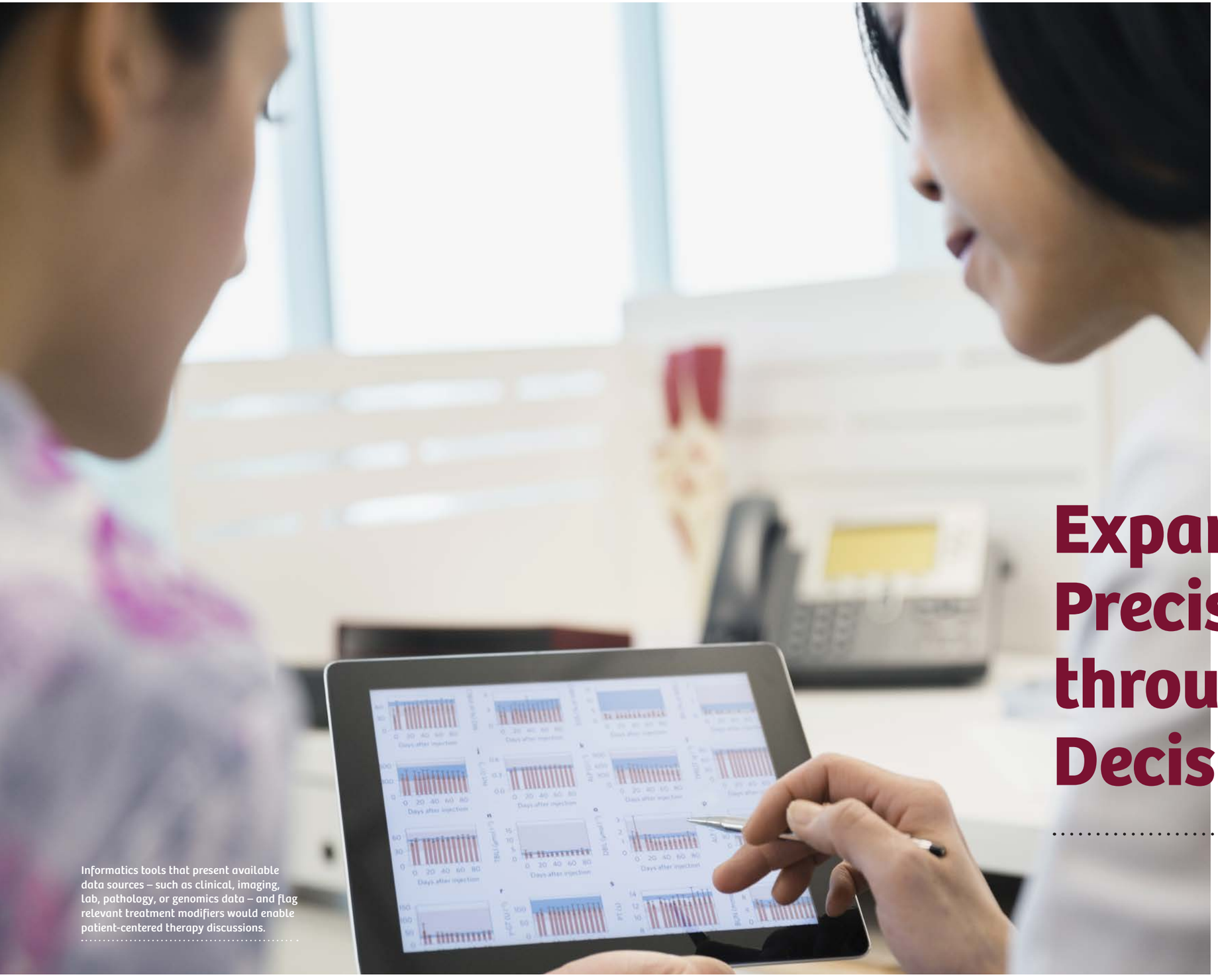


Informatics tools that present available data sources – such as clinical, imaging, lab, pathology, or genomics data – and flag relevant treatment modifiers would enable patient-centered therapy discussions.

Expanding Precision Medicine through Integrated Decision Support

Collating multiple data sources in clinical workflows allows for more precise and cost-effective diagnostics and therapies. Advances in cardiovascular and cancer medicine, for example, require intelligent IT tools and cross-disciplinary data-handling strategies, as a recent expert symposium showed.

Text: Catherine Shaffer | Photos: Getty Images, Peter Thompson

Paving the way for precision medicine

The increasing wealth of patient-related health data holds the promise of personalized and efficient diagnostics and treatment decisions – a paradigm for which the term "precision medicine" has been widely used. However, health data such as clinical, imaging, lab, pathology, or genomics data – still reside in isolated silos. Inefficiencies resulting from poor data integration have led to waste and error in clinical workflows as well as to overtreatment, resulting in harm to patients and significant cost overruns. A 2013 report by the Institute of Medicine pinpointed unnecessary and error-prone services as the largest contributor to waste in U.S. healthcare, with insufficient diagnostic information and the need to re-order tests as one of the major causes.[1]

Many experts agree that an integrated diagnostics approach that levers available data sources with the aid of computational tools and easy-to-use IT interfaces could help steer clinical pathways and pave the way for precision medicine.[2] This was also the focus of a special symposium supported by Siemens Healthineers at the 2017 meeting of the Radiological Society of North America (RSNA) in Chicago.[3] "Our aim is an innovative approach that matches each patient with treatment that works best for them" outlined Dr. Ihab Kamel, Professor of Radiology and Oncology at Johns Hopkins University in the U.S.

"Our aim is to match each patient with treatment that works best for them."

Dr. Ihab Kamel, Johns Hopkins University, Baltimore, USA

Collating data in cardiac care

Cardiovascular medicine offers an example of an area where integrated decision support tools can offer benefit in terms of patient outcome as well as reduction in cost and workflow efficiency, according to Dr. Ronak Rajani, who is a cardiologist with King's College in London, UK. In his presentation, he noted that while the burden of cardiovascular disease is increasing, the corresponding knowledge base and the disease-related data that doctors have to handle are increasing in parallel.

For example, ten years ago, evaluating a patient with chest pain was a relatively simple process, Rajani said. Today, it requires collating multiple datasets from heterogeneous informatic systems – including clinical data, electronic patient records, blood test results, ECG results, and prior imaging and angiography – before eventually proceeding to a coronary CT angiogram. Integrated decision support tools that pull together this information in a unified platform could ease workflows and help choose the best treatment options for individual patients.

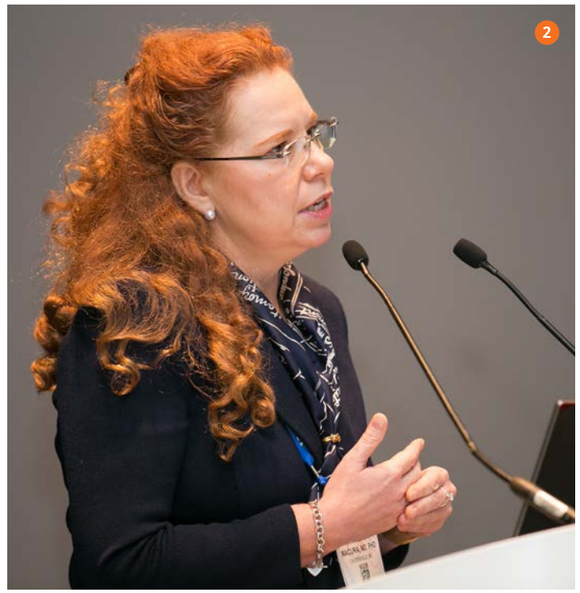
"We don't need more clinicians, we need intelligent solutions," said Rajani. As such, computer integration at the clinic workstation would not only offer the capability to collate patient records and best practices from the scientific literature – it would also allow outcomes for individual patients to be assimilated back into its algorithm, thereby helping to continuously optimize treatment strategies for future clinical decisions.

"If we take my practice of 2,500 cardiac CT scans being performed in London, and you have integrated decision support tools, and you have another nine centers around the world, you can start to see that you collect very robust, very analytical data from 25,000 patients in only one year," said Rajani.

1. Dr. Ihab Kamel
Clinical Director MRI, Professor of Radiology, Radiological Science and Oncology, Johns Hopkins University, Baltimore, USA

2. Dr. Katarzyna Macura
Professor of Radiology, Urology, and Oncology, Assistant Director ICTR Imaging Translational Program, Johns Hopkins University, Baltimore, USA

3. Dr. Ronak Rajani
Head of Cardiac CT at Guy's and St Thomas, Reader in Cardiovascular Imaging at King's College, London, UK



Towards precise cancer staging and risk stratification

Cancer care is another area of medicine that requires the integration of large amounts of data in the decision-making process. Data integration challenges include estimating risk, tumor staging, and coordination of multiple specialists in a team.

In prostate cancer risk assessment, for instance, computational tools may help overcome the decision-making challenge. PSA screening has been used since the mid-1990s to screen patients for prostate cancer and to predict risk. While this has led to reductions in mortality, it can also entail harmful overtreatment and

unnecessary side effects in less aggressive disease, according to Dr. Katarzyna Macura, Professor of Radiology, Urology, and Oncology with Johns Hopkins University in the U.S. This double bind has highlighted a need for better risk stratification and treatment decisions for those patients, Macura said.

She proposed a decision-making strategy leveraging blood, urine, and tissue-based biomarkers, as well as advanced MRI technology, to assess tumors and more accurately target biopsies. In the future, computational analysis and modeling tools could allow integrating multi-format data from high-throughput technologies (e.g., genomics, proteomics, and radiomics data) to reduce overtreatment and personalize disease management.[4]

Another application of IT-enabled decision support could be lung cancer, in which image-based tumor staging can be highly time-consuming. Imaging reports are variable in content and quality; in addition, curation of imaging and clinical data can be difficult. However, with simple interaction front-ends, curation can be made available and implemented in a software solution.

"We are faced by an avalanche of data. That's not going to stop," said Dr. Bram Stieltjes, Vice Chair of Research in the Department of Radiology and Nuclear Medicine at University Hospital Basel. According to Stieltjes, staging of lung cancer is frequently error-prone or inefficient. For example, positron emission tomography is the diagnostic standard procedure for staging patients with non-small-cell lung cancer, but reading the image takes an hour, and communication within nuclear medicine departments is often suboptimal, decreasing efficiency further. Most hospitals create freestyle reports that do not necessarily contain all relevant information. All of these factors may lead to misstaging and treatment errors, Stieltjes explained.

"Eventually, the aim of integrated decision making is value-based care."

Dr. Mathias Prokop, Radboud University, Nijmegen, The Netherlands

They suggest an automated staging system that makes use of imaging data from RIS and PACS repositories, combined with machine-learning-supported data curation and image annotation. The user interface then provides access for clinical readouts and annotated reporting. The process involves several learning phases based on the patient database before it produces a probabilistic tumor staging that can then be reviewed by tumor boards or diagnostic departments. "I really believe in man-machine interaction rather than a magical box that will solve the problem," said Stieltjes.

Integrating patient values

Not least, patient wishes need to be accounted for in integrated clinical decision-making. Dr. Ritse Mann, a Breast and Interventional Radiologist at Radboud University in Nijmegen, The Netherlands, highlighted this in his presentation, elaborating on the challenges of multidisciplinary team (MDT) decisions in cancer care.

According to Mann, the MDT process entails problems such as long preparation times to extract all relevant data from patient records, missing or overlooked data, and communication using primarily oral input during MDT meetings, making the process sometimes a "game of telephone," as Mann noted. For example, notes from MDT discussions are often taken by associates without specialized training and may contain inaccuracies, but still serve to communicate with other physicians.

Many of these problems could be overcome with informatics tools that ease patient data presentation and flag relevant treatment modifiers, thus enabling patient-centered therapy discussions, Mann said. However, the input of the patients themselves should not be overlooked in the process. By incorporating patient wishes in the MDT discussion, personalized medicine becomes a real-world option. Dr. Mathias Prokop, Professor and Chairman of Radiology at Radboud University, agreed: "Eventually, the aim of integrated decision making is value-based care, focusing on meaningful outcomes that are relevant for patients and their lives." ●

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6. Dr. Ritse Mann
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