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Medicine's dynamic duos

Leipzig is working on the healthcare of tomorrow

In Leipzig, expertise in the field of virtual medical twins as an innovative technology for the healthcare of tomorrow has been growing for years. The goal is to develop the next generation of virtual twins. Medicine's new "dynamic duos" are much more than just a common interface to data or an electronic patient file. What approach is Leipzig taking in their development? **By Urs Moesenfechtel**

In simple terms, a virtual medical twin is a computer-based image of a patient. It links all case-related data such as laboratory findings, medical history, CT/MRI images, genome data or evaluations of surveys on quality of life. Virtual twins enable proactive health management for patients, the optimization of therapies, and the prediction of treatment outcomes. They can also provide decision-making support on various medical issues.

MediNet: Flexible and cost-efficient integration of virtual twins

Virtual twins are used to create standardized interfaces to the clinical IT systems in which patient data is stored in a distributed manner. In Leipzig, work is already underway on the next generation of virtual twins. The MediNet research and development project of the Innovation Center Computer Assisted Surgery (ICCAS), which has been running since 2022, has set itself the goal of accelerating transfer in the healthcare sector. To this end, a technology platform for time- and location-independent medical care based on virtual twins was created. The focus is

By using virtual twins, all case-related data is continuously available across all applications and on different devices – during consultations, at the workplace and on mobile devices. Location and time-independent, collaborative work is made possible in healthcare facilities and telemedicine.

Photo: © Matthias Brandt | Universität Leipzig – ICCAS

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> *Virtual twins enable proactive health management for patients, the optimization of therapies, and the prediction of treatment outcomes.*

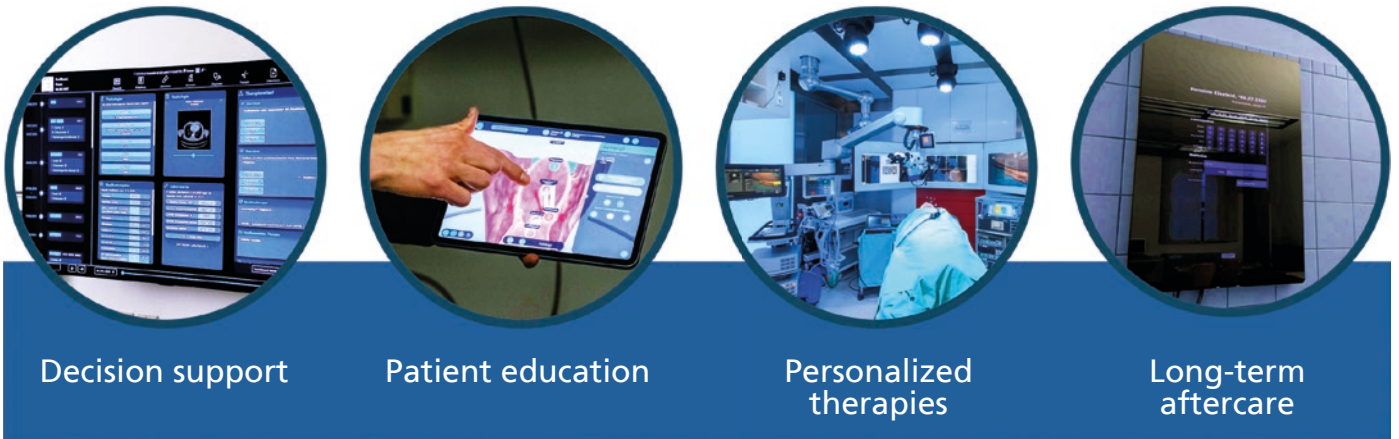on improving the integration of mobile sensor technology, stationary medical technology, IT systems and the medical experts. Regional companies are supported in the integration of their systems.

MediNet wants to contribute to helping overcome the biggest hurdles when it comes to new products entering the healthcare market: the structured identification of needs and synergies, as well as the integration into the complex, less standardized IT landscapes of providers. The project, which is funded until March 2026, has one unique feature: The backend technology (virtual twin) of the MediNet platform is independent of medical disciplines and manufacturers. In order to integrate a new AI method or application, the platform no longer needs to be individually tailored to a hospital's technical framework. "The MediNet platform reduces risks and costs for SMEs and

users in the healthcare sector. The platform is constantly being expanded, so that SMEs developing innovative healthcare technologies can continue to be a part of it in the future," says Prof. Neumuth, Technical Director of the Innovation Center Computer Assisted Surgery at Leipzig University.

The CERTAINTY project: Virtual twins in cancer immunotherapy

The CERTAINTY project was also launched in Leipzig in December 2023. The project is developing a virtual twin for cancer immunotherapy, in particular for CAR T-cell treatments for multiple myeloma. The Leipzig team at the Fraunhofer Institute for Cell Therapy and Immunology (IZI), Leipzig University Medicine and ICCAS, as well as the Fraunhofer Center for International Management and Knowledge Economy (IMW), has joined an

| Decision support | Patient education | Personalized therapies | Long-term aftercare |

Virtual twins connect medical stakeholders and technical systems along the entire value chain. The shared platform makes data available across system boundaries, enriches it with automatic analyses, and thus supports assistance systems, e.g. for decision support in tumor boards, during digitally supported patient-specific education and surgical procedures, or in aftercare and nursing.

Illustration: © Matthias Brandt | Universität Leipzig – ICCAS

international consortium and is collaborating with biotech companies like Singleron Biotechnologies GmbH/Germany, TriNetX Oncology GmbH/Germany, and Roche Pharma AG/Switzerland. Other research institutions and clinics in Germany, the Czech Republic, France, Belgium and the Netherlands are also involved. Patient organizations and professional associations such as the Myeloma Patients Europe AISBL, headquartered in Belgium, the European Society for Blood and Marrow Transplantation (EBMT) from the Netherlands, and the HealthTree Foundation in the USA are also involved. Over the next four years, CERTAINTY plans to set up a complex infrastructure for virtual twins in cancer immunotherapy which will link information from the cellular level, clinical data, treatment courses, social factors, and manufacturing processes for CAR-T cell therapeutics. "Based on various computer-aided models and algorithms,

CERTAINTY will aid in the development of a virtual twin for the individual disease progression and course of treatment of patients with multiple myeloma who can be treated with CAR-T cell therapy. We also have long-term plans to adapt the virtual twin to other indications being treated with cellular immunotherapies," says Dr. Kristin Reiche, CERTAINTY project leader and head of the bioinformatics working group at the Fraunhofer Institute for Cell Therapy and Immunology in Leipzig.

Challenges and research activities in the field of virtual twins

Nationally and internationally, there is growing research activity on digital/virtual twins in medicine, but most projects in this field focus on specific diseases. Often a fixed combination of components is developed, which can then only be used in very specific contexts. Independent platforms and robust standards either do not yet exist or lack a broad base. The opportunities for start-ups and SMEs to quickly launch innovative products on the market is limited by the dependence on large manufacturers in particular.

Leipzig's concept for the next generation of virtual twins

The next generation of virtual twins, as they are now being developed through MediNet and CERTAINTY, addresses these issues and thus goes far beyond a common interface to data or an electronic patient file. Instead of marketing a single virtual twin product as a standalone or as

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a product that is firmly integrated into the ecosystem of a large company, the Leipzig concept of virtual twins opens up the market for innovations. The entire network of partners is working on establishing virtual twins in healthcare in a sustainable way. The long-term goal is to make central Germany into a model region for virtual twins. Research and development projects to set up and establish virtual twins in healthcare are currently being supported by public third-party funds. These come, for example, from the EU and from the infrastructure funding in the region. The funding includes regional transfer activities aimed at connecting companies, research institutions, and healthcare providers. In MediNet and CERTAINTY alone, more than 20 researchers, clinicians, and engineers are already working on the next generation of virtual twins. ∎
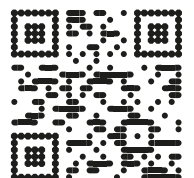
Leipzig for Life Changers

Bringing smart ideas to market – in Leipzig

The healthcare market is rapidly evolving:
health apps, networked medical technology, operations by robot –
exciting innovations are emerging in all areas. But where do these smart ideas
reach market maturity and decisively drive the transformation process?
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