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Revolutionising healthcare: The tech innovations shaping your future

Carrie Arnold, Public Health Journalist June 2025

Key takeaways

- Innovative heart treatments, AI-powered surgical robots, and booming wearable tech are changing healthcare
- These advances are transforming patient care but come with high costs
- Value-based care models may help balance progress with affordability

Twenty years ago, adults whose heart valves had dangerously narrowed – a condition called aortic stenosis – required open-heart surgery to replace the diseased valve. Cardiac surgeons needed to split the sternum in half, place the patient on a heart-lung machine and physically cut out the faulty valve before installing a prosthetic one and wiring the breastbone shut. The strategy required a week in hospital and carried risks that were often too great for frail older adults. The alternative was worse. Without replacement, the heart would lose its ability to pump blood, leading to heart failure and death.



Illustrations: Matt Saunders



Building on developments in cardiac catheterisation, Edwards Lifesciences developed a series of prosthetic heart valves that can be inserted via the femoral artery, without the need for stitches or breaking the sternum.

We are dealing with extraordinary advances in medical innovation, not just in heart surgery but across the board. Although healthcare systems have embraced many of these advances, they have struggled in their ability to monetise innovation in a way that benefits patients and payers alike. Precisely how medicine will solve this conundrum remains unclear, but value-based care and other new payment models may allow all this new technology to truly shine.

Minimal incisions, maximal impact

Advances in surgical robotics are transforming major, invasive operations requiring lengthy hospital stays and months of recovery into routine, outpatient procedures. Intuitive Surgical's Da Vinci 5 robot allows surgeons to perform a range of gynaecological, bariatric, gastrointestinal and other surgeries through miniature incisions, while visualising patient anatomy in 3D at a special console. The company has also built on its quarter century of innovation with an AI-powered surgical 'assistant' that can monitor the procedure and offer real-time feedback. In 2024, Intuitive's robots carried out 2.7m operations, a rise of 17% compared with the previous year. Given that more than 300m surgical procedures are performed each year, and that 21m of those would benefit from minimally invasive options, Intuitive Surgical is poised to have a huge impact on both patient health and bottom lines.

Stryker, a Michigan-based company that makes a range of medical implants and devices, has also developed several lines of surgical robots. An ageing population has created a steady increase in the number of people needing knee, hip and other joint replacements. Robotic-assisted operations are expensive. They cost an average

"We are dealing with extraordinary advances in medical innovation"



Global surgical robot market

Source: Grand View Research



of \$2,400 more than conventional procedures in 2024, according to a study in the Archives of Orthopaedic and Trauma Surgery. However, less invasive operations have allowed doctors to shift these procedures from more expensive hospital stays to outpatient ambulatory surgery centres. And robot-assisted knee replacements have fewer complications such as blood clots.

The technology revolution isn't just happening inside hospital walls. Sales of wearable medical devices such as microfluidic patches to analyse sweat and smart watches that can detect abnormal heart rhythms such as atrial fibrillation totalled \$45bn in 2024 and the figure is predicted to grow to \$152bn by 2029. Sales of continuous glucose meters have expanded to include those without diabetes as even apparently healthy adults have begun to use them to optimise their diet, exercise and health.

Historically low-tech items are also getting digital makeovers. Continuous positive airway pressure (CPAP) machines to treat sleep apnoea have formed the backbone of ResMed's \$34bn business. Recent investments have led to the development of technologies that sense when patients are inhaling or exhaling to tailor airway pressure to each patient's specific breathing patterns. These technologies not only make CPAP more comfortable, increasing patient usage, they also enable physicians to monitor treatment efficacy.

Other innovations are happening behind the scenes. With the help of artificial intelligence programs that can predict the precise shape of proteins, such as AlphaFold and RoseTTA, drug developers can carefully create a molecule that will interact with its target and have the desired effect. The use of these models could potentially shave several years and millions of dollars off the cost to bring a drug to market. These precision therapeutics also mean that drug companies can identify the molecular basis of disease and divide patients into subgroups to test targeted treatments. Novel cancer drugs have paved the way in precision medicine; but pharma companies are exploring treatments for other diseases, such as gene therapies for inherited forms of blindness and neurodegenerative conditions such as spinal muscular atrophy and amyotrophic lateral sclerosis.

This ethos has also arrived in drug manufacturing. As drug companies hone their ability to target specific molecules, they will need to synthesise smaller amounts of a wider variety of drugs. The use of prefabricated modules or pods to be used as cleanrooms and manufacturing facilities is allowing pharma heavyweights such as BioNTech to scale up manufacturing of mRNA and other products quickly and easily. Modular manufacturing strategies are also proving promising for on-demand drug synthesis and finishing, as well as in low- and middle-income countries that currently lack facilities with good manufacturing practices.

Paying the price of invention

The question facing the US healthcare system now, however, isn't whether innovation is possible but whether patients can afford it. In 2023, the Consumer Price Index rose by 4.1%, compared with a 7.5% rise in healthcare spending. In 2024, the US spent \$4.9trn or \$14,570 per person on healthcare. This is equivalent to 17.6% of GDP, according to National Health Expenditure Data, a government database. Technological innovation, combined with an ageing population experiencing multiple chronic conditions, is helping to drive this seemingly endless rise in healthcare spending.





A national push towards value-based care, in which payment to providers is tied to patient outcomes, may help the marketplace prioritise those innovations while simultaneously yielding long-term savings. GLP-1 drugs may be the poster child for this. Despite the high price tag for these drugs – out-of-pocket costs are upwards of \$1,000 per month – they have the potential to forestall far more expensive complications such as diabetic ulcers and amputations, severe cardiovascular disease and kidney failure requiring dialysis. Whether value-based payments will be able to help healthcare find the sweet spot between innovation and cost savings remains to be seen, but there is no shortage of ideas on how to use technology to cut costs. The ideas that take hold in the next few years are likely to leave their imprint on medicine for decades to come.

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