Editorial

Social robots: should they be used in paediatric care?

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Robotic technologies are continuing to evolve and are increasingly being used in paediatric care for social interaction, and for interventions, such as comfort and rehabilitation.[1,2] For many years paediatric clinicians have recognised the importance of play as a way for children and young people to process and communicate their worries and concerns about their healthcare experiences and to develop coping strategies for maintaining their wellbeing. Robots are well-suited to engage children in play and social interaction and to alleviate distress related to hospitalisation.[2]

Social robots are designed to interact with humans for social or emotional interactions and follow social behaviours and rules. They can utilise sensing, perception and interaction technologies and have specific applications for use[3,4] that should be considered when deciding what robot to use. Sensing technologies refer to the way the robot receives or senses communication from the user. They may include direct input, touch or force, infrared or ultrasonic, audio and vision sensing.[3] Perception technologies refer to light, speech, emotion, facial, gaze and object detection, localisation, and navigation.[3] Interaction technologies concern the robot interactions with the user and may include speech, body language, facial expression and other outputs.[3] Lastly, the applications of social robots may involve their use in clinical practice for companionship, communication, engagement[3,5] and rehabilitation by improving patient motivation and adherence to exercise.[6] Although social robots have received a reasonable amount of research evidence, most of this has been conducted with older adults.

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Common social robots

PARO is an advanced interactive robot designed to resemble a baby harp seal. It has been used in various clinical fields to calm and distract from pain,[7] depression,[8] reduce negative behavioural responses and engage[5] users with its soulful eyes and emission of seal-like sounds.[8] PARO has five sensors: tactile, light, sound, temperature and posture.[8] PARO responds by behaving in response to touch and sound and tries to repeat responses it learns as though it were a live animal. Of the current social robots, PARO is probably the most used and researched robot. However, it is not perfect. PARO weighs 2.5kgs and, therefore, may be too heavy for some paediatric patients to use without a supporting structure to place it on. PARO can be used to distract children from pain or distressing situations and as a companion to overcome the loneliness of being hospitalised. PARO has also been used in paediatric intensive care to promote rehabilitation of speech, memory, fine motor skills and for sensory stimulation.[9]

Humanoid robots such as NAO and MEDi (Medicine and Engineering Designing Intelligence) are designed with a human-like form and mimic human actions. These social robots can also be used to encourage paediatric patients to play or as distractors during painful, anxiety or fear-producing procedures.[2] However, these robots can be challenging to use with paediatric populations as they are often large, frequently fragile and expensive to purchase. A small desktop humanoid robot, Alpha Mini (approximately 24 centimetres high), which was developed for educational purposes has been successfully used by Wu and colleagues[10] in a care environment to overcome the challenges of finding space for a large humanoid robot and the expense of equipment purchasing. However, the small robot was broken during Wu's[10] research when it walked off the table. Hence, supervision would be required if using humanoid robots with children.

Humanoid robots have been used for children with cerebral palsy who experience physical disabilities because of musculoskeletal motor problems and who may also experience communication challenges.[11] For example, they are used to assist children to participate in physical therapy programs and learn how to form social connections by recognising emotional expressions such as sadness, joy and anger.[11] Animal (such as PARO) and humanoid robots have also been found to benefit children with autism.[12]

Considerations

Some of the important considerations relating to the use of social robots in clinical practice are the need for evaluating their use through research, staff training on robot use, privacy and security, infection control, and the cost associated with their purchase. Research into the use of technology such as social robots in clinical practice is important to identify acceptance of technology among health professionals and users, staff education and training needs, determining its efficacy and effectiveness and for co-design.[13] Co-design of technologies used in paediatric care should include health professionals, family carers and paediatric patients. Integrating robots into clinical practice can be challenging as staff can have concerns about workload, infection control, stigma and ethical concerns.[14] Staff education is required to help overcome the barriers to the use of social robots and to facilitate the uptake of robots.

Privacy and security of personal information are other important considerations when using social robots, especially when they are used by vulnerable populations such as children.[4] Users of social robots may ascribe human characteristics and capabilities to social robots (anthropomorphism) and develop social bonds that have implications for privacy due to disclosures that potentially arise from the development of these bonds.[15] As anthropomorphism is a characteristic of early childhood cognitive development, this has been found among young children when using social robots, especially if they have human-like features.[16] It is argued that privacy should be a key component of robotic development, and in Europe, for example, this is mandated by the General Data Protection Regulation (GDPR).[17] In Wu's[18] research, reducing reliance on cloud-based data processing and choosing robot hardware that aligns with the GDPR have been adopted to protect the privacy and security of personal information.[18]

Costs of social robots may be prohibitive; however, as more are developed, the costs may reduce over time. For example, the cost of robots such as NAO is approximately $18,000 AUD, and PARO costs approximately $8500 AUD. Alpha Mini a smaller-sized humanoid robot, costs approximately $1200 AUD. Although initial costs of purchasing a social robot may be high, they do allow for multiple uses and have longevity if cared for correctly. Thus, their continued use over time may make them a worthwhile investment.[19]

In recent years, soft skin materials have been developed for improving effective human interaction.[20] However, no matter the robot outer covering, in healthcare settings, cleaning and infection control are an important consideration when multiple users are using social robots. It is imperative that they are not used when exposure to body fluids, or other dietary food or fluids is possible. Users should wash their hands before using them, and the robots themselves should be cleaned regularly to minimise the transfer of microbes. PARO for example, is made from antistatic fur which minimises dirt from clinging to it, and it is sprayed with disinfectant and brushed after use. Robots covered in hard plastic, such as NAO, can be wiped down with alcohol wipes between uses.

Conclusions

As robotics advance, their costs will be reduced, and they will be more responsive and adaptive to the needs of paediatric patients. As a result, there will be more reliable evidence for their use, and we will be more likely to see a significant increase in user experience. Social robots offer the potential to bring comfort, distract children during distressing procedures, and companionship, especially during periods when they feel alone. Future research is needed to ensure that robots that meet the needs of children are developed through a co-design approach. Advancements in robotics alongside AI technology will likely develop personalised robots with natural language dialogue that can understand human emotions. Such developments will assist nursing care and quality of life for paediatric patients and their families.

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