AUTOWORK

automation of work in healthcare

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Summary: This report presents the results of a future scenario workshop focused on healthcare technology and healthcare robots from the Norwegian Research Council funded project "AUTOWORK." The workshop was designed to explore and envision potential futures for the healthcare industry, with a focus on how healthcare technology changes work practices and health technology that ends up being left unused. It is part of a series of workshops in different sectors. The following report provides an overview of the workshop methodology, key insights, and recommendations for future research.

About the AUTOWORK project

The AUTOWORK project is a collaborative initiative between NTNU Norwegian University of Science and Technology and Monash University in Australia, aimed at exploring the profound transformation digital technologies are bringing to society and work-life. As increasingly advanced, complex, and intelligent machines begin to perform tasks once mastered solely by humans, the implications for individual workers and society remain uncertain. AUTOWORK focuses on three sectors particularly vulnerable to automation's impact: Building, Sales, and Healthcare. Led by Håkon Fyhn at NTNU. AUTOWORK is funded by a grant from the Norwegian Research Council's Welfare, Work, and Migration program, Project no. 301088.

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THE FUTURE OF AUTOMATION OF WORK IN THE HEALTHCARE SECTOR IN NORWAY

1. Introduction to automation in the healthcare sector

The Norwegian health care sector employs the most health care personnel per capita in the world with approximately 3400 per 100.000 population (European Commission, 2024). Automation in the workplace involves the integration of technology to take over tasks that were traditionally performed by humans. This technological shift can range from automating simple, repetitive tasks to handling more complex processes that require decision-making. As these technologies become more advanced, they are capable of performing a wider variety of tasks with greater efficiency, accuracy, and consistency. This evolution is bringing about significant changes across various industries, fundamentally transforming the way work is conducted. The introduction of automation is not merely a technological change but also a cultural and operational shift that redefines roles, workflows, and even the nature of jobs themselves (Turkle, 2011; Pols, 2012). As a result, many sectors are undergoing a profound transformation, adjusting to new modes of operation where machines and software play an increasingly central role in day-to-day activities. The impact of automation is far-reaching, influencing not only productivity and efficiency but also the broader dynamics of the workforce, including job availability, skill requirements, and workplace interactions (Søraa et al. 2023).

At the same time, the health care sector is also highly digital (Menvielle et al. 2017), with digital tools, systems and managerial infrastructure highly embedded into how care work is done and organized (Moser, 2019). From early days of digitized medical records with storing and retrieval of medical information, to novel high tech uses of e.g. AI tools for optimizing prognosis and treatment, as can be seen in the boom of digital AI imagery technologies (Ho et al. 2019; Panayides et al. 2020). The healthcare sector is one area that stands to benefit immensely from the integration of automation technologies and digitalization. Technologies such as electronic medical records streamline patient data management, making it easier for healthcare professionals to access and update information quickly and accurately. Similarly, robotic surgery is another cutting-edge application of automation in healthcare, allowing for highly precise surgical procedures that can reduce the risk of human error and improve patient outcomes.

The use of automation in healthcare extends beyond these examples, encompassing a wide range of applications designed to improve patient care, reduce administrative burdens, and support healthcare professionals in their work. One of the key benefits of automation in this sector is its ability to minimize errors and enhance accuracy, leading to safer and more reliable healthcare services. Additionally, automation can help in managing the increasing demand for healthcare

services, driven by factors such as aging populations and the rise of chronic diseases. By automating routine tasks and supporting complex procedures, healthcare systems can become more resilient, capable of delivering high-quality care to more patients while optimizing resources and reducing costs. However, there are also several challenges for this future.

2. Future scenario workshops

The purpose of the AUTOWORK project's future scenario workshop focused on healthcare tech and healthcare robots is to explore and envision potential futures for the healthcare sector with multiple stakeholders. By bringing together stakeholders from various fields, including healthcare professionals, technologists, and designers, the workshop aims to facilitate conversations and generate ideas about how technology can be used to improve healthcare outcomes, and highlight future possibilities for how work is being done. Through the use of scenario planning techniques, participants can imagine different futures and consider the opportunities and challenges that come with them.

WHEN	WHO
December 13th. 2023 09:00-13:00	**Organizers:** NTNU AUTOWORK Ålesund Municipality ALV Møre & Romsdal **Participants (22 total):** Health/nurse student (7) Healthcare teacher (4) Health technology advisor (3) Head of department in health (3) Municipality workers (2) Ergotherapist (1) Pensioners' association (1) NTNU health science researcher (1)
WHERE United Future lab Norway, Ålesund	

2.1 Methodology

The structure of this AUTOWORK future scenario workshop investigating automation and robotization in the healthcare sector involved several key elements. First, the workshop began with an overview of the current state of healthcare technology and an exploration of emerging trends in the field. This helped set the stage for the rest of the workshop and provided context for the scenarios that were developed. Next, the workshop moved into a scenario planning exercise, which involved imagining different future states of healthcare and exploring the potential impact of automation in the healthcare sector, with a particular focus on the role of healthcare robots in patient care and the integration of new technologies into existing healthcare systems. This involved creating personas and narratives to help bring the scenarios to life and enable participants to understand the experiences of different stakeholders in the healthcare system.

Figure 1: The workshop participants during plenary discussion.

Throughout the workshop, participants engaged in group discussions, brainstorming sessions, and ideation exercises to generate new ideas and perspectives. They also worked in smaller groups to develop and refine specific scenarios related to how healthcare workers and patients interact with health technologies. The groups then presented their findings to the larger group for feedback and discussion. Finally, the workshop concluded with a synthesis of the scenarios and a discussion of key takeaways and action items. This helped ensure that the insights generated

during the workshop were captured and translated into tangible outcomes, such as new technologies or strategies for integrating existing technologies into sale and service. Overall, the structure of the workshop is designed to encourage collaboration, exploration, and creativity as well as facilitating the generation of new ideas and insights regarding potential challenges and solutions that can help shape the future of the healthcare industry. The methodology was inspired by the "Aha-method" (Drive Sweden, 2019), but in a simplified manner. However, a larger format could benefit from adding more participants and scenario-parts.

3. Future scenarios developed

The participants discussed a wide range of prepared future scenarios involving usage of various healthcare technologies.

➔ Mobility walkers
➔ Night and day calendar
➔ Wearable GPS trackers

The cases were used to help the participants reflect on contemporary technology and use-cases. Then, the participants reflected on and imagined how the scenarios presented could be solved in the future, including both technical and non-technical solutions. We attempted to ground the examples in relevant experience from a team member who has long experience working as a healthcare professional.

Figure 2: The workshop participants and research team discussion.

3.1 Mobility walkers being poorly adapted to home environments

Consideration of mobility walkers resulted in an interesting discussion regarding a mismatch between the technology and the home environment. Several participants argued that the home was not suitable for mobility walkers, due to there being many carpets and high door thresholds in the house. Participants also highlighted the need for a more user-centered approach, ensuring that the technology aligns with individual preferences and functional goals. For instance, options like lightweight walkers, treadmills with support systems, or even exoskeletons were proposed as alternatives. In addition, the importance of better collaboration between home care services and physiotherapists was identified as critical to align care plans with both the patients needs and home conditions. This fostered a discussion about the need to adapt older adults' homes according to their situation while still giving them agency in their own treatment.

3.2 Aversion to technological solutions for sleep issues

The discussion focused on the patient's altered sleep patterns, exploring challenges and interventions. Participants questioned whether the patient's daytime sleeping is problematic and examined potential causes like boredom, depression, medication, or lack of stimulation. They emphasized the need for personalized assessments to understand the patient's preferences. Proposed solutions included technology like sensors, smart lighting, and voice reminders, alongside non-technological options such as increased social activities, sleep education, and involving his support network. Ethical concerns about autonomy, privacy, and whether interventions primarily benefit the patient or others like next of kin or healthcare personnel was also raised. The participants highlighted skepticism toward technology, particularly among older individuals, and emphasized the need for fair, inclusive, and tailored approaches to address the patient's well-being.

3.3 From wearable trackers to microchips

GPS trackers highlighted a range of perspectives on tracking technology. Wearable GPS trackers, commonly used for patients with memory impairments face several challenges, including being unappealing, easily lost, and requiring frequent maintenance by healthcare workers. In response, many participants suggested surgically implanted microchips as a potential alternative. While microchips were seen as invasive, some participants argued their benefits, such as reducing patient distress associated with visible tracking devices and alleviating the workload for healthcare workers, might outweigh the drawbacks. Ethical concerns were noted regarding autonomy and consent. However, participants who supported tracking devices emphasized that such technology should only be implemented when patients are of sound mind. For instance, microchips could be implanted in early adulthood and later activated when necessary, either with the patient's consent or following a professional medical evaluation. This approach balances the need for autonomy with the practical benefits of more discreet and reliable tracking solutions.

4. Discussion: Common future scenarios between groups

Many workshop participants expressed a strong expectation that the healthcare sector would increasingly rely on technological solutions to meet the growing demands of an aging population. As the demographic shift in Norway leads to a higher proportion of elderly individuals requiring care, the strain on healthcare resources and personnel is expected to rise significantly. In response, participants foresaw a greater dependency on remote, internet-based monitoring technologies and alarm systems. These technologies were anticipated to become more prevalent, offering a means to monitor patients' health and safety more efficiently, even from a distance. This shift towards remote monitoring would allow healthcare workers to manage larger caseloads without compromising the quality of care, helping to mitigate the increased workload associated with the aging population. By enabling continuous monitoring and timely interventions, these technologies could play a crucial role in maintaining patient well-being while easing the burden on healthcare professionals.

Figure 3: The workshop participants brainstorming ideas

Another prominent theme discussed during the workshops was the anticipated reliance on technology designed to alleviate the physical strain on healthcare workers' bodies. The demanding nature of care-related tasks, particularly those that involve lifting, transferring, or supporting patients, often results in significant physical stress, especially on the back and knees. Participants with prior experience in the healthcare sector highlighted the potential of assistive mobility technologies, such as exoskeletons, to address these challenges. Exoskeletons, which are wearable devices that enhance the strength and endurance of the wearer, were frequently mentioned as a promising solution for reducing the physical toll on healthcare workers. These devices could enable workers to perform physically demanding tasks with greater ease and less risk of injury, thereby extending their ability to work effectively in physically taxing environments.

The adoption of such technologies could lead to a reduction in work-related injuries and increase the longevity of healthcare workers in their roles, ultimately contributing to better patient care. Furthermore, participants emphasized that the integration of these technologies could help attract and retain workers in the healthcare sector by improving working conditions and making care-related tasks more manageable. This focus on technology that supports the physical well-being of healthcare professionals underscores the importance of innovative solutions in sustaining a robust and resilient healthcare workforce amidst the growing demands of an aging society.

5. Key insights

The workshop generated several key insights related to the future of healthcare and the role of technology in improving patient care and outcomes. These insights include:

- ➔ Digital technology combined with patient wishes can contribute to an increase in care provided in the patient's home.
- ➔ Sensor technology for monitoring patients may disturb them less than in-person check-ups.
- ➔ Health technology available in each health service doesn't always meet the patients' needs.
- ➔ Social robots have the potential to enhance patient well-being by providing companionship, support, and assistance with daily activities.
- ➔ Automation can free up time for healthcare workers, enabling them to spend more time with patients.
- ➔ Current use of healthcare tech and healthcare robots are highly dependent on the commitment of internal leadership in each health service.

5.1 Recommendations

Based on the insights generated during the workshop, several recommendations for future research are proposed. These recommendations include:

- ➔ Continued research into the integration of new technologies into healthcare systems, with a focus on developing user-friendly interfaces and minimizing disruption to existing workflows.
- ➔ Health technology must be means-tested towards the patients by mapping their needs.
- ➔ Frameworks to ensure the ethical use of technology should be developed.

Any integration of new technology should include clear commitment of management, including dedication of resources for proper training and support.

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6. Summary

This report on future healthcare scenarios derived from an AUTOWORK workshop has explored the potential transformations within the sector driven by advancements in technology and the challenges posed by demographic shifts, particularly the aging population. These technologies are expected to enable more efficient patient monitoring and reduce the workload on healthcare professionals, whilst also creating novel problems. Future scenarios of healthcare futures where technology plays a central role in enhancing patient care, supporting healthcare professionals, and ensuring the sector's resilience in the face of increasing demands, is high up on the wishlist. The adoption of these innovations is projected to improve the efficiency, safety, and sustainability of healthcare delivery, ultimately leading to better outcomes for both patients and providers. Whilst older participants were quite sceptical about new care technologies e.g. in terms of surveillance, this was not something younger participants were concerned about.

References

Drive Sweden. (2019). AHA – Automated Humanitarian Assistance: Final Report. Retrieved from https://www.drivesweden.net/sites/default/files/2021-11/final_report_aha_191129.pdf

European Commission. (2024.). *Healthcare personnel statistics - nursing and caring professionals*. Eurostat - Statistics Explained. Retrieved February 7, 2025, from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Healthcare_personnel_statistics_-_nursing_and_caring_professionals

Ho, C. W. L., Soon, D., Caals, K., & Kapur, J. (2019). Governance of automated image analysis and artificial intelligence analytics in healthcare. Clinical radiology, 74(5), 329-337.

Menvielle, L., Audrain-Pontevia, A. F., & Menvielle, W. (Eds.). (2017). The digitization of healthcare: new challenges and opportunities.

Moser, I. (2019). Velferdsteknologi - en ressursbok. Cappelen Damm Akademisk.

Panayides, A. S., Amini, A., Filipovic, N. D., Sharma, A., Tsaftaris, S. A., Young, A., ... & Pattichis, C. S. (2020). AI in medical imaging informatics: current challenges and future directions. IEEE journal of biomedical and health informatics, 24(7), 1837-18

Pols, J. (2012). Care at a Distance: On the Closeness of Technology. Amsterdam University Press. https://www.jstor.org/stable/j.ctt6wp5zw

Søraa, R. A., Tøndel, G., Kharas, M. W., & Serrano, J. A. (2023). What do older adults want from social robots? A qualitative research approach to human-robot interaction (HRI) studies. International Journal of Social Robotics, 15(3), 411-424.

Turkle, S. (2011). Alone Together: Why We Expect More from Technology and Less from Each Other. Basic Books