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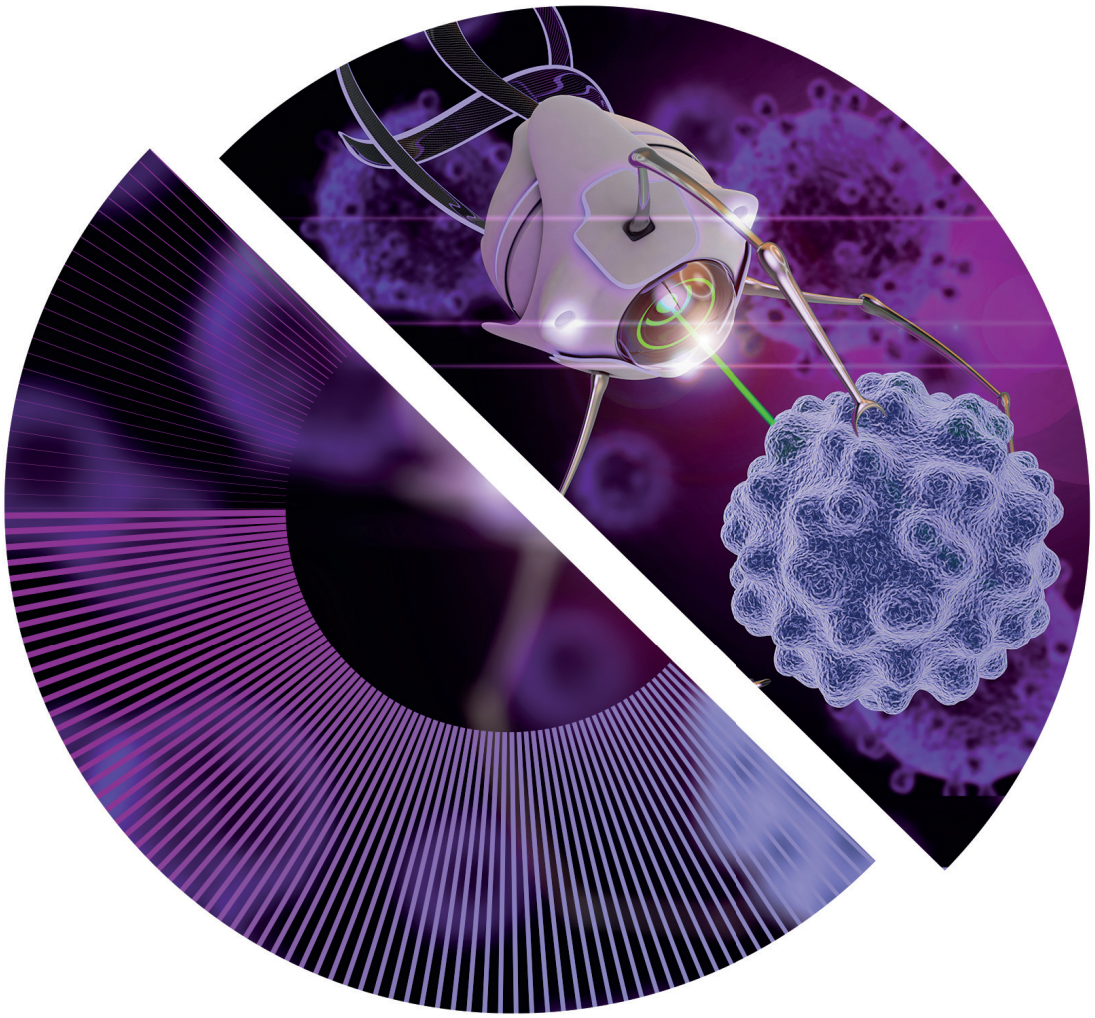


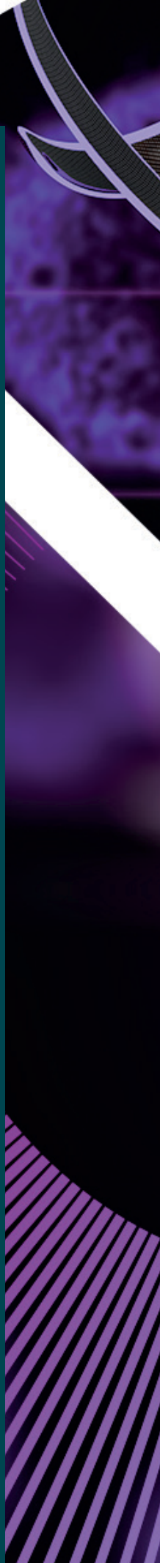
Accelerating the future
Realising the potential of the Internet of Medical Things

Life sciences and healthcare predictions 2030

Deloitte Centre *for* Health Solutions

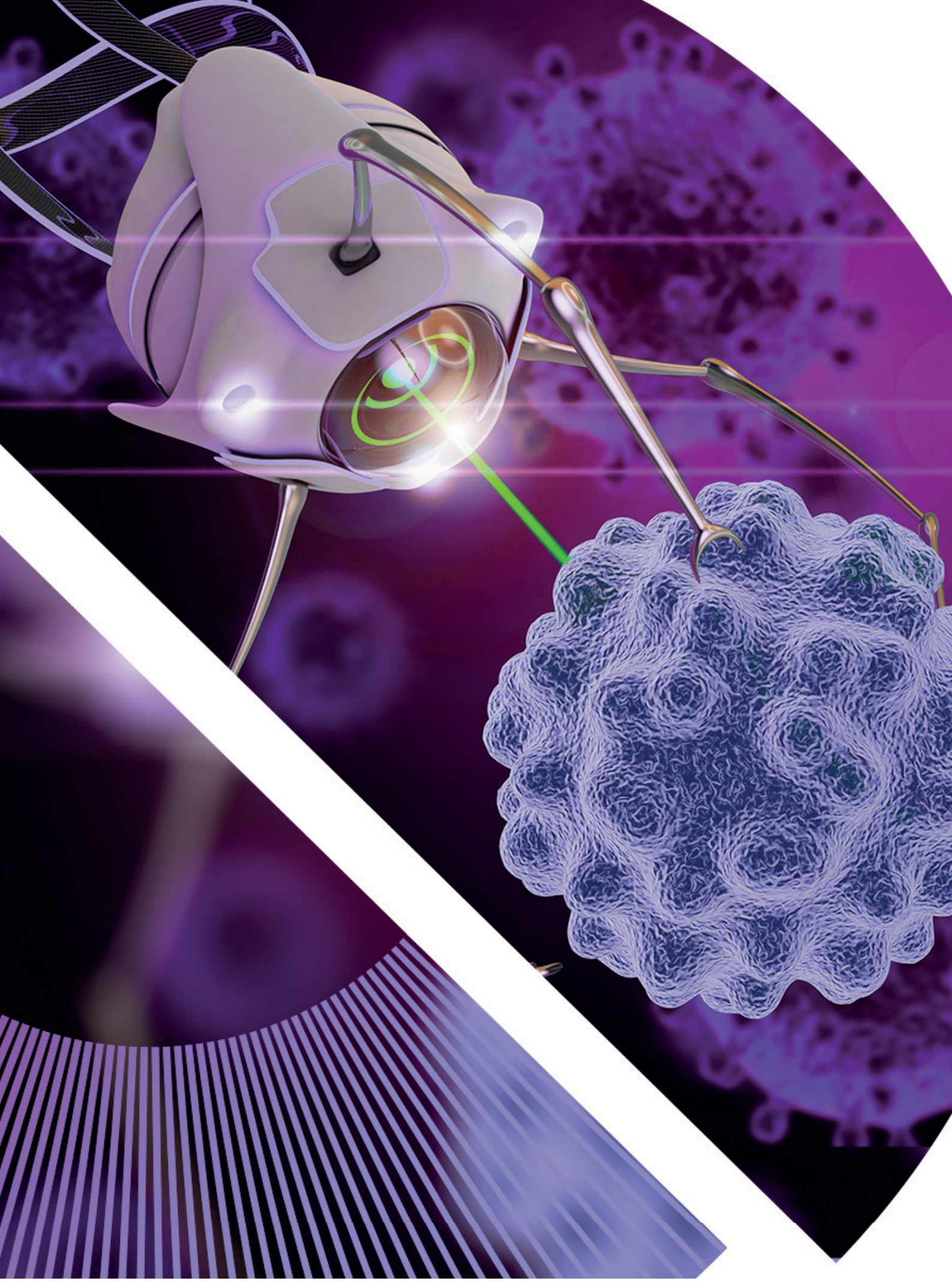
Realising the potential of the Internet of Medical Things

MedTech's data-driven innovations delivering patient-centric care



Prediction 2030

MedTech companies play an integral part in most patient interactions, with digital disruption transforming the industry into a more connected, efficient and agile system. Many companies have adopted connected medical devices that generate, collect, analyse and transmit substantial amounts of health data. Advances in cloud and AI technologies are used to store and interrogate these data and integrate insights into electronic health records (EHRs). MedTech companies that have redesigned their commercial models, including platform-based customer-centric services, enjoy a competitive edge, guided by a strong leadership-driven innovation agenda. Advances in wireless technology, connectivity, miniaturisation and computing power are a 'force multiplier' in unlocking the potential of emerging medical technologies as part of the Internet of Medical Things (IoMT). This in turn has accelerated healthcare's transformation through the use of a wide range of devices that collect patient data enabling much more cost-effective diagnosis, monitoring, treatment and management. More collaborative ways of working and rapid advances in science, technology and data analytics have helped reimagine diagnostic pathways and enabling more predictive, personalised, preventative, participatory and precise (5P) healthcare, and more cost-effective outcomes. Companion diagnostics are a crucial tool for personalising patient therapies with MedTech playing a leading role in driving value-based healthcare. Many companies have become 'Software as a Service' providers, targeting prevention at specific patient groups. As consumers have become more self-sufficient, MedTech has adapted its approach to engage with them directly.



The world in 2030

- Connected devices including patient-centric technologies such as wearables and smart implants, and interoperable data create end-to-end information chains across the entire healthcare ecosystem, enabling care anytime, anywhere.
- Health data generated by connected devices is integrated into EHRs through customised apps to create a robust data and highly precise diagnostics ecosystem generating AI-guided treatment plans for self-managing health.
- MedTech companies have embraced the IoMT and transformed their existing business models or adopted new ones, demonstrating to providers and payers how connected devices can drive a new value-based care paradigm.
- MedTech companies have invested in building smart factories, integrating and scaling disruptive technologies and using predictive analytics to improve asset and process efficiency, inventory and capacity tracking, preventative servicing, demand management, order fulfilment, and supply chain resilience to deliver a strong return on investment (ROI).
- Diagnostic devices are smaller: MRI machines the size of a tumble-dryers, CAT scanners small enough to sit on a table and pocket-size ultrasounds are ubiquitous.
- Devices have become integrated with the user's body for real-time data acquisition and monitoring, with stakeholders across the health ecosystem, such as insurance and pharma companies, investing in devices and data to improve their own effectiveness.
- Companies that provide telehealth services are using virtual reality (clinicians use holographic images to show patients their medical conditions, how a medication works, or demonstrate exercises to reduce pain), improving remote care.
- MedTech companies have adopted ambitious ESG goals, use eco-friendly and/or durable materials, work with end users to reuse and recycle devices, minimise waste and energy and embrace the circular economy.

Conquered constraints

Skills and talent

MedTech companies have adopted build, buy, and partner strategies to close their capability gaps and upskill their organisations. Collaborations with consumer, big tech and digital health companies enable MedTech to benefit from their experience of brand development, customer engagement and advanced analytics. Local and international clustering of MedTech companies, supported by industry associations and government funded research centres, have increased availability of and access to talent. Recruitment is focused on acquiring advanced digital, cognitive and analytical skills; communication and consumer behaviour (including health equity) skills are increasingly important.

Funding and business models

Government grants, tax credits and investment in manufacturing infrastructure have boosted MedTech's transformation to Industry 5.0. As a service (aaS) business models (software (SaaS), hardware (HaaS), data (DaaS)), and subscriptions have all gained in popularity, helping companies build more integrated offerings. Platform-based business models facilitate information sharing and goods and services exchange among ecosystem players. Risk-sharing and gain-sharing agreements are also the norm. Value-based pricing for connected devices ensure outcomes data are readily available in real time and can be analysed by AI algorithms. Having an ESG and equity track record has also enabled MedTech to benefit from green funding.

Regulations

Evolving regulatory directives on digital and AI and the Corporate Sustainability Reporting Directive (CSRD), have led MedTech to use a 'regulatory-by-design approach'. Regulators have also adopted a risk-based approach and encourage submission of real world evidence (RWE), which they analyse with GenAI to assess the safety and efficacy of innovation. Collaboration with regulatory authorities has enabled the development of harmonised regulatory standards in a more equitable and sustainable way.

Digitalisation and data

The ubiquitous digitalisation of healthcare has created a golden thread linking device manufactures directly to healthcare professionals (HCPs) and patients. Trust in the capability and use of devices and software is crucial. Consequently, security by design (engineering the devices and software to resist cyber threats and comply with regulations), alongside regular assessments and updates to address vulnerabilities and keep devices secure and users safe, are paramount. Measures include building on the FAIR (findable, accessible, interoperable and reusable) data principles and adhering to data security regulations.

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Imagine the world in 2030*

How implantable devices have helped a patient understand and improve his health outcomes

Jon was identified as having a hereditary risk of developing colorectal cancer, via a genetic test after his father was diagnosed and treated for colon cancer. Jon has always been careful with his diet but his father's diagnosis in 2023 led him to read everything he could about prevention. Consequently, he continually tracks his gut microbiome and uses a GP-prescribed GenAI-enabled app on his phone to create personalised meal plans that contain an adequate amount of fibre, prebiotics and probiotics, and which monitors the impact of his diet on his gut health via an implantable device. He can see his results in real time and gets advice on any changes needed. When he turned 30 in 2024, Jon's GP and hospital consultant agreed that he should have an AI-guided colonoscopy every two years to detect any possible lesions. The images are analysed using a machine learning algorithm and shared securely with his GP and the consultant. Following a test just after his 35th birthday, the AI algorithm alerted his consultant about a stage 0 cancerous lesion. Combined with his genetic data, this information was used to develop a personalised treatment plan involving augmented imaging-guided surgery and at home-delivered preventative targeted chemotherapy. Jon manages his medication schedules, tracks his symptoms, accesses educational resources and communicates with his provider remotely through the hospital patient support portal. A virtual reality rehabilitation app, coupled with implantable sensors, supports him with his pelvic floor exercises and helps to manage any pain. He continues to receive nutritional support based on his results for improved outcomes and has recently downloaded a recommended app to support his mental health.

How a MedTech company uses skin implants to help people manage their type 1 and 2 diabetes

InvisaAI specialises in skin implants to monitor glucose changes for patients with type 1 and 2 diabetes, and to measure treatment outcomes, including those from GLP-1 receptor agonists. The company is also committed to the health equity agenda, and follows an equity-by-design approach, ensuring that genomic, clinical and behavioural patterns of diverse groups of the population are considered, to ensure fair pricing of their devices. InvisaAI has a patent for a new biomaterial identified by its GenAI platform. Created with equity-by-design principle in mind, the skin implant was assessed via a decentralised global clinical trial and can match the exact tone of different skin types and colours, which means that most population groups can use it. Moreover, the material is very durable so it can be used for up to three years, being not only environmentally friendly but also cost-effective for payers and national health systems. Patients can read the data via a companion app developed in partnership with a digital health company enabling them to manage their condition more independently. Patients own their own data but can consent to share it with their healthcare provider via a secure interoperable platform which is integrated with the patient's EHR. InvisaAI also has the capability of analysing RWE, which accelerated the approval of the skin implant in several markets, as well as enabling more aggressive price negotiation with payers and showing improved disease management results. The company is now adapting its GenAI platform so other MedTech companies can use it as a subscription service.

How the IoMT technologies support a community health nurse to deliver smart, state-of-the-art hybrid care

Carl is a nurse in a community healthcare centre. He works mainly from home, using integrated data from wearable sensors and remote monitoring systems that enable him to continuously track patient vitals, collect data, and detect potential issues in real time. He can also conduct virtual consultations from home, and using enhanced connectivity he can input directly into a patient's EHR. Secure messaging systems and mobile apps facilitate efficient communication among his team members, ensuring timely collaboration and information sharing when needed. When Carl needs to see a patient, virtually or in person, a GenAI assistant, NursiGenie, provides him with a summary of the patient's history, verifies medications, ensures accurate dosing and links to a smart pill bottle that tracks administration. Coupled with a much reduced admin burden through the automation of most repetitive tasks, Carl's well-being and sense of purpose at work has improved. The community centre where Carl works has a partnership with a MedTech company that provides not only the wearable sensors, but also SaaS, enabling secure data transfer. Another partner, a telecoms company, ensures that all HCPs have access to high-speed connectivity. Carl has bi-annual virtual reality-enabled training on the use of cutting-edge digital tools, alongside access to online platforms, mobile apps for up-to-date medical resources, guidelines, and other training materials.

* Note: All elements on this page are from a perspective of 2030 and are fictional

Evidence in 2024

Global 5G and IoMT markets are expected to expand rapidly

The **5G global healthcare market** was estimated at US$50.8bn in 2023 and is expected to grow at a compound annual growth rate (CAGR) of 40.5% from 2024 to 2030.The global market is driven by the increasing adoption of robotic surgery and telehealth, alongside advances in telecommunication and 5G technology. In deploying wearable medical devices, 5G can transfer huge patient data files quickly, and the availability of affordable sensors is fuelling market growth. Partnerships between governments and key market players to deploy 5G in healthcare are also propelling this growth. For example, in March 2024, **Thailand and Huawei** partnered to establish ASEAN's first 5G-enabled 'smart hospital', to enhance healthcare delivery through the integration of 5G technology, AI, multi-access edge computing and a hybrid cloud system.[1]

The **global IoMT market** size is projected to grow at a CAGR of 38.5% from an estimated US$60.03bn in 2024 to US$814.28bn by 2032. Trends driving this growth are a rise in partnerships among key players and end-users, the launch of innovative products, and exponential increases in demand for IoMT devices, telehealth and telemedicine during and since the COVID-19 pandemic. Connected devices have also enabled individuals to monitor and manage their own health and obtain virtual diagnoses more efficiently. Patient monitoring is expected to expand at a higher CAGR, due to the rising prevalence of chronic diseases and increased waiting times to consult a specialist.[2]

How Medtronic and its AccuRhythm device overcame some of the inherent challenges in developing AI

Medtronic's AccuRhythm AI utilises a large global data repository for training and validation, including both standard ECGs and rare and edge case scenarios, helping to reduce bias and ensure appropriate behaviour of the AI when deployed in the market. The developers took active steps to consider additional permutations of data, to account for common differences observed across populations. To prevent the AI from re-learning undesirable habits or bias, they locked its training once scientists were satisfied with its performance. Before launch, the company rigorously validated the AI's decisions with human adjudicators, to ensure consistency with human decisions. Sensitivity remains in the 99% range.[3]

The potential of smart ortho implants in remote patient monitoring

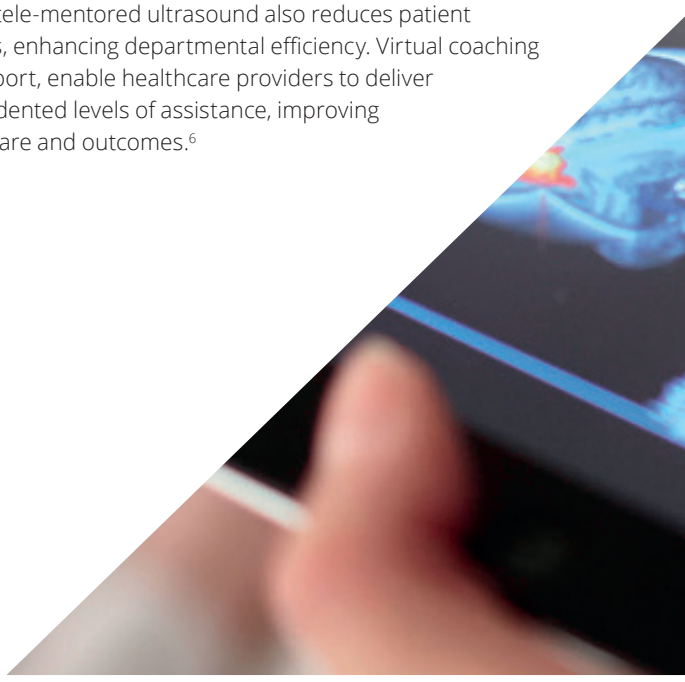
Canary Medical's smart ortho implant developer has logged 1,000 years' worth of day-by-day follow-up data on joint replacement patients. Its remote patient monitoring system (with battery imbedded in the implant) measures and analyses post-op recovery and implant performance. Sensors in the smart implant monitor from 7am to 10pm, daily, in year one (when the most physiologic changes occur), and less frequently thereafter to preserve battery life (giving a single implant and battery 20 years functionality). The sensors measure patient activity and range of motion to track recovery and the implant's stability and osseointegration. The implant transmits this data daily via Bluetooth to a base station in the patient's home allowing the patient and physician to review the data and identify post-op performance compared to pre-surgery and benchmarks this against others' data to assess speed of recovery. This remote monitoring helps to assess recovery progress and identify outliers who need more intervention, allowing physicians to follow-up with the few patients who may need an in-person appointment, radically reducing physician time and costs.[4]

Robots enable more precise eye surgery

AcuSurgical, a surgical robotics company, is developing the world's first bi-manual/dual-instrument robot for eye surgery. AcuSurgical has successfully completed its first clinical study with the Luca™ surgical robot for vitrectomy procedures. More than 300 million patients worldwide suffer from retinal disease, a debilitating condition that includes age-related macular degeneration, diabetic retinopathy and macular holes. Retinal surgery requires micrometre accuracy which can be performed only by highly trained surgeons who can achieve at most 100 micron precision. AcuSurgical's robotic system provides precision up to 10 microns. The Luca™ system will allow surgeons to treat more patients, address a wider range of pathologies, expedite training, and increase accuracy and safety.[5]

Increasing connectivity for sonographers to improve patients' outcomes

GE HealthCare's innovative MyRemoteShare and DigitalExpert enable real-time connectivity between ultrasound machines and healthcare providers and securely connect colleagues and educators through audio, video and screen share capabilities. These tools transform the sonographer experience and extend access to care. They provide real-time guidance, advice and initial image quality approval, boosting sonographer confidence and engagement and accelerating learning for new technologists. Remote tele-mentored ultrasound also reduces patient callbacks, enhancing departmental efficiency. Virtual coaching and support, enable healthcare providers to deliver unprecedented levels of assistance, improving patient care and outcomes.[6]



How innovations in cervical screening devices can improve detection in low-income countries

Cervical cancer is a major cause of female deaths in developing countries, due to a lack of accessible screening, suboptimal medical equipment and patient reluctance due to perceived discomfort. A pilot study, in the Journal of Women's Health Care shows how **Viospex's** 5-petalled Bouquet Speculum kit can screen and treat cervical cancer and uses radial opening to distribute the instruments forces radially and symmetrically as opposed to the vertical forces of the two-bladed speculum. This provides a more comfortable examination for the patient. By combining the Bouquet Speculum with acetic acid, MedicalFreeze, lubricant, cotton swabs and gloves, the Cervical Cure kit is a cost-effective solution to treating cervical cancer in low resource countries. In a partnership with ProjectCURE, the kits have been distributed internationally, providing screenings and treatments to thousands of women.[7]

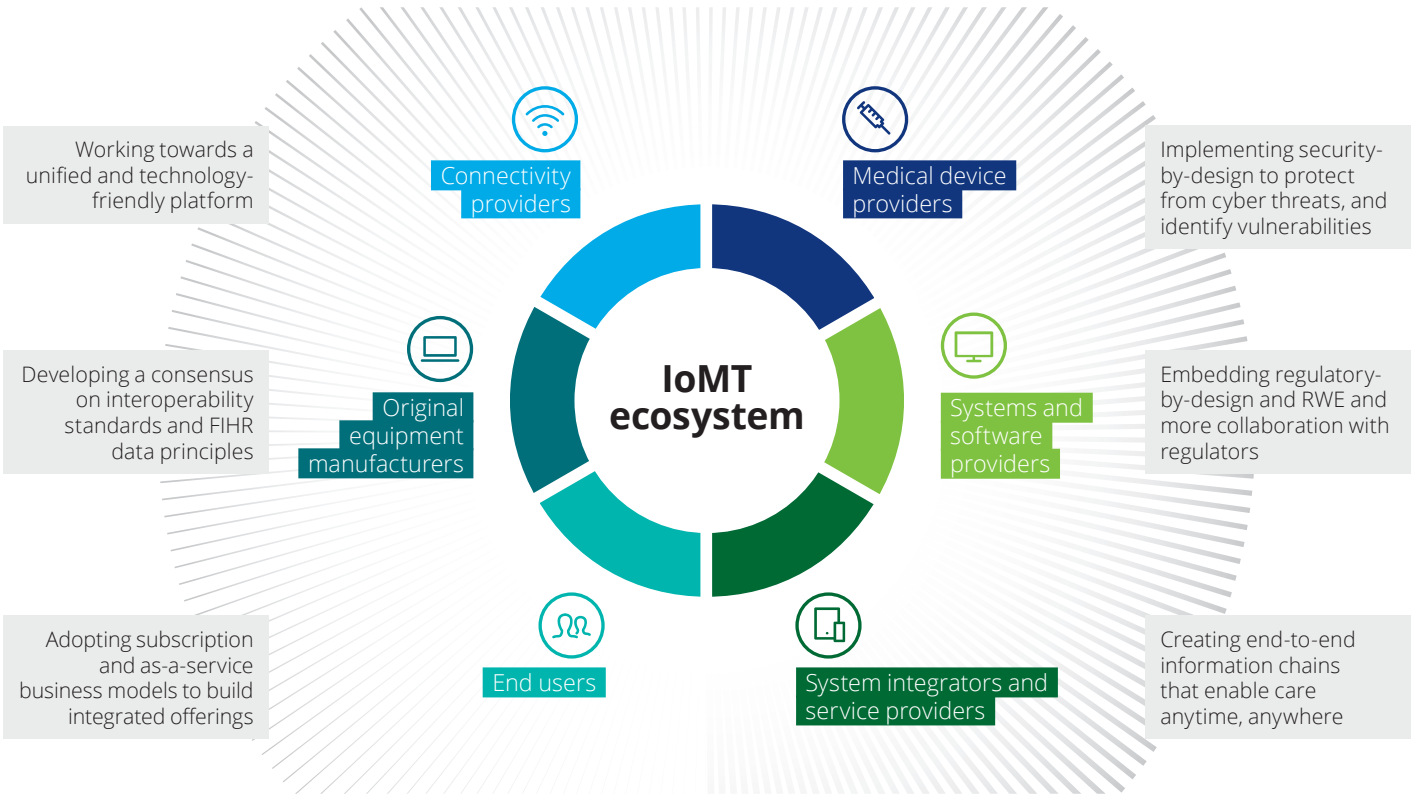
Artificial intelligence and the transformative power of GenAI

The impact on MedTech

AI algorithms are being used by MedTech companies to interrogate the vast amounts of patient data collected through sensors, identifying patterns and insights that lead to the development of quicker, more accurate diagnoses and faster development of more personalised treatment plans, and more efficient management of system resources. In August, the FDA published its quarterly updated list of 950 authorised AI-enabled medical devices with 68 new devices added to the list since its previous update in May 2024. AI in Healthcare Milestones provides a quarterly analysis of the FDA's authorisations and demonstrates how the number of approvals has increased exponentially since 2018. Radiology has the highest number of authorisations (76%) and the steadiest increase of AI-enabled device submissions of any specialty, cardiovascular is next at 10%.[8] As yet, no devices authorised by the FDA uses GenAI or is powered by large language models. Even so, GenAI is expected to transform products and services by:

- substantially accelerating software development (e.g. generating and documenting codes and test cases, and synthetic data to train machine learning models), with software as a medical device (SAMD) becoming a much-used business model.[9]
- analysing large healthcare datasets from users' devices to shift the focus towards prevention.
- increasing creativity to develop innovative solutions/designs (including new biomaterials) tailored to different population groups, with personalised outreach messages to target these groups.
- improving digital health literacy and customer experience with the integration of AI chatbots and omnilingual software to support different segments of the population. Analysing user data enables companies to improve their products and increase market penetration.

The IoMT ecosystem and the key actions life sciences and healthcare stakeholders should consider when operating in the IoMT



Source: Deloitte analysis.

- enhancing diagnostic imaging and analysis with larger volumes of images analysed faster, diseases detected at earlier stages and development of personalised treatment plans for patients. Other areas of medicine, such as surgery, will also benefit from automation and imaging analysis, as well from the development of improved biomaterials.

- enabling analysis of outcome data, critical for regulatory approval, pricing and negotiating reimbursement.

Examples

DiagnaMed has developed **Brain Age**, an AI health platform that uses electroencephalogram data to estimate brain age (whether a brain is ageing faster or more slowly than is typical for healthy individuals). A combination of clinically validated neurological tests (including the Resilience Index, the Vulnerability Index and the Number Symbol Coding Task) is used to identify individuals at risk of accelerated ageing or cognitive decline to whom early lifestyle or clinical interventions can be beneficial.[10,11,12]

Paige's Diagnostic AI applications are digital pathology solutions that support pathologists with diagnostics, identifying patients at risk of developing cancer and suspicious tissue areas (including hard-to-find or small cancers).[13] In January 2024, Paige announced it had used data derived from more than four million digitised pathology images to develop a single Diagnostic AI application that can identify cancers across more than 17 different tissue types (accuracy 0.95), multiple rare tumour types (accuracy 0.93) and metastatic deposits, a first in AI-based cancer diagnosis.[14,15]

ActivSight is a modular imaging device that can be connected to a standard endoscope and third-party camera and uses two imaging modes: ActivICG, which displays the volume of blood in a tissue after a dye injection, and ActivPerfusion, which displays real-time tissue perfusion without the need of a dye. The device enables the overlay of critical structures in real time imaging during surgery procedures, reducing the risk of complications.[16]

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