcare sector's outcome is only moderate. The council of healthcare experts convened by the federal government has found that overtreatment, undertreatment, and provision of wrong or inappropriate healthcare services are widespread. Patient satisfaction, on the other hand, is generally high, and waiting times are mostly short.

Do the Benefits Outweigh the Costs?

I am convinced that the sharp dividing line between outpatient and inpatient care is one of the reasons for the comparatively unfavorable cost-benefit curve. Hospitals are permitted to provide outpatient treatment only within very narrow limits. Instead, this is reserved for physicians in private practice, even when specialist care is needed. Since 2004, medical care centers have also been permitted to participate in outpatient care. Such centers are being built by hospitals, for example. I believe we need to reconsider the division of labor between hospitals and physicians in private practice. Looking at the international landscape, the role taken by the German government in controlling and directing the course of the healthcare sector is rather modest. That means that the major players in the healthcare sector traditionally enjoy tremendous latitude. The central body in this regard is the Federal Joint Committee, whose membership is made up of representatives from health insurance companies, physicians, dentists, and hospitals. Patients' representatives have the right to attend and speak at its meetings, but have no voting rights.

The central task of the Federal Joint Committee is to specify the catalog of services approved and paid for under the statutory health insurance system. Physicians can therefore use new methods of outpatient diagnosis or new treatment methods only on the condition that they are approved by the Federal Joint Committee as medical services provided under statutory health insurance. As a result, it is possible to assess the benefits and cost-benefit ratio of specific therapies. Physicians also receive information on how to prescribe medications for maximum economic efficiency. The decisions made by the Federal Joint Committee are central in terms of quality assurance as well. For example, it sets the minimum quantity standards for operations.

A Stronger Role for Health Insurers

Since the beginning of 2009, insured parties and employers have been paying their contributions to a newly established central health fund (see Fig. 3). The health fund distributes moneys to the

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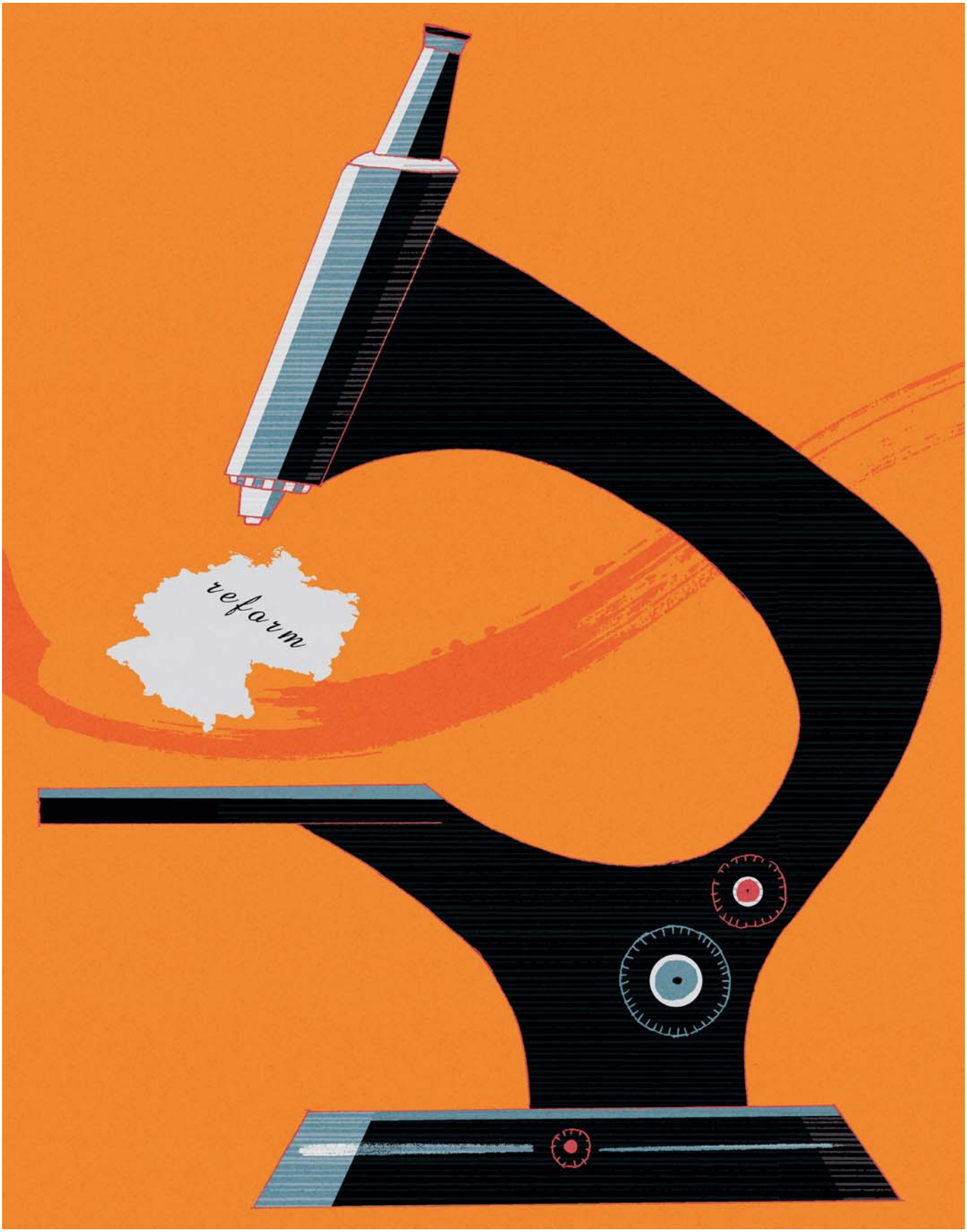

reform

Facts & Figures

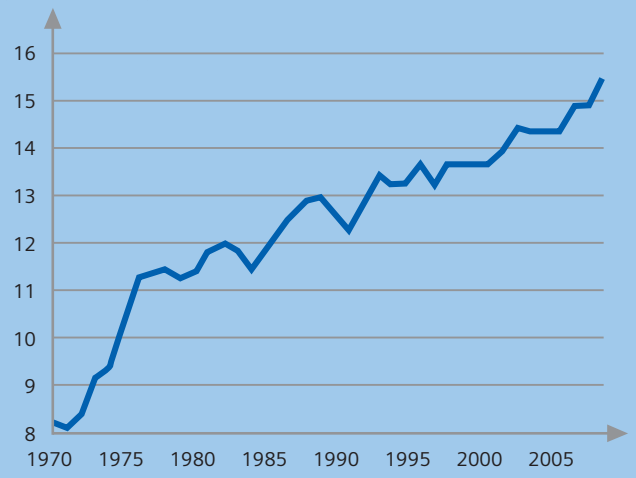
Healthcare Expenditures

Germany is one of the countries with the highest level of health expenditures expressed as a portion of GDP, after the United States, Switzerland, and France. In terms of per-capita spending, Germany ranked near the top among OECD countries in 2006 at US$3,371 (measured at purchasing power parity).

Contribution Rates

As Fig. 2 (see opposite page) shows, the percentage of GDP consisting of healthcare spending has also risen sharply, from 5.7 percent in 1970 to 10.4 percent in 2007. The rising contribution rates charged by health insurers are also attributable to the fact that incomes subject to mandatory contributions (particularly employee wages) have grown slower than GDP.

Fig. 1: Average contribution rate charged by health insurers (as % of income)[1]



Statutory Health Insurers

The development of contribution rates under the statutory health insurance system regularly drives healthcare reform cycles in Germany. Nearly 90 percent of the population is covered by approximately 170 statutory health insurers. The statutory health insurance system collects income-based contributions to finance the costs of care. As Fig. 1 shows, the average contribution rate for health insurers has risen from eight percent in 1970 to more than 15 percent in 2009, in spite of the many healthcare reforms enacted during that period.

Private Subscribers

The German Health Insurance Act permits employees with a high income (the threshold for 2010 is €49,950), the self-employed, and civil servants to decide whether they wish to belong to a statutory health insurance plan or would rather obtain insurance from a private health insurer. As a result, about ten percent of the population has private coverage.

Healthcare Policy in Recent Decades

To curb spending in the healthcare sector, healthcare policy over the past three decades has tended to favor health insurers over the providers of healthcare services. One of the very first steps was to call on health insurers to act more consistently and uniformly, and there was a substantial push to centralize decision-making authority. At the federal level, an industry association of health insurance companies was established. Its responsibilities include establishing fixed prices for pharmaceuticals and medical aids, with its decisions binding for all health insurers. This association works together with the group that represents the interests of physicians in private practice, the National Association of Statutory Health Insurance Physicians, to establish the required fee schedule and the rules capping physician compensation. The association also works with the German Hospital Federation to decide on the lump-sum payment system (German Diagnosis-Related Groups), which is also binding for all health insurers.

Competition Among Health Insurers

The German legislative branch has consistently and deliberately encouraged competition among health insurers. Since 1997, all insured parties generally have the right to change health insurers. About five percent of insured parties do so each year – a significant enough figure to put pressure on insurance company managers to compete. The major competitive parameter for health insurance companies in the past was the contribution rate: Insured parties and their employers paid contributions directly to the health insurers, which had to calculate contribution rates to be sufficient to cover their own costs.

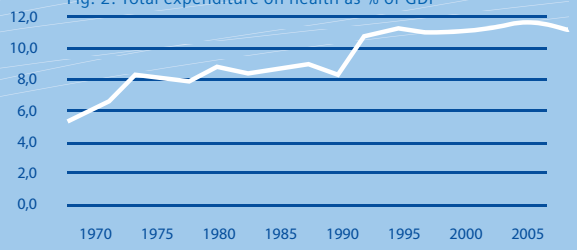
[1] Source: German Federal Ministry of Health

General Government Expenditure on Health as % of Total Expenditure on Health: 76.6 (2006)

Population in Thousands: 82,641 (2006)

Per Capita Total Expenditure on Health: US$3,669 (2006)

Fig. 2: Total expenditure on health as % of GDP[2]



[2] Source: German Federal Statistical Office. All other data: WHO Statistical Information System (WHOSIS), http://www.who.int/whosis/en; last accessed February 5th, 2010.

Number of Hospital Beds per 10,000 Resident Population: 83 (2006)

Number of Dentists per 10,000 Resident Population: 8 (2006)

Number of Physicians per 10,000 Resident Population: 34 (2006)

Number of Nurses per 10,000 Resident Population: 80 (2005)

80

Male Life Expectancy at Birth in Years: 77

77

82

Female Life Expectancy at Birth in Years: 82

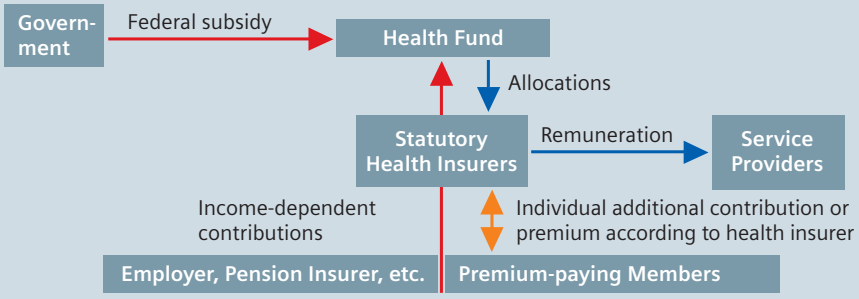
health insurance companies according to the risk structure of their insured parties. If the health insurers cannot cover their expenses with these allocations, they have to charge the insured an additional contribution. On the other hand, they can provide the insured with a reimbursement if the amount they are allocated by the fund turns out to be greater than their needs. The amount of this additional contribution is developing into a major competitive factor. While the basic contribution to the health fund is paid in about equal portions by the employer and the insured, the insured party alone pays the additional contribution.

The additional contribution to the health insurance company, like the basic contribution rate, depends largely on the health insurer's expenditures. The individual health insurance companies have recently been given an increasing number of tools for managing their expenses. For example, individual health insurers can sign discount agreements with pharmaceutical companies, giving the drug company preferential supplier status with their insured parties in return. The insurance companies can also sign selective contracts with physicians' networks or integrated care providers. The effort to curb expenses is at the heart of these actions.

Increasingly, however, the health insurers are coming to see these selective agreements as an opportunity to make their own particular mark on the healthcare sector and thereby position themselves compared to competitors.

I believe it is necessary to encourage competition among health insurers with regard to the quality and economic efficiency of care. This way, insured parties can obtain health insurance coverage that is in line with their preferences.

Fig. 3: Flows of payment in the statutory health insurance system



A Two-class System of Medicine?

Private health insurers do not assess income-dependent contributions. Instead, they calculate premiums according to the individual risk levels for each subscriber. By taking out health insurance, young subscribers are saving toward the increasing costs they will face as they age ("provisions for aging expenses").

By law, those with private health insurance pay higher prices to obtain services from physicians, hospitals, and pharmacies than those insured under the statutory health insurance system. This has triggered some debate regarding whether these patients are given preferential medical treatment, with others receiving "second-class" medicine. Empirical evidence shows that privately insured patients receive appointments for medical care more quickly and are more frequently given expensive new drugs. That leaves us with the question of whether we are moving increasingly toward this kind of "two-class" medical system. Thus, I am firmly convinced that we urgently need to reform the financing of the statutory health insurance system.

The opinions reflected in this article do not necessarily reflect those of Siemens Healthcare.

Jürgen Wasem studied Economics and Political Science at Pennsylvania State University, USA, the University of Sussex, UK, and the University of Cologne, Germany. After earning his doctorate, he became a consultant with the German Federal Ministry of Health. After holding professorships at the University of Munich and the University of Greifswald, he moved to the University of Duisburg-Essen, where he has held the Alfred Krupp von Bohlen und Halbach Foundation Endowed Chair for Medicine Management since 2003.

Professor Wasem was the chairman of a commission of experts assembled by the German Federal Government on the reform of premium calculations in the private health insurance sector; the legislature acted on the majority of the commission's findings. He is also the chairman of the federal board in charge of mediating disputes on fees between health insurers and physicians who provide outpatient care, and the Chairman of the Academic Advisory Council of the Federal Social Insurance Office, which is responsible for comparing risk structures between the health insurers. Professor Wasem also played a major role in developing a network of health technology assessment (HTA) task forces in Germany; his institute regularly performs HTAs and systematic reviews for the appropriate federal agencies. In his work, he also focuses on evaluations of the health and economic efficiency of medical products and pharmaceuticals.

Further Reading

Siemens offers a variety of customer magazines and information channels. "Further Reading" introduces a selection of articles and topics featured that may be of interest to you. To learn more, follow the link below each article. To subscribe to any of the magazines, see page 81.

Small Dose for Small Patients

The Arnold Palmer Medical Center with the Arnold Palmer Hospital for Children (left) and Winnie Palmer Hospital for Women & Babies (right)

Arnold Palmer Hospital for Children in Orlando, Florida, USA, prides itself on providing advanced, specialized care for children. It comes as no surprise, then, that it was the first pediatric hospital worldwide to purchase Siemens' SOMATOM® Definition Flash computed tomography (CT) scanner, one of the fastest scanners with the lowest dose on the CT market. The system combines Dual Source technology with the fastest available hardware component and innovative features, enabling thoracic scanning without breath holds and, in many cases, high-quality images with doses of less than one millisievert (mSv). John Bozard, President of the Arnold Palmer Medical Center, remarks, "It is certainly going to give patients and their families a higher level of comfort about CT."

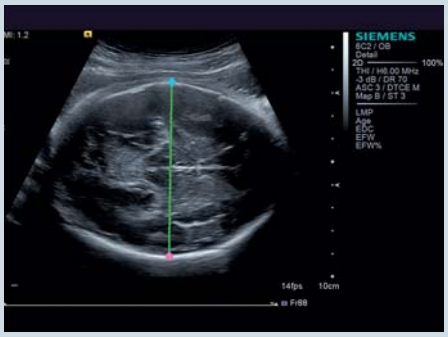
While reducing radiation exposure is important for all patients, pediatric patients in particular are more vulnerable to the adverse effects of ionizing radiation. This makes SOMATOM Definition Flash an especially attractive choice for pediatrics. Joseph Foss, MD, Chair of Pediatric Radiology, adds, "We reviewed all of the systems available, and the Definition Flash definitely provided the lowest dose possible for our patients, which was very important to us."

The requirement for breath holding during CT scans has always been a challenge with pediatric patients and often resulted in the need for sedation. SOMATOM Definition Flash's speed can eliminate the need for breath holding and, therefore, result in a scan that is less burdensome and safer for patients. For the complete story about Arnold Palmer Medical Center's scanner acquisition, please use the link below.

www.siemens.com/SOMATOM-Sessions-lowdose

Knowledge-based Automated Fetal Biometrics Using *syngo* Auto OB Measurements

Measuring fetal biometry has become standard practice in prenatal care to determine the growth development and well-being of the fetus. Obtained manually, fetal measurements are time-consuming and highly user-dependent. In addition, due to the multitude of keystrokes required to perform each measurement, users are prone to develop repetitive stress injury (RSI). Siemens Healthcare has developed an application addressing these issues. *syngo*® Auto OB measurements automate the manual process of fetal biometry measurements saving up to 75 percent of the keystrokes in routine fetal exams and improving standardization and reproducibility of results.
Common fetal biometric measurements include: biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), femur length (FL), humerus length (HL), and crown rump length (CRL). The American Institute of Ultrasound in Medicine (AIUM) publishes guidelines for measuring these values. They help diagnose fetal pathology including growth restriction, microcephaly, and macrosomia. In addition, they are utilized to estimate the gestational age (GA) of the fetus (i.e., length of pregnancy in weeks and days). Accurate estimation of GA is important to determine the expected delivery date, assess the fetal size, and monitor fetal growth.
The most common current workflow requires expert users to perform biometric measurements manually. This paradigm yields several challenges, such as user dependency, time intensity, or RSI due to the multiple keystrokes needed to perform each measurement. *syngo* Auto OB measurements are based on advanced statistical pattern recognition technology enabling rapid automated measurement of fetal biometrics to increase consistency of results among users.



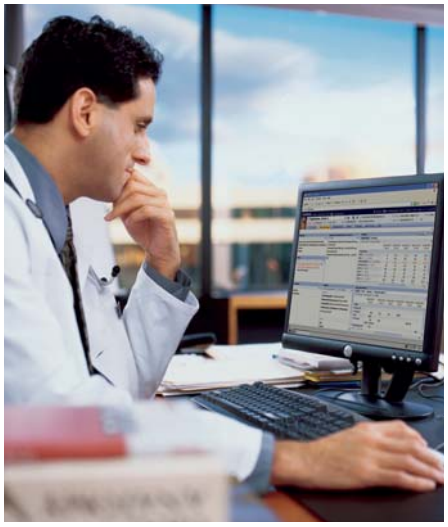
Example of biparietal diameter measurement with *syngo* Auto OB

A whitepaper published by Siemens highlights the advantages of *syngo* Auto OB measurements and how it can be utilized to address the challenges of fetal biometry. It can be accessed using the link below.

www.siemens.com/clinical-OBGYN

E-prescribing: The Path to Physician Adoption of HIT

Adoption of health information technology (HIT) by physicians in the U.S. has progressed at a very slow pace. Admittedly, a recent confluence of developments in the specific HIT area of "e-prescribing" has opened the door for its wider general implementation. A whitepaper recently published by Siemens focuses on e-prescribing in the U.S. It summarizes various studies and lists the benefits that are being realized by physicians who have adopted either a full or basic system.
Two factors contributing to the success of such efforts are the technical characteristics of these solutions and the practical workflow benefits that e-prescribing technology delivers. In general, these solutions are easy to install, maintain, and use. The implementations are efficient from a time and resource standpoint and do not, as a rule, disrupt the normal physician workflow. On the contrary, e-prescribing data and workflow enhancements address a set of readily identifiable pain points common to almost every practice.
These pain points include frequent medication-related phone calls either from patients or pharmacies, excessive chart pulls, lack of satisfactory medication history data, incomplete allergy and drug interaction data, and cumbersome formulary data access and management. By addressing these pain points with one user-friendly, relatively inexpensive solution, the chances for more widespread adoption and subsequent ongoing use of e-prescribing are greatly enhanced. As a result, the healthcare system should see broad adoption by physicians across the practice spectrum.
To download the full whitepaper, entitled *E-Prescribing – The Path to Physician Adoption of HIT,* please use the link below.



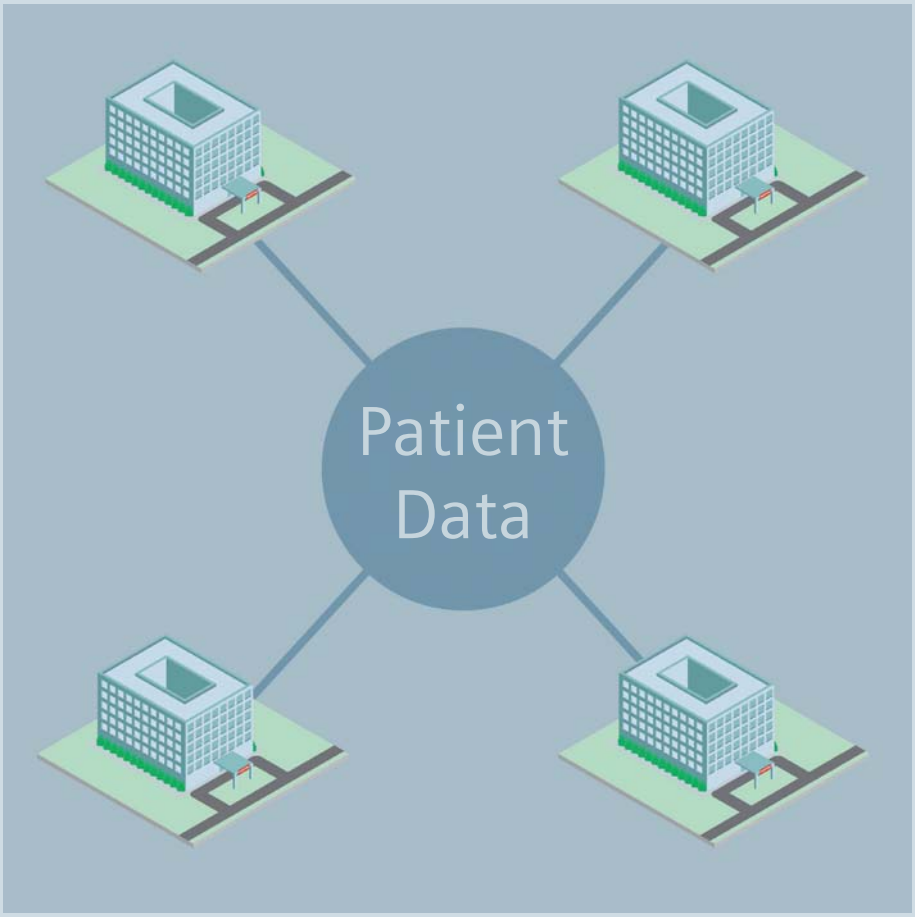
www.siemens.com/e-prescribing

Step-by-step IT Implementation

Brookhaven Memorial Hospital Medical Center, a 306-bed, acute-care, non-for-profit, independent community hospital in East Patchogue, Long Island, New York, USA, strives to provide leading-edge healthcare solutions through a compassionate team as well as technologically advanced facilities. Serving a population of more than 350,000, Brookhaven's laboratory currently runs about 3.3 million tests per year. This, coupled with the facility's focus on providing quality healthcare with the leading technology, led Brookhaven to adopt an IT initiative with the help of Siemens and its comprehensive portfolio of performance-driven healthcare IT products and solutions.

In 2000, Brookhaven installed the NOVIUS® laboratory information system (LIS) to meet growing demands and provide quality care by improving turnaround times, delivering quicker clinical results, and expediting patient care. The LIS is configured to handle hematology, chemistry, urinalysis, coagulation, microbiology lab workflows, and reporting, aiding in workflow optimization and seamless interoperability between multiple lab settings. Joe Bak, Brookhaven's LIS manager, appreciates its scalability, "It has been able to grow with us to meet our needs and has given us great flexibility in configuring the system, especially with reporting."

In 2007, Brookhaven deployed Siemens' Soarian® Clinicals, a complete hospital information system (HIS) that helps ensure a seamless flow of information within the hospital enterprise. The LIS infrastructure was further complemented in 2009 with the fully integrated Web-based EasyLink™ Informatics System to implement autoverification, manage quality-control data, and optimize the performance and productivity of the laboratory. By connecting the lab's multiple instruments to its LIS through EasyLink, Brookhaven can now consolidate patient data management while at the same time gain greater control over its workflow and operational performance. "Now that we've gone to autoverification, we've achieved a 19-percent improvement in STAT turnaround times," Administrative Director Jim Carr says. "That's one of the biggest changes we've ever seen and it's significant because our work predominantly comes out of the ED [emergency department]." To provide Brookhaven the tools to quickly build interfaces and enable the exchange of complex information, Siemens suggested the implementation of OPENlink™. This application-independent interface engine can bridge lab, clinical, imaging, financial, administration, and other systems that require online data. This allows users to transfer data between heterogeneous systems and applications, even when they utilize different communication standards and protocols. Step-by-step, Siemens has helped Brookhaven meet its objectives with solutions – NOVIUS Lab, Soarian Clinicals, EasyLink, and OPENLink – that improve performance and productivity as well as connect every patient touchpoint across the care continuum. To read in more detail about the implementations as well as Brook-haven's future plans for the initiative, use the link provided below, and click on "case studies."



www.siemens.com/
diagnostics-it

Justifying the Investment

More than two years ago, the Institute of Diagnostic Radiology at the University Hospital Zurich invested in two unique systems from the high end of Siemens' computed tomography (CT) scanner range: Dual Source SOMATOM® Definition and SOMATOM Definition AS. The institute's head of radiology, Professor Borut Marincek, MD, justified the investment on the basis of reduced dosage. "For the sake of our patients," he says, "we will always opt for the latest technology that offers the best results with the lowest possible dosage." Now, after having time to evaluate the new technology, Siemens' CT customer magazine, *SOMATOM Sessions*, went back to the institute to ask the burning question: Was the investment worthwhile?

"Definitely," answers Marincek's colleague, Sebastian Leschka, MD. With the new scanners, the institute is not only lowering patient exposures, it also is saving time, money, and hassle in the day-to-day workflow as a result of the systems' high scanning speeds and optimized workflows. "They have provided significant economic benefits," says Leschka, adding that the "next-next" generation scanner, the SOMATOM Definition Flash, promises to trump these improvements even more. To read the entire story regarding the hospital's investments, including improvements in cardiac CT and thoracic scanning, use the link provided below.

www.siemens.com/SOMATOM-Sessions-investment

Whole Blood Total Bilirubin Determination in Neonates

About 60 percent of newborn babies display mild jaundice (yellowing of the skin) within the first two days after birth due to shortened lifespan of red blood cells coupled with slow maturation of liver glucuronyl transferase activity. Mild jaundice is usually not detrimental; however, some newborns develop severe jaundice from high levels of unconjugated bilirubin circulating in the blood.

Nearly 60 percent of newborn babies display mild jaundice, which can be a result of unconjugated bilirubin circulating in the bloodstream.

If left untreated, unconjugated bilirubin may deposit in the basal ganglia and brainstem, causing irreversible neurologic damage, a condition known as kernicterus. Kernicterus can cause cerebral palsy; problems with hearing, vision, and teeth; and mental retardation.

Simple and noninvasive phototherapy is the first approach to reduce high levels of neonatal bilirubin. However, if phototherapy does not lower the baby's bilirubin blood levels, an exchange transfusion may be required. Since untreated hyperbilirubinemia may cause severe permanent health problems, all newborns should be checked for jaundice. The practice guidelines of the American Academy of Pediatrics include provisions for measurement of total bilirubin to evaluate the degree of jaundice and the necessity for intervention.

Because of the complication of collection, limited blood volume, and higher hematocrit, testing neonatal blood can be challenging. Large reagent-based chemistry analyzers require the separation of plasma from the red blood cells prior to analysis. Blood gas analyzers offer an alternate method for assessing the risk of developing kernicterus using direct multi-wavelength spectrophotometry on small volumes of whole blood.

Siemens Healthcare Diagnostics magazine *Perspectives* presents a neonatal whole-blood total bilirubin performance evaluation of two blood gas systems: the RAPIDLab® 1245 from Siemens Healthcare Diagnostics compared to the Radiometer ABL 735, a member of the Radiometer ABL 700/800 family of systems.

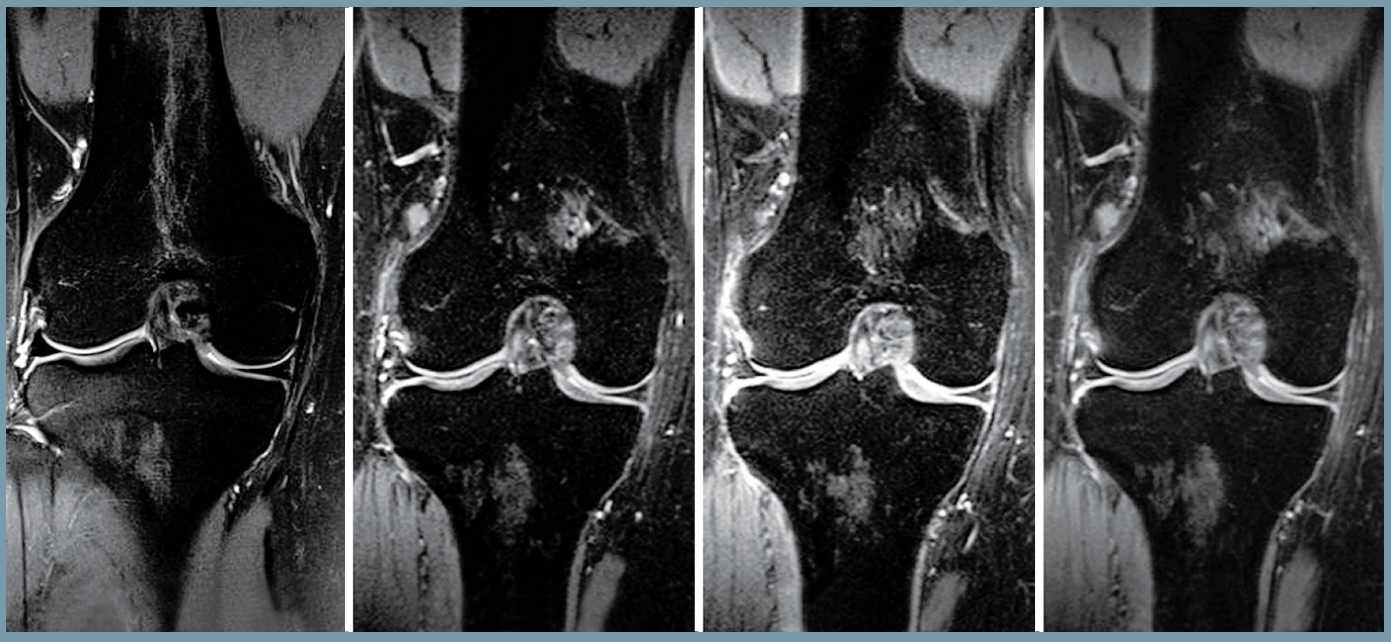
As demonstrated in the hospital setting using diverse clinical specimens from neonates, whole-blood total bilirubin analysis on the Siemens RAPIDLab 1245 blood gas analyzer is accurate and precise when compared to the Radiometer ABL 735. Analysis of unhemolyzed whole blood using the RAPIDLab 1245 or RAPIDLab 1265 is a clinically acceptable method for monitoring the development of pathologic concentrations of bilirubin in neonates. The full results for this new alternative for monitoring bilirubin in newborns can be accessed using the link below.

www.siemens.com/bili

3D High-resolution MRI of the Knee

Magnetic resonance imaging (MRI) of the knee is justifiably one of the most commonly performed MRI examinations, as it offers excellent direct depiction of cartilage, ligaments, menisci, and periarticular soft tissue. This can be achieved by standard application of fat-saturated moderately T2-weighted 2D Turbo Spin Echo (TSE)-sequences in three orientations. However, conventional TSE-sequences are not isotropic, hence structures and signal alterations/lesions with a size less than the usual slice thickness of three to six millimeters (mm), i.e., meniscal roots, may not be completely detected. A slice thickness below three mm is rarely acquired because of its reduced signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) as well as the prolonged acquisition time for complete joint coverage. Furthermore, postprocessing options are limited for 2D sequences for the assessment of structures which are captured in an oblique course through several slices, like the anterior cruciate ligament or the femoral trochlear cartilage. In this setting, the introduction of a highly resolved 3D moderately T2-weighted (3D-T2w-TSE) sequence may be useful. In research, time-efficient 3D-T2w-TSE sequences have already been evaluated for the central nervous system and recently for the body trunk. They enable data acquisition with high isotropic spatial resolution and allow for interactive three-dimensional visualization. Such postprocessing after an initial isotropic data acquisition has been proven successful in many other MRI and computed tomography-based applications.
The application *syngo*® SPACE, a 3D-TSE-sequence with moderate T2-weighting standing for 'Sampling Perfection with Application optimized Contrasts using different flip angle Evolutions' might establish a new approach to MRI for the knee. Parallel imaging facilitates blockwise 3D-data acquisition with isotropic spatial resolution for evaluation of the whole knee in a reasonable time window. Radiologists at the University Hospital of Munich's Department of Clinical Radiology investigate the application of *syngo* SPACE for imaging the knee and present their results, including shorter acquisition times as compared to two-dimensional datasets, in a recent article published in Siemens' MRI customer magazine, *MAGNETOM Flash*. That article can be accessed using the link below.

www.siemens.com/MAGNETOM-Flash-knee



As compared to the T2w-2D-TSE-fs in 3 mm (far left), coronal *syngo* SPACE reconstructions in 0.5 mm (middle left), 1 mm (middle right), and 2 mm (far right) show good homogeneity throughout the image.

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