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Thinking Healthcare Ahead

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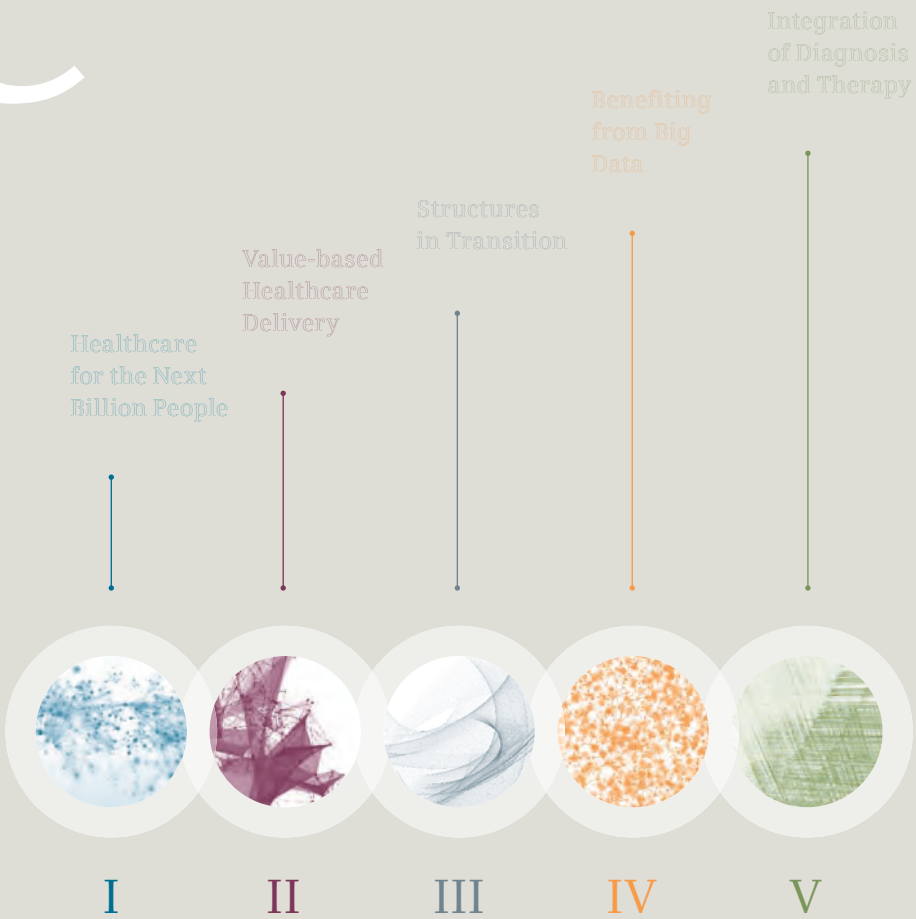
Integration of Diagnosis and Therapy
Benefiting from Big Data
Structures in Transition
Value-based Healthcare Delivery
Healthcare for the Next Billion People
I
II
III
IV
V

Virtual Models for Better Decisions

Text: Jürgen Schönstein

There have been a number of innovations in the history of imaging that drastically changed diagnostics. Virtual body models for the evaluation of therapies might just be the next milestone.

For decades after Wilhelm Roentgen's discovery of X-rays, medical imaging was a major tool in diagnostics. And since the late 1970's, scanning devices have been used as tools to guide minimally invasive procedures. But for Dorin Comaniciu, Head of Imaging and Computer Vision at Siemens Corporate Technology, this is just a prelude: "Today we do image-guided therapies," he explains. "Tomorrow, this will be about recommending and supporting therapy decisions, guiding therapy through very detailed models of the patient." Comaniciu, together with a team of 150 researchers, is working on using imaging and lab data to create computational models of a specific patient's body; for example, they build "virtual hearts," which will enable surgeons to better plan and manage their procedures.

With such models, they will also be able to predict if a therapy will work, thus reducing cost and patient suffering by avoiding ineffective treatments, and at the same time, improving patient outcomes. Greg Sorensen, CEO of Siemens Healthcare North America, sees these tools for optimizing the use of therapies: "Even more than a good diagnosis, in terms of frequency, monitoring how a therapy is working is what our technologies are used for – and if you do that well, you can save your healthcare system huge costs, by terminating ineffective therapies, and shifting people to effective therapies."

But this decision will always be the clinicians' to make, assures Sorensen: Predictive tools can help reduce the risk of error and support therapy choices, but not replace the clinical expertise. "A lot of our activities are about bringing more intelligence to the data," explains Comaniciu. "Our job is to bring value to the decision-making process." ■

Fast Facts

The global operating room market is expected to grow from nearly US$13.1 billion in 2014 to reach nearly

$21

billion in 2019.

Source: www.bccresearch.com, http://bit.ly/1p6ZHMt (last accessed 8/26/14)

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Diagnostics is the missing link for a sustainable healthcare system, providing immediate opportunities to reduce costs and to deliver higher quality of care.

Value Based Healthcare Center Europe

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Source: Value Based Healthcare Center Europe, http://bit.ly/1qoV5Gz (last accessed 8/26/14)

Personalized medicine and technological advances

With the cost of decoding an individual's genome expected to fall in the next two to three years to US$1,000 from its current price range of US$10,000 to US$25,000, the market for genome decoding in developed countries will explode. This will lead to a greater understanding of disease and the development of new therapies but will raise complex privacy and cost-benefit issues.

Source: Harvard Business Review (hbr.org), http://bit.ly/1q1G2mn (last accessed 8/26/14)

Bringing Value to the Decision-making Process

Text: Jürgen Schönstein
Photos: Steffen Thalemann

Innovation in healthcare is more than just improving technology – it is about re-thinking how healthcare is delivered, to improve outcomes and, at the same time, make it available to more people. Greg Sorensen and Dorin Comaniciu discuss how improving diagnosis will change healthcare for the future.

Too many people, in the U.S. as well as globally, have no access to healthcare at all. Will the healthcare of the future be healthcare for all?

Greg Sorensen: Expanding access is certainly a key part of what we are doing. The goal of less expensive medicine is shared by all. Our point-of-care diagnostics business, for example, aims to bring devices directly to any patient care environment. Much of this equipment is sold to doctors' offices and nursing locations.

But the equipment is becoming more and more complex. Take imaging, for example: A few decades ago, all you could do was take diagnostic pictures. Then, with improvements in quality, imaging became part of the treatment, using image-guided procedures. Where will this trend lead us next?

Dorin Comaniciu: We are currently working with imaging to develop virtual models – of the heart functions of an individual patient, for example. That involves understanding the anatomy, the movements, the electro-physiology and all specifically for the respective patient.

Greg Sorensen: When we think about wearable devices such as fitness bands, the reason they count steps so accurately despite many sorts of body movements is because built into their software is a model that interprets the signals that come from the device bouncing around. In the same way, a small data point like a blood test result can be used inside a model to inform larger questions about disease changes. This enables relatively simple measurements to become very powerful.

Something as simple as an app that could remotely model a person's health metrics, even if they don't have direct access to healthcare facilities?

Dorin Comaniciu: This will certainly be a very important direction for us. But here is what we can do already, for example, for patients whose hearts are not beating

synchronously. If this symptom is not treated, it can lead to heart failure. But cardiac re-synchronization therapy does not work in 30 percent of the patients. We want to find procedures through which we collect information about a patient, and based on a physiological model of the patient's heart, say in advance if this therapy will work or not. This is a very important new trend in medical science.

Greg Sorensen: And these tools can help prevent readmission, which saves a lot of money. About half of all patients, for example, do not respond to the therapy that they receive. Even more than a good diagnosis, in terms of frequency, monitoring how a therapy is working is what our technologies are used for – and if you do that well, you can save your healthcare system huge costs, by terminating ineffective therapies, and shifting people to effective therapies.

How do you decide where to focus your research efforts?

Dorin Comaniciu: Our researchers are passionate to make a difference in the real world. With our clinical partners – interventional radiologists, cardiologists, as well as surgeons – we are trying to improve the quality of care while helping to reduce the cost. One example is minimally invasive surgery, where building 3-D models of the interior human body will help with motion compensation: How do we compensate for breathing? Or take tumor operations: We build virtual models of the vessels inside the liver, and this modeling supports the minimally invasive procedures.

Is the purpose of the model to help the surgeon prepare his strategy through simulation, or is it used as a real-time tool during the procedure?

Dorin Comaniciu: Primarily, it is to prepare for the surgery – to understand what therapy will do. The second step is guiding the actual surgery with 3-D models, by showing, for example, on the model what kind of vessels you might touch during the excision of a tumor.

In other words, imaging is not just a guide, but more like an assistant. Could you imagine this being used in hospitals or health systems where such highly skilled medical experts are not available, bringing high-quality procedures into underserved areas globally?

Greg Sorensen: Absolutely. That is the most exciting part of the job for me: We have ›

Dorin Comaniciu (left) is Head of Imaging and Computer Vision for Siemens Corporate Technology in Princeton, New Jersey, USA

Greg Sorensen (right), a Harvard-trained medical practitioner and researcher, is President and Chief Executive Officer of Siemens Healthcare North America

Exploring new ways in integrating diagnosis and therapy: Greg Sorensen and Dorin Comaniciu.

an opportunity to massively impact how healthcare is delivered. Software that allows a surgeon in a remote part of the world to plan and deploy a surgical approach they otherwise could not do, that will help people all around the world.

So a lot of your research focuses on software?

Dorin Comaniciu: We do work with a lot of software that is tied in with the hardware – scanners, for example, are becoming more and more intelligent. Lab tests are becoming more intelligent. So a lot of our activities are about bringing more intelligence to the equipment. A good example is intelligent software for MRI. This future technology will allow MR scanners to do acquisitions many times faster – and it's strictly a software technology.

The USA is probably your biggest single market – but which market is most interesting in the longer term? China, India, or maybe Brazil?

Greg Sorensen: The growth lies not in any one country. It is definitely global, but we know that many trends that are set in the United States percolate throughout the world. The same ideas of paying for value, of quality and safety, are what everyone wants. Percentage-wise there is faster growth in other parts of the world, but innovations in the USA spread far and wide.

So from an American businessman's perspective, who has to deal with cost-cutting healthcare reform: Do you sometimes envy other healthcare markets?

Greg Sorensen (laughs): That's a good question. But you know something interesting? When patients in different countries are surveyed, they always love their own healthcare system. I am in the United States, and I love the U.S. market. It is the most dynamic, with lots of innovative things going on.

Dorin Comaniciu: I am always looking at this through the lens of technology. And I am quite optimistic that we can increase the efficiency of any system, while increasing the effectiveness for the patients.

Can you give us an example?

Dorin Comaniciu: When you look at fractures or lesions in ribs, which are curved, reading the images is quite cumbersome in 3-D. So

about eight years ago, we had the idea to "unfold" the rib cage, and then to provide the clinicians with a plane image, where they can immediately see if there is a problem. It took us quite some time to perfect this technology to unfold the rib cage reliably – but once we did this, it quickly became a product. You can imagine how much this has increased productivity, and also the confidence in reading these images.

Where do you see the next "killer app" in healthcare?

Greg Sorensen: One of the reasons that we work so hard to stay close to our customers is that we frequently see them taking a device we have designed for one use and start using it in a completely different way – which might open a whole new market for us. X-ray machines initially designed to look at bones were used to look at vessel wall calcifications. Blood tests thought to measure one disease state turn out to be valuable in many others. We have some ideas about where our technology is going, but we are fascinated by the directions our customers take our offerings.

Dorin Comaniciu: Reproducibility of results is one of the most important topics. We try to develop analytics to ensure that reproducibility increases, but the decisions still need to be made by the clinicians. We can present data in a way that the probability of errors is decreasing and ultimately the results are improving. Our job is to bring value to the decision-making process.

Greg Sorensen: And that is why there is no replacement for human skills. A finding or test result might be normal pre-op yet be abnormal post-op. Human knowledge will always be required to place findings in clinical and human context. ∎

150 Global researchers

Improving the outcomes for individual patients through better diagnoses and adapted therapies is one big challenge for the healthcare of the future – the other is to bring healthcare to the billions of people around the globe who currently have no access, by making healthcare more affordable. The solution to both challenges lies in making better decisions, which will improve results while reducing costs – and this is where Dorin Comaniciu, Head of Imaging and Computer Vision at Siemens Corporate Technology, and his 150 global researchers focus their attention. They are using imaging and lab data to create computational models of a patient's heart, for example – and with this "virtual heart," surgeons will not only be able to better plan and manage their procedures, they will also be able to predict if a therapy will work; this helps reduce cost by avoiding or adjusting ineffective treatments, and improves patient outcomes. "Smart scanning and testing" will not only guide procedures with high-quality images and lab data, but by using models, it will be more like a "virtual assistant."

In this context, Greg Sorensen, CEO of Siemens Healthcare North America, sees the current challenges for the health system in the United States as an opportunity to innovate for the global market: The United States has the highest standards in medical technology, but is under great pressure to optimize the cost of healthcare delivery. He knows that "people who want low-cost healthcare in the developing world actually share the same goal as everybody in the United States – affordable healthcare."

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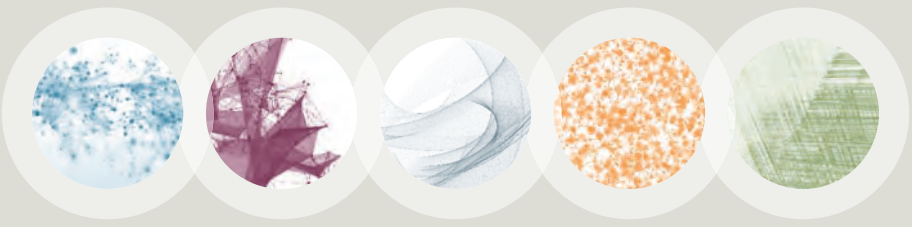

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