

The documents below consider issues related to medical ethics and priorities. Read them **both** in order to answer **all** the questions on the paper.

Document 1: adapted from *Robot niche expands in senior care*, an article written by Mai Iida, published in the *Japan Times* in 2013. The author is a journalist.

Japan's population is ageing rapidly. So, more practical and affordable robots are being developed to help senior citizens handle daily tasks and to cope with a predicted shortage of caregivers (care workers).

The Japanese government estimates that the number of people in Japan aged 65 years or above is expected to rise by around 7 million between 2010 and 2025, when they will be 30% of the overall population. In future around 2.5 million caregivers will be required to look after them. The government also reports that there is a large turnover rate of caregivers. This is partly because 70% of caregivers experience back pains, due to constantly lifting the elderly between beds and wheelchairs, and so have to leave work.

The government has therefore allocated ¥2.4 billion (\$24 million) in the 2013 budget to help develop nursing care robots and increase their use. The Ministry of Economy, Trade and Industry (METI) will give substantial financial help to 24 companies to develop "nursing care robot equipment." This includes the development of a device to help carry the elderly, a mobile flush lavatory and a wireless sensor to help track senior citizens who wander off.

The deputy director of METI's industrial machinery division noted that high prices have been a major problem in introducing nursing care robots for the elderly, with some of the machines costing over ¥10 million. He said: "We aim to offer cheap robots widely, costing between ¥100,000 and ¥200,000. By 2018, the subsidised production should greatly increase and so people will be able to afford them. We aim to achieve a situation where every senior citizens' home will have at least one robot."

The evidence of using communication robots so far has been very positive. At the Fuyouen senior citizens' home in Yokohama, a humanoid 40cm tall robot plays games and quizzes and sings and dances with the residents. An 88 year-old resident said, "I learned a lot from him." A 92 year-old resident told the baby seal robot, "You're so cute, look at me!" It responded by moving its head and legs, squealing and blinking its eyes. The home's caregivers noticed that these robots have a positive psychological effect, bringing smiles to the faces of even clinically depressed residents. One said, "If robots are able to interact with human beings, this will widen the nursing care services we can offer."

Referring to these communication robots, the head of the Fuyouen home said, "I find them very effective." He also hopes that practical robots will be developed to help caregivers to lift and carry elderly residents. "I think caring, and the warmth of physical contact can never be replaced by robots. But with many in the nursing care industry suffering from back pain, I am hoping that robots will be developed to enable caregivers to work longer."

Given this evidence, it is clear that there is an increasing need to design more practical and affordable robots to help senior citizens with daily tasks, as well as to cope with a projected shortage of caregivers. So, we need to recognise the benefits that these robots will bring.

Document 2: adapted from *Legal and Ethical Issues relating to Healthcare Robots*, an online article written by Dr Catherine Easton in 2013, on the UK-based Society for Computers and Law website. The author is a UK university lecturer in law.

Robots can now provide a realistic solution to certain aspects of healthcare provision. Robotic mobility aids, such as wheelchair robots and manipulator arms, are used in physical therapy. Also emotional and psychological support can be given by systems designed to help children's rehabilitation through interaction and storytelling.

The time has now come that we need to look at legal and ethical issues relating to the use of robotics in healthcare, because of their planned rapid development and the risk that this brings. Robot development has been driven by the growing ageing population and a global need to cut the cost of healthcare. The US Government's '*Roadmap for US Robotics*' highlights the potentially significant economic benefits from using robotics in healthcare. Over a hundred US hospitals advertise robotic surgery, often focusing on its benefits, but overlooking potential risks.

Firstly, there are problems of safety standards and legal responsibility. Safety standards need to be flexible to keep up with technology. In 2005 the International Standards Organisation set safety standards for non-medical personal care robots. Also, when Professor Asaro presented research at the 2007 International Conference on Robotics and Automation, he said legal responsibility for healthcare robots could be the same as for any other manufactured product. However, in healthcare it is more difficult to predict the behaviour of the humans with whom the robot is interacting, especially children. Also, who is responsible if a robotic system malfunctions and a patient, medical practitioner or equipment is damaged? It is possible to blame designers, programmers, medical staff and even the patient.

Another problem is of trust. Robots in the healthcare environment will not be successful if they are not fully trusted by both patients and practitioners. Patients need to feel comfortable with the technology and be able to rely upon it in a weak state. In Japan, where over 23% of the population is aged 65 and above, there is a great shortage of care workers. Even here, where robotic development has led the way, responses to robot aides have not been entirely positive. Certain systems have been removed from hospitals for ethical reasons due to patients' lack of trust and their desire for human interaction.

Finally, there is a problem of psychological bonding. With everyday interaction, robot users can project human qualities onto the robots and feel a bond. In terms of ethics, a patient who feels a personal attachment to a robot may become distressed if the robot's behaviour changes. Researchers from the MIT, speaking at We Robot Conference, University of Miami, argued that if a robot is damaged or even reprogrammed this could have a detrimental effect on the mental well-being of its user. So, healthcare workers need to be aware of the problems that bonding with robots can bring.

The above problems of legal responsibility, safety standards, trust and psychological bonding need to be solved before healthcare robotics can succeed. So, questions need to be raised about the ethics of using healthcare robots in the meantime, because of the risks involved.

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