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Special Article

Promoting Human and Planetary Health Simultaneously by Addressing Sustainability on an Holistic, Multidimensional Level in the Design and use of Sars in Healthcare

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Abstract

Digitalization of healthcare is well under way, though far from being fully realized. Socially assistive robots (SARs) are being discussed as possible solutions to urgent, global health challenges, such as insufficient numbers of care providers to meet increasing client care needs.

At the same time, large parts of the world are working to stop climate change and adapt to its tangible consequences. The objective is to meet the goal of the Paris Agreement to limit global warming to well below 2, but preferably to 1.5, degrees Celsius compared to pre-industrial levels. The EU visualizes net zero greenhouse gas emissions by mid-century while others have set an earlier date.

In this short paper, we discuss the connection between addressing challenges in healthcare on the one hand and climate change on the other. The purpose is to suggest adding sustainability to the design and evaluation toolbox when developing SARs and considering their implementation in healthcare. In addition, we argue that a holistic, multidimensional take on sustainability is essential, and we discuss how sustainability may be addressed in HRI in healthcare.

Keywords: sustainability, climate change, health challenges, nursing, socially assistive robots, automation.

Introduction

Societies are currently shaped by two global mega trends. Today, many countries face a lack of skilled, available care providers and deficient care provision. This development is often compounded by increasing numbers of citizens needing care due to demographic changes and limited available resources (Archibald and Barnard, 2017). Worldwide, challenges remain in achieving the Sustainable Development Goal of access to good quality and affordable health care for everyone at all ages, set by the UN (Sachs et al., 2021; UN, 2019). Further, climate change is a global, wicked problem threatening the continuity of life on Earth (Lehtonen et al., 2019). The EU visualizes net zero greenhouse gas emissions by mid-century while others have set an earlier date. Finland for example aims to achieve carbon-neutrality by 2035 as the world's first fossil-free welfare society (Finnish Ministry of the Environment 2021) and is reforming its Climate Change Act to achieve the target (Koljonen et al., 2021). An ecological reconstruction is excruciatingly urgent (Haines et al., 2020), as is addressing the nurse workforce shortages that are forecast to continue (see for instance Keva 2021; Zhang et al., 2017) if we are to secure good care for everyone.

Technological solutions have been proposed as responses to both wicked problems. The role of automation in care is currently explored as technological advancements, particularly in artificial intelligence, have proven effective in diagnostics for example (Akbar, Lyell and Magrabi, 2021). Robots have been suggested as a cost-effective and efficient solution (Archibald and Barnard, 2017) and research has found SARs to carry some potential in assisting patients and nurses in healthcare (Giansanti, 2021). However, actions for securing good care for everyone through automation of health practices carry impacts on the environment (van Wynsberghe, 2021; Mensah, 2019). Environmental costs such as using ecological resources and consuming energy for example arise throughout the technological product life cycle, starting from the manufacturing of devices, training models, using the technology in clinical care processes, and finally during waste disposal.

In this short paper, we discuss the connection between responding to healthcare challenges and nursing shortages by introducing SARs, while also responding to climate change. Interlinkages between climate change and health merit discussion, aiming to find solutions for how to address sustainability while designing and implementing technology to support care and health processes. We propose including sustainability as a variable in research and development of SARs and when considering implementing SARs for use in clinical care processes. We argue that it is essential to adopt a holistic and multidimensional perspective on sustainability. Further, we discuss how one might address sustainability of SARs while designing and deploying robotics to assist in healthcare. Schroeder et al. (2013) maintain that in the field of healthcare, sustainability as a concept has not yet been sufficiently studied. It is our ambition to add to the debate (Haines, Scheelbeek and Abbasi, 2020) regarding the role of healthcare in climate action and to provide developers, healthcare professionals, and researchers with tools for evaluating sustainable costs when developing and using SARs.

Sustainability

First, it is important to address the concept of sustainability. Albeit being a popular and pervasive notion of late, the definition of sustainability is still unclear. Mensah (2019) derives from a systematic literature review that sustainability comprises three pillars: environment, economy, and society. These three domains are inter-related and should be considered as an integrated entity, with internal synergies and trade-offs or tensions. The inter- and intragenerational equity at the core is important to acknowledge as there are both short and long-term implications of sustainability. Progress meeting our needs should not compromise future generations' ability to do so (Mensah, 2019). Also, ethics has been proposed as an additional fourth dimension of the concept of sustainability (Kemp 2005). Evaluating whether our decisions and actions are sustainable is an important first step towards responsible climate action, all the while meeting present day needs in organizing care. We will now discuss how such a holistic, systematic integration of sustainability when considering SARs in healthcare could look like on a micro, meso and macro level.

Addressing sustainability

What?

Technology

At the level of patient care in day-to-day practice, we find robots interacting with nurses, patients, and relatives. It's first and foremost important to address all three aspects of sustainability in development and use of social robots, through every phase in its lifecycle (van Wynsberghe, 2021). Is the production, implementation, and recycling of robots compatible with a responsible use of environmental resources, such as minerals? Are the algorithms running on it trained and modelled sustainably, considering energy consumption? Is justice a specific value in the sense that the countries providing minerals for the tech also get to reap the benefits of robots in healthcare? Do they have access to and use of SARs in healthcare? Is the business model of the technology sustainable, and for whom?

In the process of producing, distributing, and consuming SARs, one should be mindful of the fact that design and implementation decisions may add to pollution, depletion of natural, finite resources and decreased biodiversity (Mensah, 2019). Addressing this fact may include activities like measuring carbon footprints and carbon dioxide emissions in the use of data sources, power supplies, transportation, and infrastructures.

At the same time, one must not forget the ethical dimension of sustainability. Ethics are the very foundation of sustainability in healthcare bringing values like dignity and respect to the fore (Nyholm et al., 2017; Crow, Smith and Keenan, 2009). An evaluation might include questions like whether it is ethical *not* to implement robots if they clearly contribute to strengthening health outcomes of patients, albeit their technological advancements may be linked to large carbon footprints?

Human beings

While considering sustainability of technology, we argue the necessity of a holistic and multidimensional approach. It is not only important to evaluate the applications running on the robot platform. We propose addressing needs and experiences of human beings interacting with the robot when considering a wise use of resources and SAR implementations in healthcare. Technology should be implemented for all the right reasons, not simply because we can but because it helps us achieve important goals (Hassenzahl, 2010). Seen through a sustainability prism, the technology shouldn't in addition compromise future generations' ability to meet their needs. We therefore propose starting with including human beings – in roles of clients, relatives, care providers, care leaders – in the development and design process to co-create use cases and to identify valid goals where SARs could assist the human in meeting them. SARs have been employed for many years in elderly care and autism therapy (Bartneck et al., 2020). Potential for trustworthy use cases has been identified (Hägglund, 2021; Andtfolk et al., 2021) so we suggest expanding on these experiences and knowledge to foster sustainable implementations.

Another variable could be the sustainability of the individual and her available resources. Evaluating how well robots score in this field could mean testing whether the design is aligned with humans' mental models of robots to avoid cognitive load (Norman, 2013) in the human-robot interaction (HRI). Another metric could be to evaluate whether the design and use of robots is adjusted to the digital health literacy of the target group. Today, not everyone knows how to approach and talk to a social robot. Therefore, considering whether challenges in this area might lead to discrimination, inequality, or lack of core care values in the HRI could be one of the pieces in the evaluation puzzle.

Organization and culture: We also suggest evaluating the sustainability of SARs out of a systemic, social perspective on a meso-level as well, to complement the microlevel of human-robot interaction discussed above. van Wynsberghe (2021), calling for attention to sustainable AI, urges us to reflect upon whether emissions from game playing algorithms are compatible with an urgent need to reduce greenhouse gas emissions. We propose a discussion in care organizations regarding roles of human care providers on the one hand and robots on the other, and the subsequent environmental costs of carrying out the tasks. Nurse leaders, care providers, and care organisations need to evaluate their choices from a sustainability perspective to make sure that decisions regarding implementation of robots do, in fact, use available resources wisely, socially, economically, and ecologically.

At this level, a sustainable choice may include maintaining universal caring values, such as dignity and privacy, and local workplace culture values in SARs assisted care practice. Culture is sometimes regarded as a fourth pillar of sustainability (Soini and Birkeland, 2014). This is supported by Porter-O'Grady and Malloch's (2010) and Nyholm et al.'s (2017) findings that sustainability is linked to care culture. Sustainability in healthcare is strengthened by creating and implementing evidence-based models that are enduring, embraced by an organization's entire staff and work as indicators of healthcare (Nyholm et al., 2017). Thereby, it's well worthwhile considering how social robots could support and strengthen care professionals' competence and sense of decent work and well-being at their workplace, while keeping in mind long-term social consequences SARs may induce in a work organization.

Society: Addressing sustainability when considering SARs in healthcare on a macro level turns the gaze towards legislation and guiding frameworks on the one hand, and norms on the other. Regulations on personal data protection and privacy govern the design and use of SARs in care, as do procurement requirements. Human rights, for example patients' right to access and to benefit from healthcare services (EU, 2007), must be ensured and societal norms and values should be reflected in robotic applications.

A discussion of management of trade-offs, tensions, and synergies is likely to arise, when discussing the connection between social robots assisting healthcare and climate action. Addressing one goal, like reducing greenhouse gas emissions, could have co-benefits for health

(Mensah, 2019). Yet, at the same time, there may be conflicts between different stakeholder interests. An open discussion regarding values one wishes to safeguard, expectations and objectives, and needs is likely to prove valuable. Furthermore, it could prove valuable to reflect on whether the environmental costs of integrating technology to healthcare, while sustaining agreed upon values, do support a sustainable economy.

How? The discussion above is by no means exhaustive nor final, but we hope it provides an insight into the complex and multidimensional nature of addressing sustainability of SARs in healthcare. As there are multiple levels to consider and many stakeholders with wide ranges of objectives and needs, on both short- and long-term scales, we propose collective, participatory, and integrated efforts when addressing sustainability in the design and evaluation process of SARS (Hagglund, 2021). The responsibility of being mindful of sustainability as a variable in developing and using SARs in healthcare cannot rely solemnly on one entity. To design the right thing, and to design the thing right, while not going against urgent needs for climate action, we propose co-creating with all stakeholders represented in a transdisciplinary way (Gaziulusoy and Boyle, 2013). In such a process, many dimensions should be addressed, on many levels, and both on a short- and long-term scale, as discussed above. Further, apart from adhering to legislatively binding documents of course, there are ethical guidelines for responsible researchers and designers to follow (Hägglund, 2021) and hopefully carbon trackers and frameworks on environmental impacts soon (van Wynsberghe, 2021).

Conclusions: In this short paper, we have discussed solutions that promote human and planetary health simultaneously by addressing sustainability on a holistic, multidimensional level in the design and use of SARs. We suggest transdisciplinary approaches to assessing the possibilities of social robots in healthcare where experts in fields like ethics, legislation, and ecology should be included alongside technical experts and care professionals in the design team. We further propose considering sustainability holistically as a variable on a micro, meso, and macrolevel.

We hope to inform the value of addressing sustainability of SARs to welfare technology developers and providers, to nurse leaders and policy makers who set requirements for solutions and digital services to strengthen health processes and care work, to care organizations implementing robots and to nursing research and education. We suggest a systematic, integrated inclusion of sustainability with a particular focus on the ethical dimension being the foundation of the concept, in all design and implementation of SARs in healthcare. It is by no means an easy task but co-creating processes, where sustainability is evaluated multidimensionally in all phases, are proposed as a valuable working method.

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