

Asia comes of age

Growing maturity in healthcare PE

Psychedelic patent challenge

Supporting and protecting innovation

Main on the move

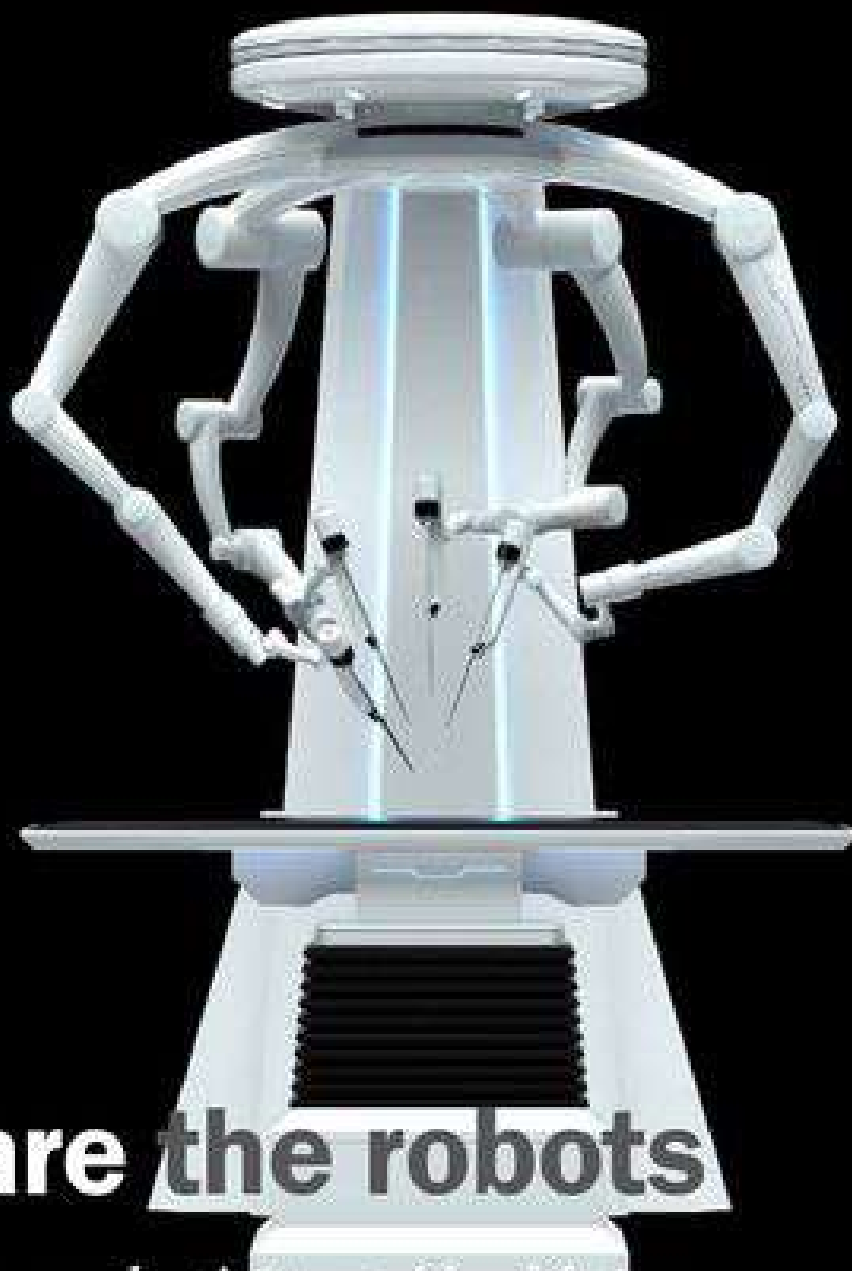
Software investor builds portfolio strength

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In focus

We are the robots

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Society faces an increasing number of technological relationship decisions, not least the pressing question of whether labour shortfalls should be met by automation, migrants, or by encouraging a higher birth rate. **Dr Michelle Tempest** and **Alina Trabattoni** of Candesic explain there is an investment opportunity from combining hardware with software to solve the issue of staff shortages while also improving care outcomes



Bridging the gaps with precision

robots revolutionise human healthcare

Medical robots have the potential to bridge gaps in the healthcare system in terms of both patient and carer requirements, while revolutionising the healing process. With healing often being a painful, lengthy, and emotionally draining process – and with nursing and healthcare teams stretched so thin – it’s no surprise medical robots are becoming an attractive alternative for healthcare professionals in providing more intelligent and comprehensive care to patients.

Yet a balance must be reached between technological innovation and healthcare, both in terms of applications and medical provisions.

Robotic beginnings

In terms of etymology, the word robot suggests the performance of tasks humans prefer to avoid. The term was coined by the Czech writer Karel Čapek in a 1920 science fiction play and derived from a word of Slavonic origins that resonates in Russian, Polish, and Czech and means ‘servitude’ or ‘drudgery.’

No obvious controversy surrounds the assignment of tasks – like maintaining nuclear power plants or repairing offshore wind farms – to robots. But when it comes to their use in the medical sector, much debate arises as to whether their application might cause damage to an individual patient’s health as well the robot’s poten-

tial to displace human workers.

Nevertheless, it’s widely accepted within the industry today that – as orthopaedic surgeon Prof Pier Paolo Maria Menchetti said in an interview – the use of robots allows for ‘high-quality patient care, making clinical processes increasingly efficient, and giving a platform for a safe environment for both patients and healthcare workers. These all range from minimally invasive procedures in surgery to frequent monitoring in medicine and through intelligent therapeutics.’

Menchetti uses robotic systems designed to enhance safety and improve efficiency, accuracy and precision for patients, staff, and surgeons in the operating room during spine surgery.

‘The use of robots will be commonplace soon, and they have the potential to revolutionise the sector due to the variety of applications and the benefits they provide both healthcare providers and patients,’ said Menchetti, who is also chairman of the EMA – EU Commission Expert Panels on spinal devices in orthopaedics, traumatology, rehabilitation, and rheumatology.

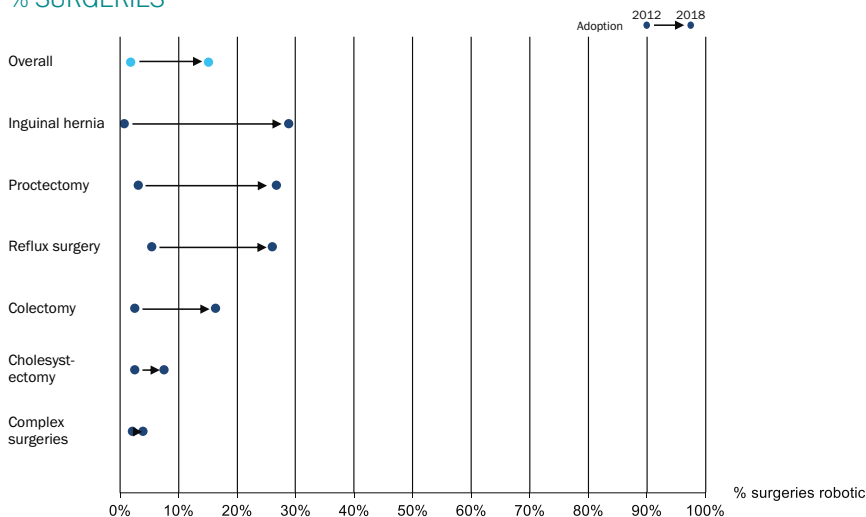
The expansive and growing realm of healthcare robotics and the way it is revolutionising the delivery of medical care, surgery, rehabilitation, and training to improve patient outcomes is examined below.

Medical robots

This category ranges from telepresence to automated pill dispensing robots, as used in hospitals to assign scheduled medications to patients. Aethon’s TUG robot, for instance, is designed for hospitals and clinics where it is used to transport medications, lab specimens, and other supplies, thereby freeing up healthcare

FIGURE ONE
PLENTY OF ROOM TO GROW IN ROBOTIC SURGERY

ADOPTION OF ROBOTICS IN SURGICAL PROCEDURES % SURGERIES



SOURCE SHEETZ KH, CLAFLIN J, DIMICK JB. TRENDS IN THE ADOPTION OF ROBOTIC SURGERY FOR COMMON SURGICAL PROCEDURES. JAMA NETW OPEN. 2020;3(1):E1918911. DOI:10.1001/JAMANETWORKOPEN.2019.18911; CANDASIC RESEARCH AND ANALYSIS



staff to focus on patient care.

Telepresence robots, meanwhile, assist physicians and other healthcare professionals in providing care to patients at a distance, and are used for remote consultations, patient monitoring, and even remote surgery. They are equipped with cameras, microphones, and speakers, and can be controlled at a distance by physicians in situations where a doctor cannot physically be present due to geography, pandemic contagion risks, or even simply understaffing.

Lengthy post-pandemic elective surgery waiting lists, along with the ongoing shortage of healthcare staff (every state in the US is short of thousands of nurses), is likely to make the use of medical robots increasingly relevant to hospitals.

Examples of medical robots include the InTouch Health telepresence robot developed by iRobot and InTouch Health for use in hospitals, as well as BeamPro and Ava Robotics.

'Autonomous robots offer a physical presence when it otherwise may not be possible, as well as significant cost savings by reducing the amount of travel and patient transfers associated with specific care plans,' said Avaro Robotics vice president Rob Kutner in an interview. 'Robots can also provide a much richer

and immersive experience for both the remote user and the person in the facility... experiences that may not otherwise be possible via fixed video, tablets, or carts.'

AUTONOMOUS ROBOTS OFFER A PHYSICAL PRESENCE WHEN IT OTHERWISE MAY NOT BE POSSIBLE

In addition to autonomously monitoring patient vitals, robots can assist in making more basic and repetitive tasks more efficient. Every day, for example, nurses perform numerous fundamental operations, such as drawing blood and monitoring vital signs. These are essential processes, but the sheer volume of these activities causes nurses physical

and emotional stress. Medical robots can relieve some of the pressure.

A venipuncture robot, for instance, can produce a 3D image of a patient's arm to identify the exact location of the vein, making it easier to draw blood and, in doing so, improve the patient experience. Nursing robots can also assist with tasks such as lifting and transferring patients, freeing up enormous amounts of time for nurses, and so enabling them to provide superior care.

Robotic surgery

Surgical robots assist surgeons during procedures by providing greater precision and control than human hands alone are capable of. Figure one shows there is plenty of room for robots to increase operating volumes and figure two highlights the white space for FDA approved robots to evolve into other specialties.

Established surgical robots such as CMR or Da Vinci Surgical Systems used for prostatectomies and hysterectomies are examples of their usefulness in minimally invasive procedures - permitting smaller incisions, reducing pain, and shortening recovery times.

Robotic systems like the Da Vinci Robotics could help address the current

500,000 women waiting for gynaecological treatment in the UK, of whom more than 5,000 have been waiting over 18 months, according to Endometriosis UK data. In early May this year, in fact, specialists at Chelsea and Westminster Hospital in London performed a record 24 surgical procedures in a two-day period, or eight times their weekly average, thanks to the assistance of Da Vinci surgical robots and a team of 20 staff members dedicated to swiftly transporting patients in and out of operating rooms.

‘Surgical robots improve safe precision surgery, reducing the complication rate,’ said Menchetti. Fundamentally, their use also ensures ‘more safety for both surgeon and patient.’

Sanitation-related robots

The Covid-19 pandemic dramatically illustrated the importance of sanitising and disinfecting care environments, highlighting its crucial importance to the patient recovery process in modern healthcare facilities. UV disinfection robots commonly carry out surface sanitization in hospitals, eliminating bacteria, germs, and viruses by shining a UV beam over them as they navigate rooms and corridors autonomously.

A patient who contracts a virus in hospital while recovering from surgery could suffer substantial complications. In some cases, these could be fatal. Deep cleaning requires dedicated personnel and extensive amounts of time, both of which are scarce in the modern healthcare industry. Medical robots, however, are ideal for disinfecting and sanitising - a straightforward but repetitive task that requires minimal skill. Delegating these tasks to robots allows hospital staff to

focus on more important tasks.

‘Robots can also improve working conditions. For example, cleaning staff commonly spend long periods in contaminated rooms, incur physical strain injuries from physical exertion, and can develop long term respiratory illnesses (like asthma) from exposure to hazardous cleaning chemicals,’ said Conor McGinn, co-founder and CEO of Akara Robotics. ‘Our robots can help address these issues... The disinfection robots Akara develops can do things people cannot, like sensing where air quality is bad, and emitting germ-killing light.’

Rehabilitation robots and exoskeletons

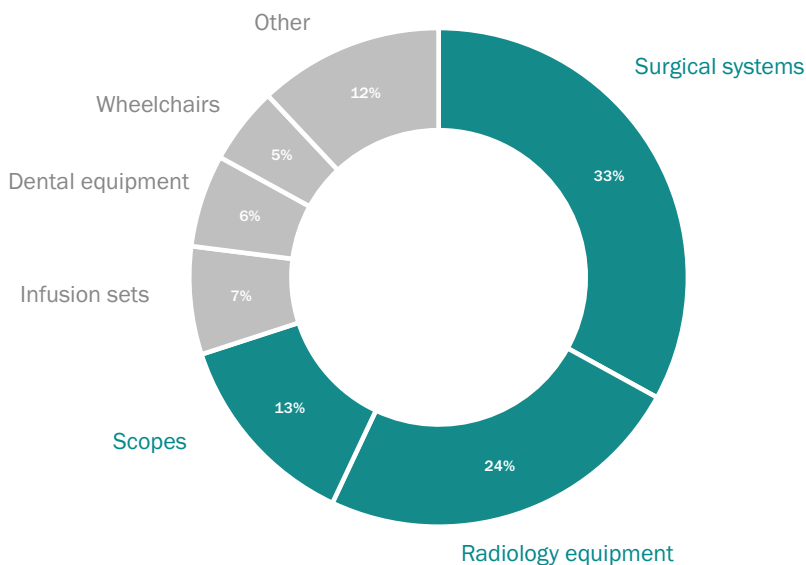
These robots are designed to help patients recover from injuries or disabilities with physical therapy exercises, provide patient feedback, and even help them learn to walk again. Exoskeletons might not be the first thing that comes to mind when hearing the word ‘robot,’ but they are revolutionising the healing process.

Aside from providing physical benefits, this type of medical robot also generates profound psychological effects - the promise of moving around has been shown to be incredibly beneficial to the healing process, resulting in a quicker recovery.

BEYOND CHIT-CHAT AND CARD GAMES, STEVIE ALSO CONSTANTLY MONITORS HIS ELDERLY COMPANIONS FOR SIGNS OF MEDICAL DISTRESS

FIGURE TWO
THERE ARE LESS THAN NINETY FDA-APPROVED ROBOTS WITH MOST HELPING IN SURGERY, RADIOLOGY AND SCOPES

FDA-APPROVED ROBOTIC DEVICES BY TYPE
% APPROVED DEVICES (83)



Automated companions

Emotional support is essential to the recovery process, and it’s been discovered that robots are surprisingly effective in its provision - sometimes all it takes is someone to talk to or sit with. The ‘Stevie’ robot, developed by researchers at Trinity College Dublin, is an excellent example of a robotic companion.

In 2019, Stevie was tested in a 300-strong elderly care facility, where the robot was tasked with conversing with, and even playing games with, the residents. The research team reported that residents enjoyed spending time with Stevie so much that he was invited to a karaoke night.

Beyond chit-chat and card games, Stevie also constantly monitors his elderly companions for signs of medical distress. In an emergency, for instance, it can recognise voice commands such as ‘help me,’ which trigger the robot to contact medical staff.

Similarly advanced companion robots - the likes of Sonia, Moxie and Ameco -

SOURCE FDA 501(K) DEVICE DATABASE; CANDESCIC RESEARCH AND ANALYSIS

could also help fill the support space, providing a range of extraordinarily beneficial services for patients of all ages.

'Moxie is a game-changing combination of Generative AI and robotics, best described as having the love and warmth of a loving dog with the intelligence of ChatGPT,' said Paolo Pirjanian, CEO and founder of Embodied, creator of Moxie the robot. 'Moxie is a safe, non-judgemental robot that focuses on emotional needs and is designed to develop resilience and balance. It leverages best practices in therapy, improving exponentially with data and AI.'

AI physicians and training

Robots are also useful in training medical professionals. Simulators, for example, can be used to replicate surgeries or medical emergencies, allowing doctors and nurses to practise their skills in a controlled environment. Some of the most effective medical robots are, in fact, simply software.

With telemedicine becoming mainstream over the past few years, AI doctors and coaches are increasingly prevalent. AI algorithms, for example, today aid physicians in earlier disease detection and more precise diagnosis. In addition, AI can easily create efficient and individualised treatment plans meticulously tailored to a patient's specific requirements.

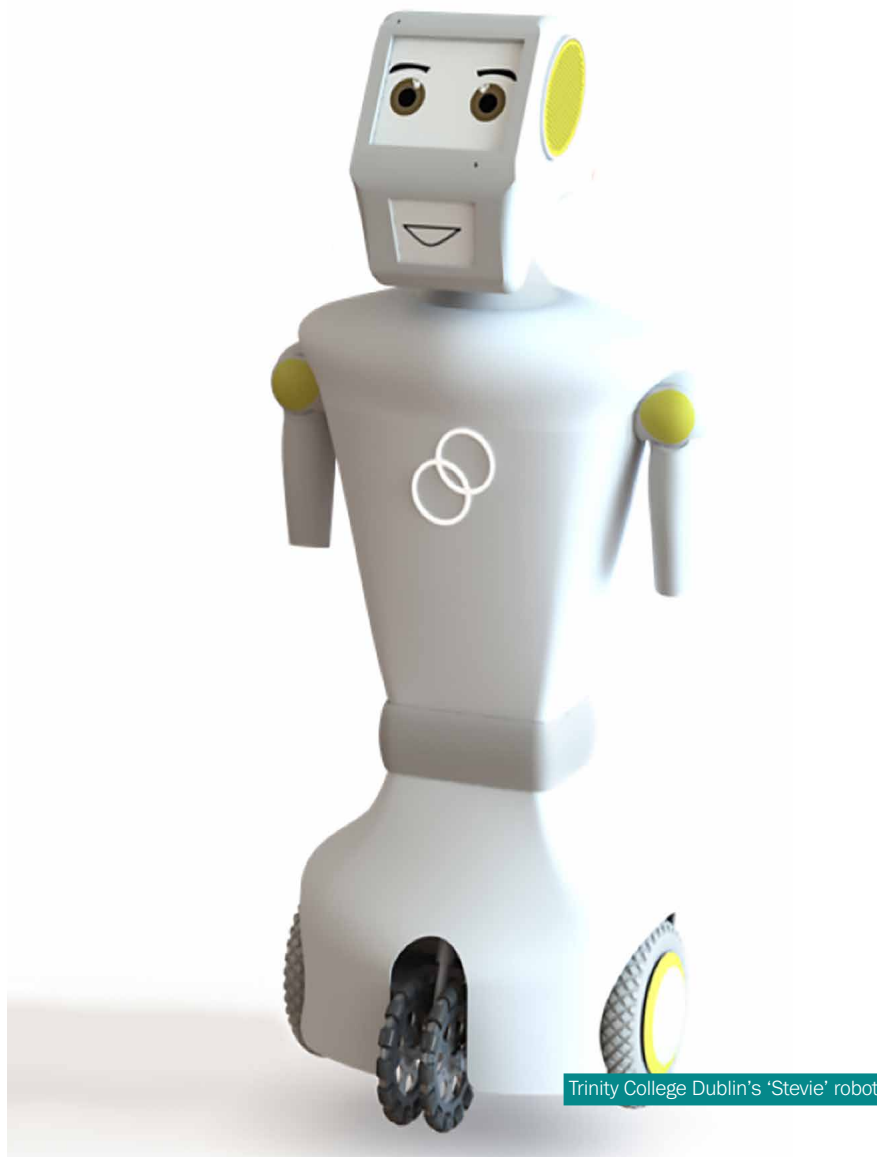
While AI systems are still in the early stages of being developed and refined, they will likely lead to increasingly accurate diagnoses and effective treatment plans for patients as each year passes.

AI is also altering the healing process in other ways, including through virtual reality fitness games. 'Supernatural' is one of the most widespread examples, motivating players to move with the help of an AI coach created from recordings of actual trainers. The use of virtual reality (VR) to gamify the patient recovery processes is proving effective in motivating and strengthening positive attitudes.

Future technology: microbots

In the distant future, robots may substantially reduce surgical recovery times through the development of microscopic robots that are small enough to traverse the human body undetected while performing surgery: microbots.

Potentially as small as a single human



cell, microbots are touted to be the answer to complications from surgery. This new technological approach is being studied and developed by scientists across the globe, although it is currently too difficult to build robots that are both sufficiently small enough for purpose and can yet be precisely controlled. They are unlikely to become a widespread medical tool any time soon, but when they do, patients can expect a rapid, less painful, and more comfortable healing experience.

The future is robotic

Medical robots are already able to relieve doctors, nurses, and healthcare teams from stress and staffing shortages, while also providing patients with companionship, mobility, and individualised

care. They are clearly making the healing process quicker, safer, and more intelligent for both carers and patients.

Robotics is a fast-evolving industry, and we are only at the foothills of medical innovation. It will take established operators, start-ups, growth capital, private equity and global government investment to work hand in hand with care providers before robots can truly revolutionise care in the home and in the hospital.

Linking hardware with software should not be feared; the link is vital in helping solve the global healthcare dichotomy of people living for longer with more chronic complex conditions, and not enough human staff to look after them.

If you are looking to invest in the pathway from empathy to precision medicine, then robots are part of the solution.