

**Insights Series**

# Innovating Personalized Care

Perspectives on how more  
nuanced diagnosis and more  
precise treatment can dramatically  
improve patient outcomes



# Preface

The pace of change throughout the healthcare industry remains extraordinary, with startling new challenges as well as dazzling new breakthroughs seeming to appear almost daily.

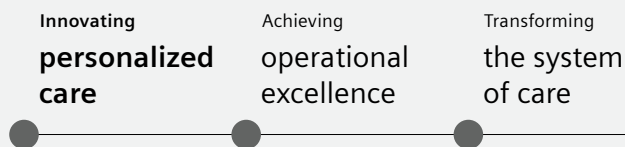
Many of the profound changes redefining today's global healthcare landscape were unimaginable just a few short years ago. A global pandemic has upended long-held assumptions about how to deliver care and respond to crises. Digital advances are revolutionizing the way patients manage their own health and treatment. Technological progress including Artificial Intelligence (AI) is building on many of our previous achievements while sparking rapid new changes.

Developments like these vividly demonstrate how difficult it is to predict the future. Nonetheless, **we believe that healthcare in the years ahead will be defined by three overarching themes**—three broad trends that encompass the most remarkable advances in healthcare as well as the most promising opportunities and the most pressing challenges.

These three themes are the improved patient outcomes made possible by advances in personalized care; the increasing importance of operational excellence; and the essential effort to continually upgrade and transform systems of care allowing for better access and greater health equity.

This thematic framework can make it easier to tackle day-to-day issues, providing a context in which to better understand how topics interrelate and how to develop long-term strategic goals that can be transformed into achievable and realistic targets.

At Siemens Healthineers, our purpose is to pioneer breakthroughs in healthcare. For everyone. Everywhere. Due to our unique capabilities in patient twinning,\* precision therapy and digital, data and AI, we believe we are uniquely positioned to help our customers and partners better understand these themes and successfully tackle them.



This paper explores one of these themes—**Innovating personalized care**—offering both an in-depth analysis of how this issue is unfolding, and a detailed look at actionable steps towards realizing this goal.

\* Patient twinning is currently under development. It is not for sale. Its future availability cannot be guaranteed.

# Background

Personalized care is seen as part of the solution to many of the most fundamental challenges facing healthcare systems globally—challenges like coping with the tremendous impact of growing noncommunicable and chronic diseases; managing the vast amounts of data being generated by new medical technologies and longer episodes of care; and effectively applying the growing capabilities of AI.

Personalized care, also referred to as precision medicine, is often understood as a way to improve health by treating patients based on their own genetic characteristics. Yet personalized care goes well beyond genetic medicine. It extends to incorporating all relevant clinical and lifestyle data, taking patient preference into account, and executing reliably on current available evidence.

## *The right treatment to the right patient at the right time.*

We are at a crucial and exciting moment in the evolution of personalized care, yet the concept is not new. In the U.S., the Precision Medicine Initiative was announced almost a decade ago. At that time, Dr. Larry Chu, a Stanford professor advising President Barack Obama on the program, offered some insight as to the effort's scope and goals. "I think precision medicine means precisely diagnosing conditions,

then integrating all relevant patient data and insights to guide care to the best outcomes. It is about providing the right treatment to the right patient at the right time."

Around the world, efforts are underway to harness the power of personalized medicine, with notable examples in China, the UK, Sweden, and other countries. In the U.S., the All of Us Research Program, born from the Precision Medicine Initiative at the National Institutes of Health, is ambitiously collecting medical and lifestyle data from more than one million individuals. This data will be used to create one of the most diverse health databases in history.<sup>1</sup>

Similarly, the UK Biobank stands as a massive biomedical research undertaking. Launched in 2006, it has already enlisted more than 500 thousand volunteers from across the UK. The long-term objective is to enhance the understanding, prevention, diagnosis, and treatment of various ailments, including chronic diseases and complex conditions.<sup>2</sup>

**For healthcare executives, industry leaders, and financial stakeholders, personalized care represents a singular opportunity.** It not only offers remarkable hope for patients, it also offers significant benefits to providers. It can improve patient outcomes and can contribute to significant cost savings through the reduction of wasteful, unnecessary, or ineffective treatments or therapeutic processes. It can also reduce the risk of adverse reactions and downstream costs for integrated networks.

In today's highly competitive healthcare landscape, personalized care can also serve as a competitive advantage, helping to attract patients and to recruit and retain staff. And by strengthening collaboration between clinicians, researchers, and other stakeholders, it creates opportunities for hospitals to build partnerships with other healthcare organizations, academic institutions, and biotech companies.

One example of a healthcare organization that has embraced personalized medicine and is seeing tangible benefits, is Johns Hopkins Medicine, which introduced Precision Medicine Centers of Excellence (PMCOEs). There are currently more than 20 PMCOEs for several medical conditions in operation at Johns Hopkins, and the goal is to have 50 such centers up and running by 2024.<sup>3</sup>

Applying personalized care demands a combination of technologies, as well as a willingness to embrace new ways of working. In some ways, it represents a departure from traditional medicine, which is often a top-down, population-based approach based on randomized controlled trials. Personalized care is a bottom-up approach starting with the mechanisms of cell or system-based disorders. Identifying the mechanisms of a disorder before it becomes an advanced, pathology-defined disease is necessary for targeted, personalized therapy.<sup>4</sup>

To realize the goal of personalized care, a comprehensive spectrum of health data is crucial, encompassing clinical

information, point-of-care testing, and specialized laboratory testing complemented by genetics, digital pathology, and medical imaging. Access to this broad range of data enables precise diagnoses and facilitates guided treatments.

Medical imaging plays a pivotal role in connecting diagnosis and treatment, aiding in disease identification, pre-clinical screening, and personalization of therapies.<sup>5</sup> The use of theranostics in combination with imaging allows for targeted and minimally invasive treatments.

The increasing importance of AI and machine learning is central to the effective application of personalized care. AI's ability to process vast amounts of data generates valuable insights that will empower caregivers and systems to enhance decision-making and learn from the outcomes.

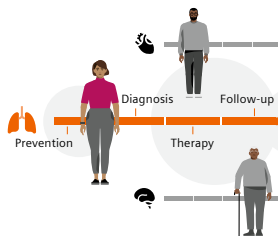
One critical challenge is to identify cost-effective and scalable methods for personalized diagnoses and treatments, ultimately leading to significant improvements in patient outcomes across diverse populations. Embracing the potential of data, technology, and collaboration will advance the field of personalized medicine and bring us closer to delivering optimal care for every individual.

Innovating personalized care rests on three cohesive elements, each of which will be explored in detail in the following pages:

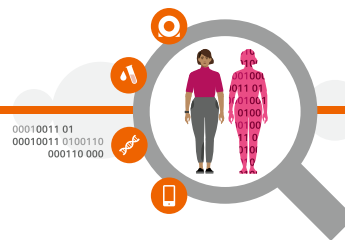
- **Organize care around the patient's medical condition**
- **Provide precise diagnoses for actionable decisions**
- **Deliver therapy outcomes that matter to patients**

## Innovating personalized care

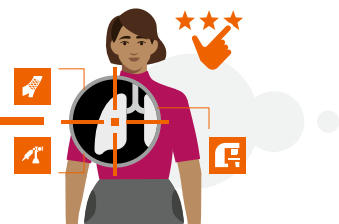
Organize care around the patient's medical condition



Provide precise diagnoses for actionable decisions



Deliver therapy outcomes that matter to patients



Implement **innovative best-practice standards** to organize care along the patient's clinical pathway, enabling you to **reduce unwarranted variations** as a precondition for personalizing care.

Read more on page 6

**Integrate precise diagnostic data**, enabling you to build a digital twin\* of the patient that provides a holistic understanding and actionable insights at the point of decision.

Read more on page 10

**Combine highly precise image guidance with minimally invasive, robot-assisted, and intelligent therapies**, enabling you to deliver better patient outcomes with improved, lasting therapy results.

Read more on page 13

# Perspectives

## Organize care around the patient's medical condition

One of the most essential and basic objectives of personalized care is to ensure that every patient receives care based on their unique medical condition. Such a strategy represents a move away from the traditional one-size-fits-all approach, toward a greater emphasis on patient-centered care and personalized treatment. Further accelerating this trend, patients are increasingly involved in their own medical decision-making.

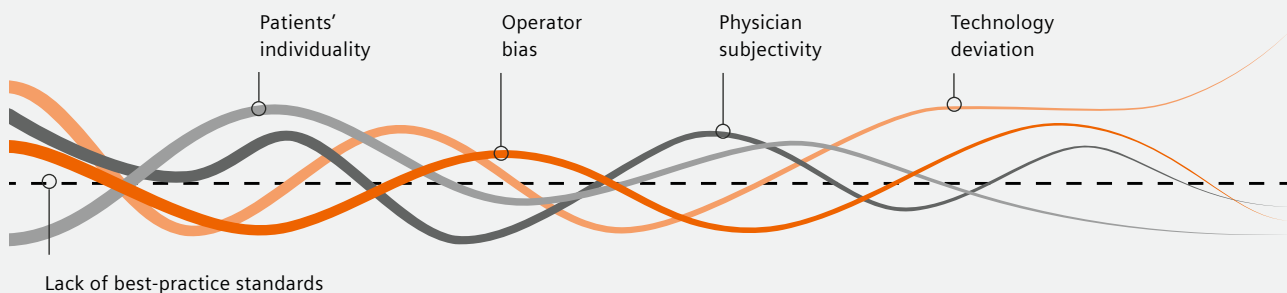
Yet the transition to personalized care is not seamless or simple—it faces various challenges, including fragmented healthcare systems, limited care coordination leading to frequent diagnostic and treatment delays, and other forms of discontinuity. Unwarranted variations in care further compound the issue, arising from clinical uncertainty, provider disparities, misaligned financial incentives, and geographic differences. These variations, influenced by patient-specific factors and systemic inability to attend to personal patient preferences, result in

wasteful resource utilization and suboptimal outcomes. Alarming statistics reveal that up to 25% of hospital costs are attributed to unwarranted variations, with some estimates reaching as high as 65%.<sup>6</sup>

Cancer care is one area where pathways today are frequently not organized around a patient's individual condition. This can serve as a telling example to illustrate the challenges and opportunities of personalized care. Other treatment pathways in other medical fields face similar situations (see illustration page 9).

Cancer patients experiencing urgent referrals often face delays in specialist consultations, with more than one in five not being seen within two weeks. For example, up to 40% of patients with breast cancer symptoms encounter delays in seeing specialists after referral. Such delays can have severe medical consequences for all cancer patients, as each month of delayed treatment can increase a patient's mortality risk by about 10%.<sup>7</sup>

### Sources of unwarranted variations



To overcome this, care pathways need to take patients' individual clinical conditions into account. It also requires the implementation and continuous improvement of best-practice standards. This depends on the seamless integration of diagnostic and therapeutic options as well as education to ensure that caregivers are aware of them.

This, in combination with the digital automation of workflows and pathways, lays the foundation for reducing unwarranted variations as a precondition for personalizing care.

Innovative technologies play a central role in enabling healthcare providers to standardize care and personalize care planning. In a radiology department, digital protocol management tools can streamline medical imaging protocols, ensure consistent and optimized image acquisition across different patient populations, and facilitate collaboration among healthcare professionals.

Technology can also support automated patient positioning before CT or MRI scans. By deploying innovative, new tools, manual adjustments are required only in about 10% of the cases,<sup>8</sup> resulting in more precise scanning and potential radiation dose reductions of up to 30% in the case of computed tomography.<sup>9</sup> During examinations, either for CT or even ultrasound, intelligent digital solutions can also reduce the

variability between patients. Standardizing these parts of a pathway provides for more quantifiable and comparable results, which helps with later data-driven decisions.

Cancer screening programs are another area where greater insights can lead to more data-driven decisions, which in turn contributes to improved outcomes. Screening is a crucial aspect of early detection and can be significantly improved with the use of new and more precise imaging devices. Mammography screening is widely recognized but not yet established in all parts of the world. In addition, more precise imaging like the use of tomosynthesis can support screening programs everywhere. Integrating digital prevention programs can complement statutory mammography screenings, providing women with more comprehensive information and advice.<sup>10</sup>

Lung cancer screening is another example where more personalized care can help to establish the right criteria and lead to more tailored approaches. Personalized, targeted lung cancer screening programs have proven to be more economical and effective than mass screening, leading to earlier detection and less invasive treatment options, helping combat a disease that causes five thousand deaths per day worldwide.<sup>11</sup> A meta-analysis showed that low-dose lung cancer screening can significantly reduce lung cancer mortality.<sup>12</sup>

Targeted low-dose CT lung cancer screening approaches are gaining traction and being rolled out in Europe as well as other parts of the world.<sup>13</sup> In the coming years, lung cancer screening is likely to contribute to more individualized treatment plans and improved outcomes as technologies continue to advance, and the policy consensus behind such screening grows.

Other areas of cancer care also stand to benefit from a more patient data-driven approach. By moving away from rigid, sequential process steps toward more interconnected, adaptive processes, waiting times for cancer patients can be reduced. More agile treatment planning creates opportunities in critical clinical situations where timing is of the essence, such as the possibility of same-day treatment in radiotherapy based on diagnostic images to immediately alleviate pain in patients with bone metastasis.<sup>14</sup> The effectiveness of radiotherapeutic cancer treatments can be enhanced by adapting or combining treatments based on more accurate information on how an individual patient responds or how anatomy shifts between treatment sessions.

Patient-reported outcome measures (PROMs) are another element of precision medicine whose value

goes far beyond cancer care. PROMs enable a seamless reporting of a patient's symptoms, quality of life, and treatment preferences. Integrating PROMs into treatment plans allows for tailored therapies and real-time progress monitoring. Leading cancer care providers like the Icon Group in Australia and Asia now deploy electronic patient-reported outcomes solutions directly into their systems for immediate treatment adaptations.

With cancer increasingly becoming a chronic disease, physicians are witnessing a rise in the number of patients requiring retreatment, leading to higher complication rates and at least doubling the time needed for medical professionals to manage these cases effectively. However, this evolving landscape also emphasizes the necessity of developing advanced care models that can predict therapy outcomes and cover the entire patient journey, integrating relevant patient cohort data. Collaboration between healthcare providers and medical technology companies in this endeavor underscores the vital role of leveraging technology to improve patient experiences and outcomes. GenAI, an AI-driven approach, is poised to play a pivotal role in enhancing follow-up care, optimizing information capture, processing, and reporting, ultimately revolutionizing the field of cancer treatment and management.

1 in 4

One in four individuals will experience a stroke in their lifetime.<sup>15</sup>

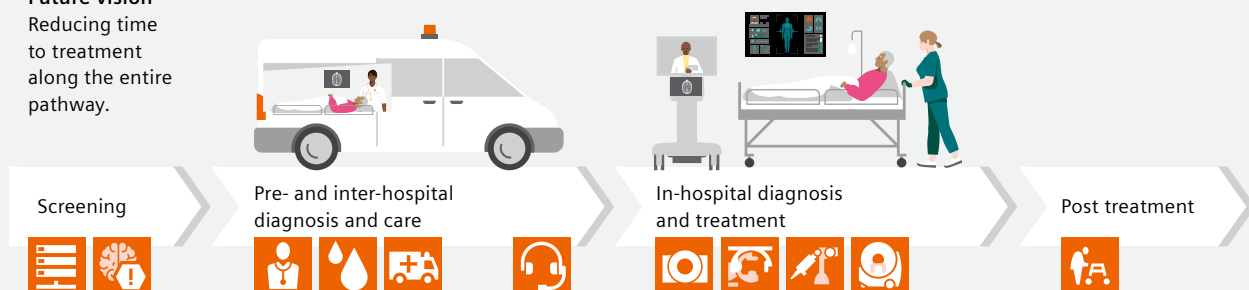


More personalized and flexible care approaches can have a significant impact. In the future, innovations such as mobile stroke units,<sup>16,17</sup> combined with data integration and intelligent triage technologies will transform stroke care delivery along the entire pathway—from screening and pre-hospital diagnosis to in-hospital treatment. Robotic-assisted interventions will further enhance stroke care.

**An exemplary best-practice case** from the Medical University of South Carolina is the world-class U.S. Stroke Belt program. This program has achieved a more than 7% reduction in inpatient length of stay for ischemic stroke patients, optimizing scheduling with digital twins\* for neurointerventional procedures, and is collaborating in pioneering robotic solutions for neuro-interventional capabilities.

## Stroke pathway

**Future vision**  
Reducing time to treatment along the entire pathway.



## **Provide precise diagnoses for actionable decisions**

A second area where meaningful progress is being made is in using more precise diagnoses to arrive at more actionable decisions.

A paradox within many healthcare systems worldwide is that the enormous amounts of data being generated fail to result in better medical decisions or outcomes, simply because the volume of data is too great to be understood, let alone applied in a meaningful way. AI and other tools are of some help, yet human decisions and input are and will remain essential.

It has been estimated that by 2025, more than 463 exabytes of health data will be generated worldwide daily. Yet developing ways to quickly and effectively apply this data demands an entirely new set of skills and tools. Only with innovation and interoperable new approaches will this data successfully deliver results.<sup>18</sup>

A related challenge is outdated or incomplete information, for example in patient records. Often paper-based data has not yet been digitalized, certain tests have not been performed, or results have not been recorded. And much of the digital data that does exist is not accessible to everyone who needs it because of limitations in technology or processes.

Even if all existing patient data, test results, clinical images, etc., are available, caregivers must still be able to manage and process the data. The pure amount of patient information, combined with the ever-growing volume of medical knowledge (guidelines, clinical

studies, medical codes, etc.) is barely manageable—and again, contributes to unwarranted variations.

### **The first step to overcome these challenges is to develop ways to improve the quality of data.**

In other words, to generate better data—data that is more accurate or more closely aligned with a specific illness or patient characteristics. The quality of medical imaging is improving rapidly, helping to provide more reliable and precise data. The 7 Telsa MRI scanners, for example, offer higher image resolution and improved tissue contrast compared to lower-field machines. This sophisticated technology aids in diagnosing and monitoring neurological conditions, and it allows for better visualization of lesions and abnormalities in knee structures.

Another example: Photon-counting CT scanners offer valuable benefits, accurately counting X-ray photons during scans to produce high-quality images while reducing radiation exposure. This can be particularly helpful for high-risk patients.

A clinical study at the University of Freiburg, Germany, found that ultra-high-resolution photon-counting CT angiography demonstrated high diagnostic accuracy in detecting coronary artery disease in a high-risk population, including those with severe coronary calcification or prior stent placement. This technology's potential to simultaneously assess coronary arteries and the aortic valve could reduce the need for invasive investigations and help lower healthcare costs.<sup>19</sup>

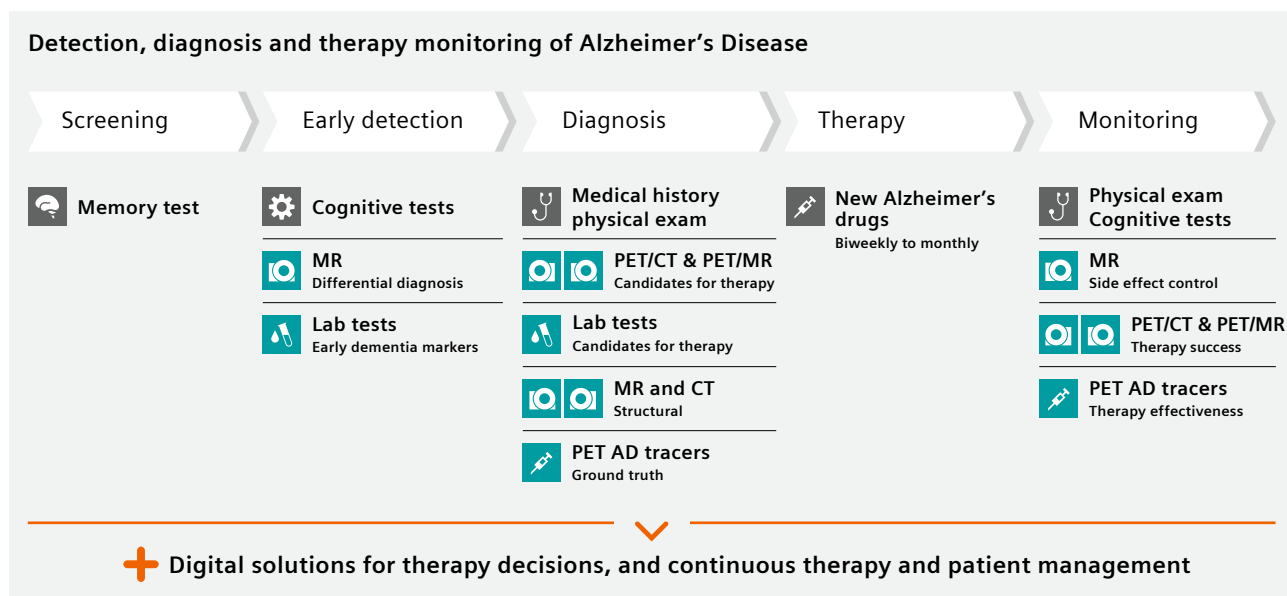
Better data can also refer to more accurate and timely results from lab tests, with data that is clear and easy to understand. According to the CDC, 70% of clinical decisions are based on lab results, making the accuracy and clarity of lab tests essential.<sup>20</sup> Sensitivity and specificity measures are crucial in evaluating diagnostic test performance, providing complementary information about its accuracy.

The Enhanced Liver Fibrosis (ELF™) blood test,\*\* a non-invasive in vitro diagnostic, serves as a valuable prognostic tool for assessing liver fibrosis severity, enabling effective treatment assessment, and personalized care for high-risk patients.

Alzheimer's Disease, which increased by 40% over the past decade and is currently responsible for more than

a quarter of all neuro-related deaths,<sup>21</sup> also demands precise detection, diagnostics, and monitoring. In addition to precise detection and diagnostics to identify the right patients for certain treatments, there is also a pharmaceutical dimension. With new Alzheimer's drugs entering the market such as humanized monoclonal antibodies, precise image-based therapy monitoring is essential to prevent dangerous side effects such as brain swelling.

**In summary: if one highly precise test can answer a given clinical question conclusively, it reduces uncertainty and anxiety for the patient, while eliminating the costs of unnecessary additional testing and ineffective treatments.**



\*\* The products/features mentioned herein are not commercially available in all countries. Due to regulatory reasons their future availability cannot be guaranteed. Please contact your local Siemens Healthineers organization for further details.

**The second step of the solution is to ensure that data is better integrated and more accessible.** Health platforms play a central role in achieving this goal by combining various applications and technologies to generate customized, end-to-end healthcare solutions. These platforms act as the foundation for this transformation, enabling access to international portfolios of transformative and AI-based applications that support operational, clinical, and shared decision-making.<sup>18</sup>

Within the medical imaging field, notable advancements have emerged. Data or image-fusion integrates data points from multiple sources, while cinematic rendering introduces a new generation of photorealistic medical visualization based on light transport. Additionally, multi-modal machine learning shows higher accuracy than unimodal methods, though it faces challenges in terms of scalability and information concatenation time.<sup>22</sup> In the field of medical diagnostics, advancements in hematology and digital pathology enable seamless integration that fosters better data integration, leading to more comprehensive patient insights.

**Digital twins\*** in healthcare offer a highly personalized approach to data integration. These virtual representations of patients, diagnostics, and therapies utilize raw data to compile information, simplifying complexity and mirroring reality. A major advantage of this technology is its ability to integrate precise diagnostic data, creating a virtual representation of patients that incorporates their physical and biological characteristics.

By achieving targeted insights and automating medical processes, digital twins represent the next step in using more precise diagnoses for more actionable decisions.

To make this possible, various health data types must be integrated and standardized.

Combining digital twins with the Internet of Medical Things (IoMT), including wearable devices and remote monitoring tools, enables real-time tracking of patients' health and treatment outcomes. Ultimately, this integration promises a transformative shift in healthcare, promoting more effective and individualized patient care.

By comparing individual health data with population studies, specific disease data, and treatment outcomes of other patients, AI may assist healthcare providers in developing comprehensive and personalized prevention or treatment plans and even reliably predict therapy outcomes. While patient avatars and organ or disease-specific models already exist, holistic digital twins that revolutionize therapeutic procedures and decision-making may evolve in the future.

Looking even further ahead, it is conceivable that a patient's digital twin could also include behavioral and psychological data, allowing decision-making to be even more personalized. However, the implementation of a robust digital infrastructure will be crucial to support the widespread adoption of digital patient twins in the healthcare sector.

The growing role of AI in healthcare is not limited to digital twins. AI will also help automate processes in radiology, improving image analysis and interpretation, as well as optimizing therapy planning and execution in areas like radiation therapy, neurointerventional procedures, or in general surgery.<sup>23</sup>

## **Deliver therapy outcomes that matter to patients**

**To deliver therapy outcomes that truly matter to patients, the foundation lies in establishing best-practice pathways and adopting precise diagnostic tools.**

The concerns and fears of patients are well known. Patients want the best possible treatment, but they also prefer treatments that are less invasive, less time-consuming, less costly, and with fewer side effects. They want clear and understandable treatment plans. Patients want care that does not involve lengthy delays as they seek the right specialists. More personalized care can help to make all of this more attainable.

More personalized risk assessment and remote monitoring contributes to earlier detection of many diseases. This allows patients to benefit from earlier treatments which are often smaller than highly complex therapies. A broad range of minimally invasive treatments and procedures are already well established and make it possible to shift many types of interventions into the outpatient sector. For instance, the application of minimally invasive techniques has revolutionized stroke treatment, with a remarkable increase in endovascular thrombectomy procedures to remove blood clots from blocked brain arteries. These procedures benefit patients by providing earlier and less invasive treatment.

**The synergy of highly precise image guidance with minimally invasive procedures has proven to be instrumental in various medical fields including cardiovascular interventions.**

These models enable precise targeting of lesions, minimizing risks to surrounding healthy tissue and

ultimately with the aim to improve patient outcomes and further reduce recovery times.

Real-time imaging during procedures like mitral and tricuspid clipping further enhances the accuracy and effectiveness of interventions. Image guidance can also enhance percutaneous coronary interventions (PCI), by allowing interventional cardiologists to visualize the coronary anatomy in real time and accurately identify the location and severity of blockages. Angiography provides dynamic images of blood flow during the procedure, aiding in lesion assessment and guiding stent placement. CT imaging can complement angiography by offering detailed 3D views of the coronary arteries before the intervention, enabling sub-millimeter precision and more accurate stent measurement, especially in complex cases.

Yet another new frontier is image-guided drug delivery. This can be employed in interventional cardiology to precisely deliver medications or therapeutic agents to treat coronary artery disease, restenosis after stent placement, and other cardiovascular conditions.

**Integrating robot-assisted interventions with precise, real-time imaging also offers significant advantages, allowing procedures to be performed with greater accuracy and reduced risks.** In the neurovascular field, for example, such an approach allows for precise and minimally invasive procedures to treat complex neurovascular conditions. The real-time visualization of delicate structures in the brain enables neurosurgeons and neuroradiologists to navigate with enhanced accuracy, reducing the risk of damage to surrounding healthy tissue, leading to improved patient outcomes and shorter recovery times.

Looking ahead, the future of robotics holds tremendous promise. Interventions will become more accessible, minimally invasive, and data-driven, with nimble, intuitive, efficient, and safe supporting technology. As of now, surgical robots are more advanced than interventional robots, but there is significant room for future development. Embracing robotic technology will impact hospitals on clinical, organizational, operational, and financial levels, contingent on how organizations respond to this opportunity. Robotic assistance, for example, in neurological interventions for stroke or for navigation in transcatheter valve replacements, supported by AI and sophisticated sensors, will enable proceduralists to navigate complex vasculature more effortlessly and efficiently, ultimately leading to reduced procedure duration and fewer errors.

**A further area where outcomes can be more closely aligned with patients' needs and expectations is in identifying intelligent cancer therapies.** Medical imaging, including MR, plays a crucial role in treatment planning, adaptation during radiotherapy, and radiotherapy assessment. Ongoing clinical studies

explore multimodality imaging in cancer treatment, empowering precision oncology. AI-based technologies enable the use of high-quality image capture during daily radiation treatments, aiding in the case of re-localization of tumors and facilitating replanning and adaptation to changes in tumor size and critical organ locations.<sup>6</sup>

The rapidly growing capacity of AI also holds enormous potential as cancer increasingly becomes a chronic disease. Today, growing numbers of patients come for a second or third time to be treated with radiotherapy, with extensive periods of intermittent care in between.

Such situations demand integrating data from previous episodes of care to provide highly individualized treatment and chart the best way forward for each patient.

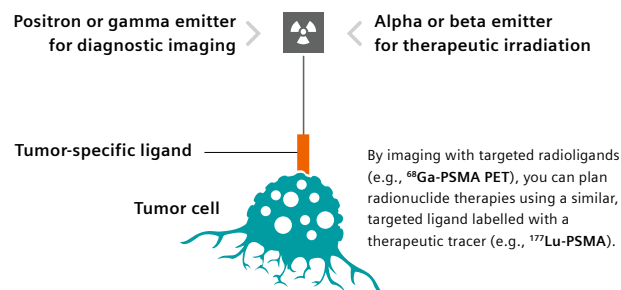
AI and deep learning techniques will play a significant role in these situations, enabling data-driven radiation therapies that predict treatment responses and toxicity levels, thereby improving both precision and effectiveness.<sup>24</sup>

## Therapy + Diagnostics

**Theranostics enables precision oncology by personalizing cancer care therapy<sup>25,26</sup>**

**Theranostics is an innovative concept** of personalized therapy that focuses on both the accurate selection of patients and providing them with targeted radioligand therapy to improve their prognosis.

Theranostics refers to structurally similar diagnostic and therapeutic agents that share a molecular-specific target that involves the use of molecular imaging techniques to identify, personalize, and monitor therapy response. It makes use of pharmaceuticals, such as radioligands, to target and treat specific areas.



Theranostics, an approach that combines diagnostics and therapy using biomarkers and advanced imaging, will also play an increasingly important role in making cancer care more patient-centric. The integration of theranostics and targeted drug therapy is one way in which more personalized treatments are being realized. Theranostics is already being applied in the area of prostate cancer, to create more tailored treatments and minimize side effects.

Further advances can be expected in the coming years, including the development of new drug-radiotherapy combinations designed to make treatment more effective and reduce resistance risks. Organ-specific risk stratification will guide clinicians in selecting the most suitable combinations for each cancer type and affected organ. Immunotherapy which utilizes the body's immune system to target and eliminate cancer cells, also shows promise for various cancer types and offers the potential for long-term remission and improved survival rates.

### Leadership strategies

A final, crucial step which is essential to each of the three efforts discussed in this paper is effective and strategic leadership—leadership that not only makes the right decisions but understands the full breadth and scope of the challenges associated with the transition to personalized care.

Some of the specific strategies that define successful leadership in this area include efforts to:

- **Focus on high-impact areas:** identify areas with the greatest potential for quick wins and measurable improvements.
- **Identify champions:** utilize existing knowledge and resources, including case studies and academic literature, and learn from other hospitals' experiences.
- **Commit to comprehensive staff training:** ensure that healthcare professionals receive specialized training in intelligent cancer therapies, image-guided minimally invasive procedures, and robot-assisted interventions.
- **Drive a culture of change management:** encourage a culture of innovation and change to drive the adoption of innovative solutions among staff.
- **Strategically invest in advanced equipment:** assess clinical areas and invest in cutting-edge equipment to support these therapies.
- **Create accountability for the use of data-driven decision support and AI:** in addition, advocate for regulatory and ethical considerations by engaging with regulatory bodies.

# Strategies and future outlook

The future of personalized care is promising, driven largely by advancements in the precision of data that is collected on every patient, with every data point providing additional and more specific information.

One example is AI-based predictive models based on data from confirmed patient outcomes. These models can aid physicians in the prognosis of disease progression based on commonly available clinical information such as blood tests, ordered by emergency physicians or primary care physicians at outpatient clinics. At the same time, advances in imaging technology, such as photon-counting CT or AI-based MRI reconstruction will further drive resolution and quantification of available information and contribute to establishing reliable imaging biomarkers.

Comprehensive data collection and appropriate access allows healthcare professionals to uncover connections and patterns in data that were previously undiscoverable. This is leading to more precise, evidence based care, opening up opportunities to take patient preference into account by making treatment options and expected outcomes transparent and allowing decisions to be made collectively.

In addition to technological advances and breakthroughs, governmental initiatives, such as the already mentioned All of Us Initiative in the U.S. and the Precision Medicine Initiative led by the Agency for Science, Technology, and Research (A\*STAR) in Singapore, are fostering

collaborations between research institutions and healthcare facilities to harness big data and AI for personalized care.<sup>27</sup>

In other medical fields, such as the pharmaceutical industry, companies are utilizing AI and machine learning to analyze vast amounts of genetic and clinical data, supporting the development of more targeted therapies for specific patient populations. In addition, new diagnostic schemes are being developed to identify patients who can benefit most from targeted therapies and to monitor potential side effects.

The future of personalized care does not, however, rest solely on technological advancements or greater collaboration. It also demands addressing holistic industry challenges, embracing ethical considerations, navigating regulatory landscapes, and promoting patient-centric approaches.

One prominent example of efforts to improve data use for personalized care is Germany's digital health regulation.<sup>28</sup> This regulation, currently still in its draft stage, aims to address several pain points related to patient health data. Data, including clinical cancer registers and different health insurance systems, is not readily available for research due to its decentralized storage across various platforms. Additionally, navigating through multiple data regulations within federal and state laws further complicates the utilization of this valuable data for healthcare advancements.

Important regulatory issues like these are currently being tackled around the world.

Addressing socioeconomic disparities in access to personalized care is also necessary to prevent a move towards a form of medicine that is available only for the affluent. Collaborations between healthcare providers, governments, and non-profit organizations can play a significant role in assuring equitable access to innovative healthcare solutions that are available to all patients regardless of their economic status or geographical location. This goal has led to the establishment of the World Economic Forum's Initiative for Precision Medicine, which aims to support the building and testing of policy frameworks to realize the benefits of precision medicine for society while also reducing the risks.<sup>29</sup>

In the coming years, healthcare leaders must actively engage with policymakers to advocate for policies that support the integration of advanced technologies while safeguarding patient well-being. This type of open dialogue is essential for fostering an environment that nurtures positive advances in personalized healthcare.

In conclusion, personalized care represents a fundamental shift in healthcare delivery, combining advanced technologies with ethical considerations, collaborative partnerships, and patient-centric approaches. By organizing care around a patient's medical condition, providing precise diagnoses and delivering outcomes that matter, a transformative healthcare journey awaits.

*The results and statements by the Siemens Healthineers customers described herein were achieved in the customers' 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 other customers will achieve the same results.*



## Suggested follow-up:

If you are interested in exploring the solutions offered by Siemens Healthineers on delivering precision diagnostics and precision therapy, please see:  
[siemens-healthineers.com/insights/innovating-personalized-care](https://www.siemens-healthineers.com/insights/innovating-personalized-care)

- Insights Series, Issue 1: Five steps every hospital CEO should start today  
Available at: [siemens-healthineers.com/insights/news/insights-series-1](https://www.siemens-healthineers.com/insights/news/insights-series-1)
- Insights Series, Issue 31: The future of interventional services – Advancing robotics in healthcare  
Available at: [siemens-healthineers.com/insights/news/future-interventional-services](https://www.siemens-healthineers.com/insights/news/future-interventional-services)
- Insights Series, Issue 41: Starting Radiotherapy in hours instead of weeks  
Available at: [siemens-healthineers.com/insights/news/starting-radiotherapy-in-hours](https://www.siemens-healthineers.com/insights/news/starting-radiotherapy-in-hours)



## Information:

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# About the authors



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Senior Global Marketing Manager  
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Isabel Heim is Senior Global Marketing Manager for Innovating Personalized Care, responsible for strategically aligning the company's messages and goals with its technological innovations, research, and portfolio. She spent several years in healthcare strategy consulting at Monitor Deloitte, serving clients in the provider, medtech, and pharmaceutical segments. Isabel has also worked at the European headquarters of Olympus, as well as at Konica Minolta.

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**Reto Merges**  
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With more than 10 years' leadership experience in healthcare marketing, Reto Merges has a strong track record in building effective teams for clinical and innovation marketing. In addition, he has four years of work experience in China, ramping up efforts for research collaborations in China and South Korea.

Reto holds a degree in electrical engineering and information technology from the Karlsruhe Institute of Technology, Germany, and has studied at the Nanjing Normal University, China. His scientific background is in the field of medical imaging, where he has authored many publications and holds multiple patents.

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