White Paper

Digital Twins in Healthcare

Unlocking the future of personalized medicine and diagnostics

HUDA MUBARAK, Consultant, Global Consulting Services, IQVIA MedTech

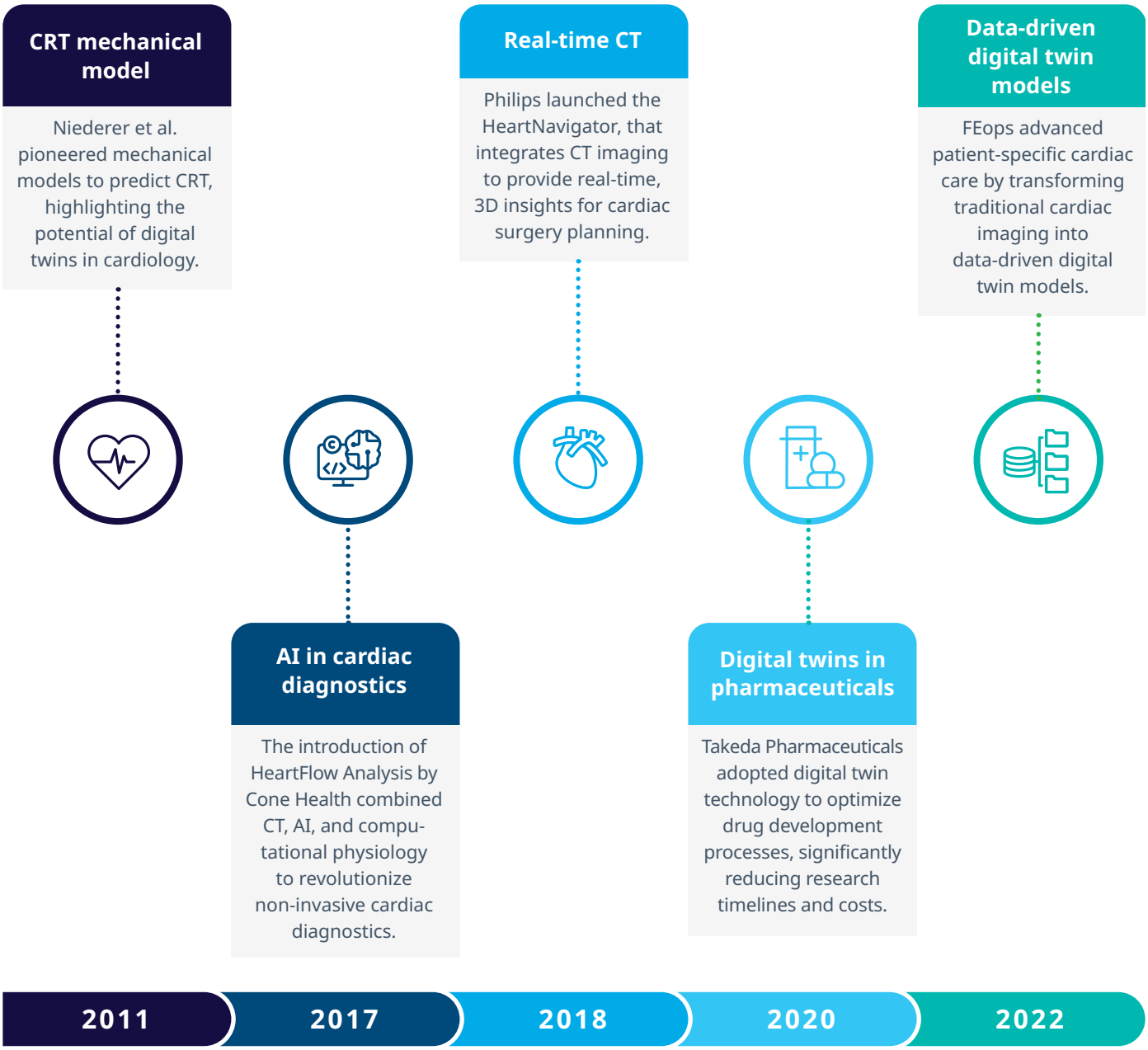
Table of contents

Introduction

Once a futuristic concept born in aerospace and automotive industries, digital twins are now reshaping healthcare. These real-time virtual replicas of organs, patients, or entire hospital systems continuously sync with real-world data from sources like electronic health records, wearable devices, and imaging.[1] In doing so, they enable highly personalized treatment, faster innovation, and smarter operations.

Their evolution in healthcare has been marked by pivotal moments: from the 2011 study by Niederer et al. demonstrating mechanical modeling for predicting CRT outcome,[2] to the 2017 introduction of HeartFlow Analysis—a breakthrough in non-invasive cardiac diagnostics using CT and AI.[3] These milestones paved the way for tools like Philips' HeartNavigator in 2018[4] and Takeda's integration of patient-specific simulations into drug development in 2020.[5]

The development of digital twins in healthcare has been marked by several pivotal milestones



Source: IQVIA MedTech Research and Analysis

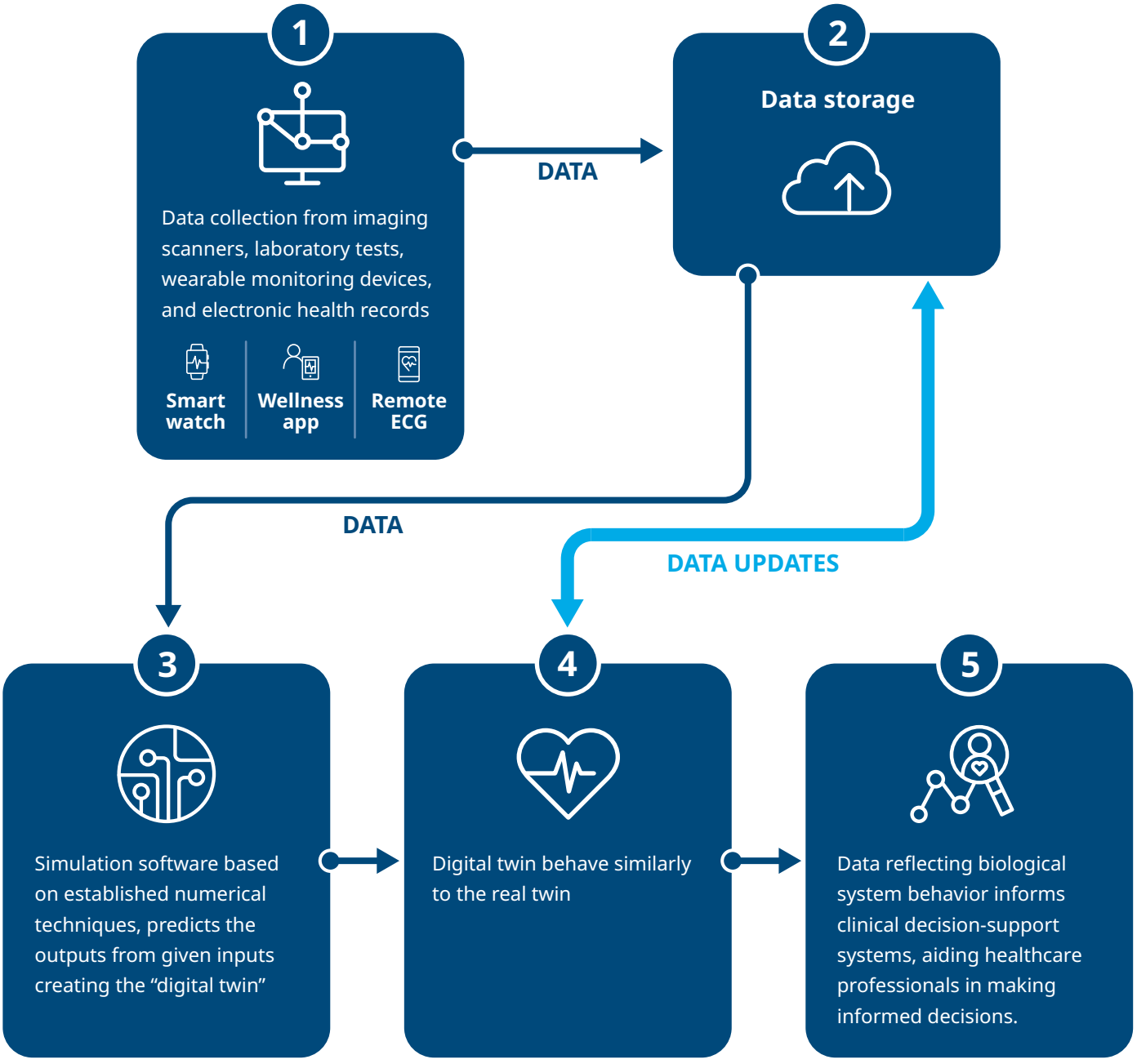
From concept to care: How digital twins work in healthcare

Digital twins operate by integrating real-time data with advanced simulation technologies to mirror the behavior of biological systems. They collect structured data from CT scans, lab results, wearable devices, and EHRs to simulate organs or physiological functions.[6,7]

These models are then used to test treatment options virtually, predict disease progression, and support clinicians in delivering personalized care.

For example, in cardiovascular care, a digital twin of a patient's heart can simulate how different stents would behave pre-surgery.[7] These models evolve continuously, updating with new data to remain relevant over time. They're not just digital blueprints—they're active tools for clinical insight.

How does a digital twin work?



Source: npj- The health digital twin to tackle cardiovascular disease

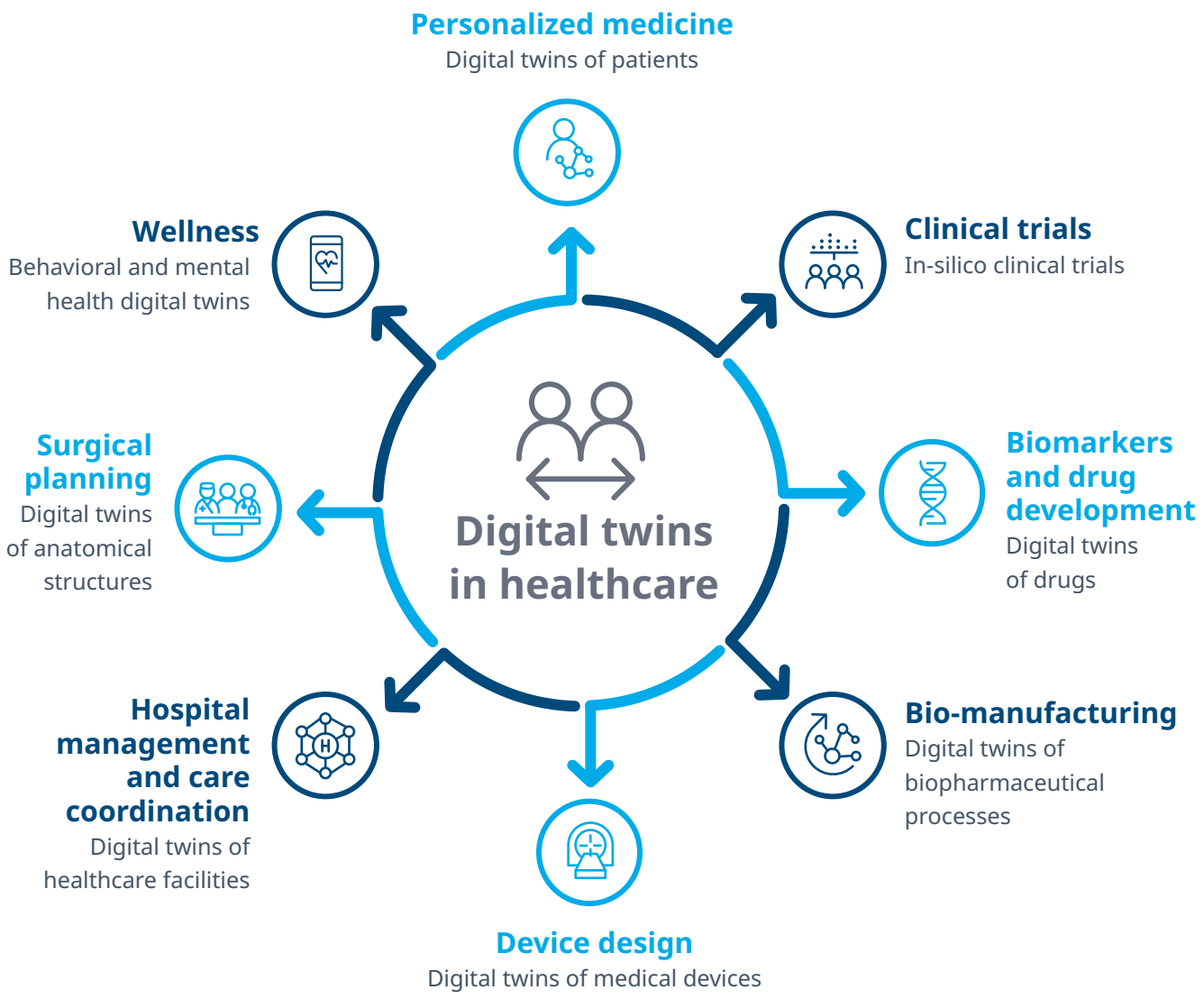
Real-world applications, market drivers, and industry momentum

Across the globe, hospitals, MedTech innovators, and life sciences firms are already putting digital twin technology to work. HeartFlow's AI-powered heart simulations help cardiologists plan interventions more precisely.[3] Philips' HeartNavigator gives surgeons a virtual look at a patient's anatomy before they even make an incision.[4] FEops' HEARTguide enables physicians to simulate and optimize transcatheter valve implantations, cutting down on procedural risks and costs.[8]

Healthcare systems, supported by partners like GE Healthcare, are using digital twins to manage workflows, streamline staffing, and reduce emergency room bottlenecks.[9] Pharmaceutical giants like Takeda are adopting the technology to accelerate drug development timelines by simulating human responses before a single clinical trial participant is enrolled.[5]

This uptake is being driven by several converging forces: demand for personalized care,[10] breakthroughs in AI and IoT,[11] and rising pressure to reduce costs while improving outcomes.[11] Regulatory openness—especially in Europe and Asia—is also creating a supportive environment for clinical-grade digital twin solutions.[11]

Applications of DT in healthcare



Source: npj- Digital twins for health

Challenges and considerations

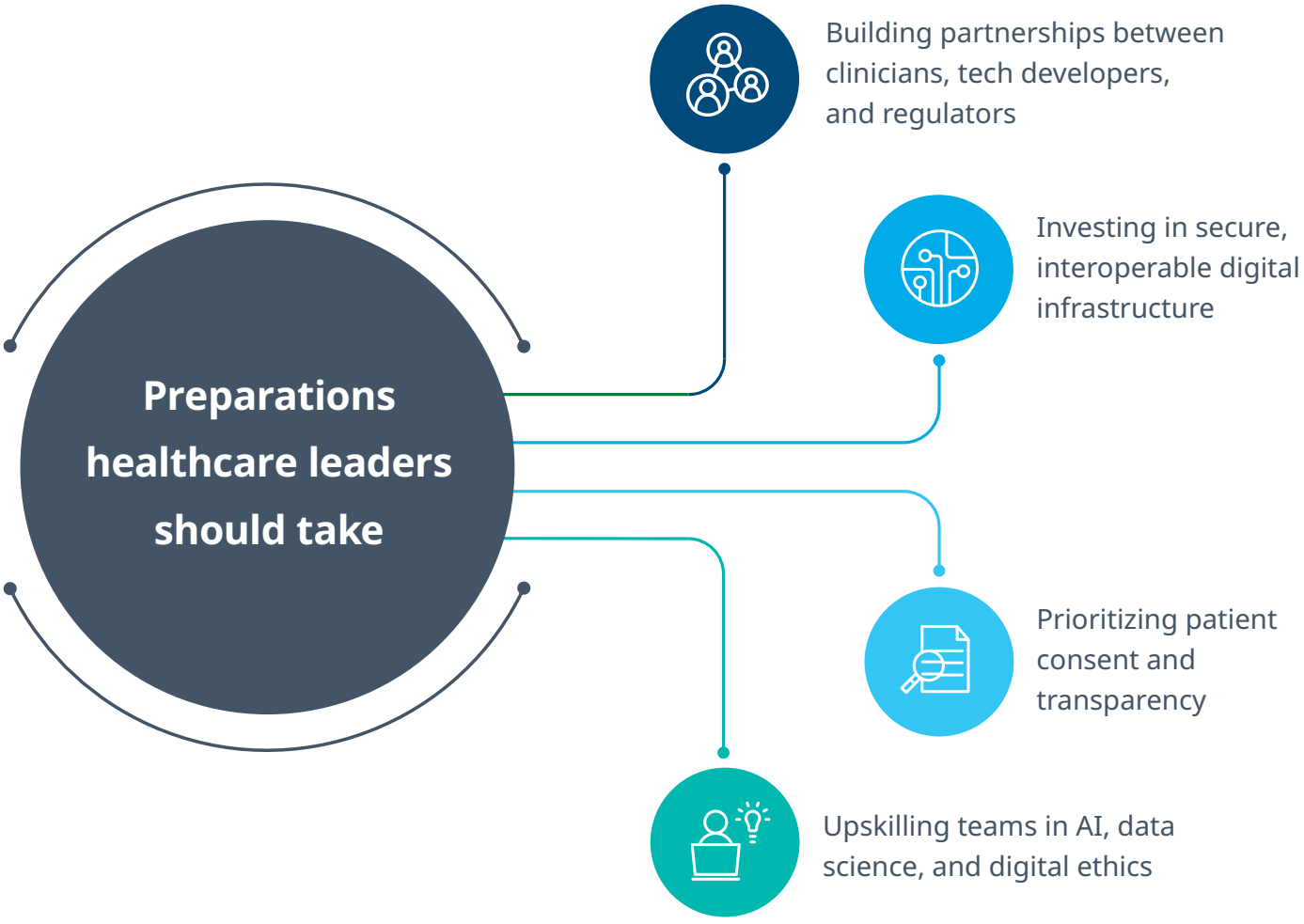
As promising as digital twins are, they are not plug-and-play. Implementing them at scale involves overcoming hurdles like data silos, lack of interoperability,[12] and privacy regulations.[11] Ethical questions also surface: Who owns the twin? Who controls the data? Smaller health systems may also face resource constraints when building and maintaining digital twin models.[11]

Still, as platforms mature and frameworks evolve, these barriers are becoming more manageable. The key is strategic investment, cross-sector collaboration, and a focus on ethical, transparent innovation.[13]

The road ahead: Future outlook and strategic recommendations

Looking ahead, digital twins are poised to expand well beyond cardiology and hospital ops. Mental health, immunology, and even public health planning are areas where digital twins could thrive.[14] They're also evolving to integrate "multi-omics" data—genomic, proteomic, and metabolic layers—offering a truly holistic view of patient biology.[13]

By acting now, MedTech companies and care providers can position themselves at the forefront of this next healthcare revolution.



Final words: How IQVIA MedTech can support

IQVIA MedTech is uniquely positioned to help MedTech innovators turn digital twin potential into clinical and commercial reality. With deep expertise in real-world data, AI-driven analytics, and regulatory strategy, IQVIA MedTech supports the full lifecycle—from model development and validation to implementation and market access.

Whether you're looking to personalize diagnostics, streamline hospital operations, or launch next-generation medical devices, IQVIA MedTech brings the insights, tools, and partnership to make it happen.

Global partner for accelerating MedTech innovation

LEARN MORE

IQVIA MEDTECH

References

1. Armeni P, Polat I, De Rossi LM, Diaferia L, Meregalli S, Gatti A. Digital Twins in Healthcare: Is It the Beginning of a New Era of Evidence-Based Medicine? MDPI, 2022.
2. Niederer, S. A., et al. Mechanical Modeling of Cardiac Resynchronization Therapy. Journal of Cardiovascular Research, 2011.
3. HeartFlow, Inc. HeartFlow Analysis: Advancing Non-Invasive Cardiology. European Heart Journal, 2017.
4. Philips. HeartNavigator: Enhancing Pre-Surgical Planning in Cardiology. Philips Healthcare White Paper, 2018.
5. Takeda Pharmaceuticals. Leveraging Digital Twins in Drug Development. Takeda Research & Development Insights, 2020.
6. Siemens Healthineers. White Paper on Digital Twin Technology, 2023.
7. The Journal of mHealth. The Living Heart Project and Virtual Twin Technology, 2023.
8. FEops. Transforming Cardiac Imaging with Digital Twin Technology. FEops White Paper, 2022.
9. GE Healthcare. Command Center for Digital Twins in Healthcare, 2024.
10. DH Insights. Digital Twins in Healthcare: Revolutionizing Personalized Medical Care, 2023.
11. DelveInsight. Digital Twin Technology: Challenges and Applications, 2023.
12. Quibim. Digital Twins in Healthcare: Applications and Interoperability, 2023.
13. MDPI. Digital Twin in Healthcare: Recent Updates and Challenges, 2022.
14. European Journal of Public Healthcare. Could digital twins be the next revolution in healthcare? 2024.

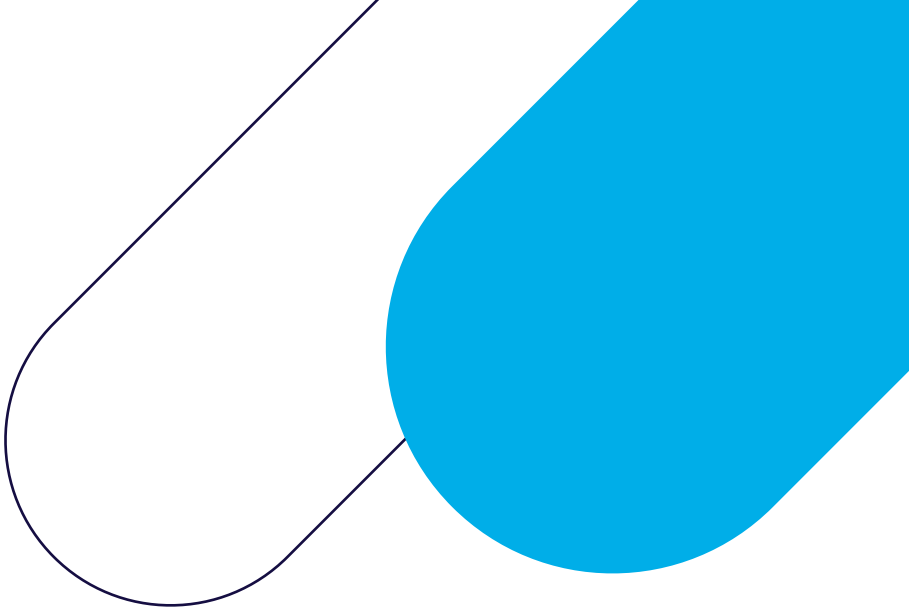
About the author

HUDA MUBARAK
Consultant, Global Consulting Services, IQVIA MedTech

Huda Mubarak is a strategic consultant with over seven years of experience advising MedTech companies on market access and innovation strategies. At IQVIA MedTech, she leads cross-functional projects focused on leveraging advanced technologies—such as digital health platforms and data-driven solutions—to inform business decisions and improve patient outcomes.

Her work spans medical devices, surgical therapies, diagnostics, and lab instrumentation, where she applies deep expertise in regulatory pathways, pricing strategies, and market entry planning. Huda is particularly engaged in supporting clients at the forefront of MedTech innovation, including those exploring digital twins and other transformative tools shaping the future of healthcare.

With a strong track record in generating insights and delivering thought leadership, Huda helps stakeholders navigate complex healthcare landscapes and unlock opportunities in evolving therapeutic and technological spaces. She holds a Bachelor's degree in Biomedical Engineering from Cairo University, Egypt.



CONTACT US

meddevice@iqvia.com

iqviamedtech.com

IQVIA MEDTECH