https://doi.org/10.26493/978-961-293-397-5.77-86

The Use of Artificial Intelligence in the Field of Health for Working-age Adults and Older Adults

Marjeta Logar Čuček
University Clinical Centre Ljubljana, Surgical Clinic, Clinical Department of Maxillofacial and Oral Surgery, Ljubljana, Slovenia

Abstract

Introduction and purpose: Artificial intelligence (AI) brings numerous positive effects that extend to various aspects of human life. It can be understood as a "machine system" that, for a set of goals defined by humans, can make forecasts, formulate recommendations, or take decisions in real or virtual environments with varying degrees of autonomy. It pushes the boundaries both in technological capabilities and in the manner in which it is used, also in healthcare. It is crucial to perceive AI not as a substitute for human work, but as a tool that can help employees achieve more favourable work outcomes, improve cost-effectiveness, and better understand complex medical data. The implementation of AI in healthcare services requires a critical assessment of the ethical and legal aspects of its use. The purpose of the research is to identify the opportunities and significance of using artificial intelligence in the field of healthcare for working-age adults and older adults. *Content presentation:* The demands for improvement and higher quality of healthcare services are increasing. Automated solutions are vital in order to achieve this goal, and artificial intelligence can play a significant role. Development is focused on building models based on extensive databases of successfully solved healthcare cases. A prerequisite for the introduction of new technologies is the transformation of traditional clinical information systems with limited data analysis capabilities. This includes digitalisation of data from various levels of healthcare, enabling a machine-readable electronic health record. Research indicates that the use of AI in healthcare is becoming increasingly common, with applications ranging from screening and triage to clinical risk prediction and faster, more accurate diagnoses. Using time analysis of a patient's health issues, genetics, and lifestyle, AI can recommend a personalized treatment plan, including appropriate medication and high-quality care. AI can also function as a

virtual healthcare assistant, providing patients with relevant information about their condition and thereby improving their engagement in their treatment plan. AI can also aid in the development of more effective drugs with fewer side effects. The use of modern information technology is also defined by telemedicine applications, which include remote healthcare consultations, diagnostics, and treatment. Advantages include integrated patient care regardless of their physical location, availability of patient data for expert consultations, and the possibility of remote notification of changes in health status in chronic diseases. AI can also simplify administrative tasks in healthcare institutions, and in this way contribute to speed, efficiency, and cost reduction, resulting in overall financial benefits to the healthcare system. Priorities to be addressed in the future include education, research and exploiting the potential of AI at all levels of study in healthcare, and creating opportunities to build on knowledge. Leaders should build organisational structures that enable healthcare staff to be involved in all phases of AI, from development to implementation. *Conclusions:* Developing skills in new technologies in healthcare requires new knowledge and building trust in AI. While this technology improves workplaces and processes, it is important to ensure that the humanity of the work environment and the relationship with patients of different generations is not diminished.

Keywords: *healthcare, development of new technologies, education, quality of life*

Introduction

Artificial intelligence (AI) has entered our lives. Should we stop its development in fear of the "new master" of the future? In reality, we humans have largely set our own limits and created our own worries with regard to the environment, the individual and society as a whole. We only need to use the new tools offered by technology to develop our potential and to retain a real measure of humanity and reason while taking responsibility.

Researcher Neher (2023) and her colleagues have defined artificial intelligence (AI) as a "machine system" that can make predictions, recommendations or decisions in real or virtual environments for a set of human-defined goals. AI's capability brings many positive impacts to humanity in various fields: improving education, optimising business processes, advancing agriculture and environmental protection, responding faster to natural disasters, integrating renewable energy, global communication, financial security, medicine (Villani, 2018).

In the field of healthcare, AI has great potential. Healthcare systems around the world are facing demographic changes, new technologies, increased patient expectations and healthcare workforce shortages. These factors are in turn contributing to the difficulty of balancing growing healthcare needs with limited financial and other resources (Posnett, 2022; Logar Čuček, 2023). The

changes call for reforms and awareness-raising on the concept of value-based healthcare (VHBC) (Etges et al., 2022).

It is thus important to understand where new technology can increase the efficiency of health services with the aim of saving lives and improving quality of life (Reddy et al., 2019; Gopal et al, 2019; Chen and Decary, 2020). Reddy and colleagues (2019) state that AI has made great progress with the development of network algorithms called deep neural networks, natural language processing, computer vision and robotics. The use of these techniques has already been actively implemented in healthcare services. It should be stressed, though that at present AI cannot fully replace employees in the provision of healthcare services. However, AI can be utilised to support the prediction, detection and management of health conditions (Harwich and Laycock, 2018). The two authors cited above also state that "these applications are key to reducing the strain on the healthcare system, improving the quality of care and patient outcomes, while at the same time reducing costs" (Harwich and Laycock, 2018, p. 9).

In order to fully reap the benefits of AI in healthcare, it is vital to be aware of the main barriers to implementing this technology. These are mainly data access issues, data quality and the certification of AI algorithms (Harwich and Laycock, 2018). This means collecting large volumes of the right types of data in the right formats, increasing their quality, and ensuring secure access to them (Gopal, 2019). The recommendations for data collection state that for most healthcare related AI strategies, what matters are large volumes of data, their digitisation and machine readability, and the quality of the data, determined by the quality of the extraction, analysis and further use. It is important that all AI-related data is collected in one place (Chen and Decary, 2020).

For the use of AI in healthcare, in addition to providing experience on the usefulness of the new technology, it is also important to formally educate staff on AI to help with their basic understanding and reduce fear of the new technology (He et al, 2019; Abdullah and Fakieh, 2020; Salah-Pico and Yang, 2022; Chen and Decary, 2020). It is key to the adoption of AI as a support for problem solving and identifying solutions (Nancy, 2019; Ronquillo et al., 2021), but it cannot replace the poor usability of AI systems, which make tools difficult to use and place additional burdens on employees (Reddy et al., 2019). The trust of healthcare staff in the reliability of AI is also enhanced by the transparency and interpretation of the results provided by the new tools (Veale, 2018). Data security must be ensured or, in other words, standards should be developed to assess safety and effectiveness of AI (Shah et al., 2019; He et al, 2019; Pedro, 2020; Salas-Pico and Yang, 2022).

This article briefly describes the mechanisms that enable AI systems to generate clinically meaningful outcomes; and then presents how AI can be applied in the field of health of working-age and older adults.

Integrating Artificial Intelligence Into Healthcare Delivery – A Vision for Service Transformation

How AI Works

Artificial Intelligence (AI) in healthcare does not work by itself, but on the basis of an ever-growing volume of data. They can only be addressed by AI-based processing (Laukka et al., 2022). Given this data, AI-enabled devices are mainly divided into two categories (Jiang et al., 2017). The first includes machine learning (ML) techniques that analyse structured data: imaging, genetic and electrophysiological data. In healthcare applications, ML procedures attempt to cluster patient characteristics or infer the likelihood of disease outcomes (Darcy et al., 2016; Cato et al., 2020). The second category includes natural language processing methods that extract information from unstructured data, i.e., clinical records, peer-reviewed and scientific medical journals, to complement structured medical data. Natural language processing techniques attempt to convert text into machine-readable structured data that can then be analysed using AI machine learning techniques (Jiang et al., 2017).

There are three types of AI techniques that are used in medical applications. The classical machine learning (ML) technique builds algorithms to analyse data that include patient "characteristics", e.g. age, gender, clinical symptoms, etc., sometimes including health outcomes as disease indicators, patient survival times and quantitative disease levels, e.g. tumour size. More recent deep learning techniques address multi-layer neural networks; they are used for speech recognition, image recognition, text understanding, etc. Natural language processing (NLP) methods help to convert unstructured narrative text into structured, machine-readable text to enable information extraction (Jiang et al., 2017; He et al., 2019). Depending on the desire to incorporate results, ML algorithms can be divided into two categories, namely supervised and unsupervised learning (Jiang et al., 2017). AI also raises concern, mainly due to its ability to modify its behaviour and act autonomously with minimal human input; however, it is currently still unable to operate without human supervision (Zlatanova and Veljković, 2023), and most importantly, it lacks a subjective essence (Ferrarelli, 2023).

Promoting and Maintaining Health, Prevention

The ageing population, the need for specialised care and more care programmes, the emergence of chronic diseases and lifestyle-related health problems, the demands for active involvement of patients in their treatment and more convenient care options, and value-added services dictate the need for new strategies in healthcare: prevention, diagnosis and optimal care (Gopal et al., 2019). AI could be used to identify individuals or groups predisposed to certain diseases and provide them with timely and effective treatment. For instance, in the elderly, AI could be used to identify cognitive decline due to neu-

rodegeneration, which is distinct from the expected memory impairment common in the elderly (Zlatanova, 2023). Wearable devices, smartphones, etc., are one of the options to maintain health, already perceived as medical devices that can monitor health-related information, for example by measuring vital signs, physical fitness, dietary calories, exercise (Giordano et al., 2021). With the use of AI, the large amount of data obtained can be analysed (similarities and differences) to enable the planning of diets, breaking of bad habits for instance in diabetes maintenance or even prevention. By detecting the signs of vision loss as a consequence of diabetes, timely treatment of the underlying disease and its consequences could be provided (Zlatanova, 2023). At the same time, individuals with certain health problems that eventually develop into complications could be identified (Necher et al., 2023). It can be concluded that the collection of a large amount of data and its analysis using AI support allows for timely diagnosis and subsequent treatment; this approach can also act as a preventive measure, as by abandoning certain lifestyle habits, potential health problems can be avoided. However, it is to the detriment of the individual and the health system that this data remains isolated and often untapped (lack data accessibility and sometimes questionable quality, lack of incentives), rather than being integrated within existing processes (Gopal et al., 2019).

Quality Clinical Diagnosis, Decision-Making and Personalised Patient Care

Using AI, all healthcare professionals and patients can easily access state-of-the-art diagnostics, treatments, development of therapies tailored to the needs of the individual (Shah et al., 2019). In the future, AI tools will be refined, software will be upgraded and databases will be improved (Watson, 2024).

The types of diseases that AI communities are most concerned with are cancer, diseases of the nervous system and cardiovascular diseases. This selection is not surprising as all three diseases are major causes of death. Accurate and early diagnoses can be achieved with AI support, enabling improvements in the analysis processes of structured data and unstructured records; the latter requiring conversion into a machine-readable electronic medical record (Jiang et al., 2017, Topol, 2019). AI algorithms can help reduce potential human cognitive biases to aid clinical decision making through accurate diagnosis (Dilsizian and Siegel, 2014; Giordano, et al., 2021; Brown et al., 2023). Indeed, research has shown a synergistic effect: when physician and AI work together, better outcomes are achieved (He et al., 2019). Especially in the diagnostic phase and later on, AI also contributes to clinical decisions by processing written information, which, together with patient data and the processing of existing professional and scientific medical literature, helps in the diagnosis and recommendations on treatment options (Hernandez et al., 2017; Giordano et al., 2021).

At the same time, AI supports the implementation of personalised patient care and monitoring (Chen and Decary, 2020). The digitisation of medical

records, the proliferation of smartphones and fitness monitoring are enabling access to digital technologies and, at the same time, the use of AI for patient monitoring, for instance patient sleep patterns, blood pressure, heart rate, etc. can be obtained in ways that have not been available before (Reddy et al., 2019). The virtual use of the listed assistants can also help in communicating health status, especially for elderly people outside the hospital setting, use of medication, analysis of patients' health status (Seibert et al., 2021). By obtaining patient information and analysing data, AI can also help reduce queues in emergency clinics (Yousefi et al., 2018). The potential of generative AI support in health and patient care for healthcare diagnoses, planning goals and interventions should also be mentioned. However, it has been shown that AI is still not specific enough and requires human critical reflection and verification (Gosak et al., 2024).

The use of robots in patient care, especially for the elderly, has become a major focus, helping to reduce health risks. Robots can be used to remind the elderly to perform regular activities, take medication, and guide them in their environment (Reddy et al., 2019).

However powerful AI techniques may be, the process of patient care begins and ends with clinical activities (Jiang et al., 2017). A similar conclusion was reached by researchers Laukka et al. (2022) in interviews conducted with nurse managers and developers of digital services. The interviewees felt that specialised healthcare will have several positive implications for work, services and organisation.

Potential Roles of AI in Clinical Settings and a Look to the Future

The application of AI in clinical settings does not take place only in oncology, cardiology and neurology, but also in other areas of healthcare (He et al., 2019). AI technology can aid triage or screening by selecting priority radiographs based on the most probable disease (Tang et al, 2018). It can help in identifying risks to eyesight, differentiating between patients who urgently need face-to-face examination and those who are not at risk (triage), diagnosing disease, quantifying vascular stenosis in cardiac imaging (Pelcyger, 2017; De Fauw et al., 2018; Kermany et al., 2018; Giordano et al., 2021; Brown et al., 2023). In the future, AI technologies will be most rapidly applied in the fields of radiology, ophthalmology, dermatology and pathology, mainly due to their powerful imaging and visual components with the possibility of automated analysis. However, according to some researchers (He et al., 2019), internal medicine and surgery will be somewhat later entrants into the AI world; the former because it requires the integration of different types of data and the latter because of the procedural components.

The integration of AI into the clinical setting will require the alignment of healthcare workers and developers regarding the goals. The future will also

require staff to be cross-trained with all colleagues at different levels of competence (He et al., 2019).

Conclusions

Successful integration of AI into health systems relies on digitised and analysed data collected in an AI-related database. It is in healthcare that the adoption of digital innovation is at its lowest level compared to other sectors. It will be necessary to move beyond the capture of paper-based patient data, which limits the effectiveness of treatment in several respects: information analysis, productivity and the efficient use of resources to carry out higher-value tasks. Data digitalisation will make it possible to use these resources more efficiently and to gain deeper insights into patients' health and care. Only once digitisation has been implemented will it be possible to carry out the processes that are the domain of AI. Interoperability will need to be established in healthcare systems to enable the exchange, integration and retrieval of health information. This does not allow unhindered access to patient data, but rather patient-centred treatment, which will reduce inefficient healthcare services and thus the cost of treatment. Older people should also be involved in the formulation of recommendations for the future development of AI technologies in the context of ensuring human rights. The need to empower them through access to information and communication technology and digital literacy will need to be highlighted, as will the need to ensure the safe use of AI in law and in technology.

Artificial intelligence will remain and go beyond its current stage of development: in the future, AI tools will be refined and improved as software and the databases it uses evolve. Humans will be able to reach beyond their limitations; they will work hand in hand with new tools to find solutions to – so far - unsolvable problems; and they will contribute, together with AI, to the advancement of humanity. In the future, AI will surely evolve into a so-called super-intelligence, which, according to researcher Gams, will help us to "live long and well as a human technological civilisation".

References

ABDULLAH, R. and FAKIEH, B., 2020. Health care employees' perceptions of the use artificial intelligence applications: Survey study. *Journal of Medical Internet Research,* vol. 22, no. 5: e17620, pp. 1–8.

BROWN, C., NAZEER, R., GIBBS, A., Le PAGE, P. and MITCHELL, A.R., 2023. Breaking Bias: The Role of Artificial Intelligence in Improving Clinical Decision-Making. *Cureus,* vol. 15, no. 3:e36415.

CATO, K., MCGROW, K. and ROSSETTI, S.C., 2020. Transforming clinical data into wisdom. *Nursing Management,* vol. 51, no. 11, pp. 24–30.

CHEN, M. and DECARY, M., 2020. Artificial intelligence in healthcare: An Essential guide for health leaders. *Health Management Form*, vol. 33, no. 1, pp. 10–18.

DARCY, A.M., LOUIE, A.K. and ROBERTS, L.W., 2016. Machine Learning and the Profession of Medicine. *JAMA,* vol. 306, pp. 848–855.

De FAUW, J., LEDSAM, J.R., ROMERA-PAREDES, B., NIKOLOV, S., TOMASEV, N., BLACKWELL, S., ASKHAM, H., GLOROT, X., O'DONOGHUE, VISENTIN, D. et al., 2018. Clinically applicable deep learning for diagnosis and referral in retinal disease. *Nature Medicine,* vol. 24, no. 9, pp. 1342–1350. DOI: 10.1038/s41591-018-0107-6.

DILSIZIAN, S.E. and SIEGEL, E.L., 2014. Artificial intelligence in medicine and cardiac imaging: harnessing big data and advanced computing to provide personalized medical diagnosis and treatment. *Current Cardiology Reports*, vol. 16, no. 441.

ETGES, A.P.B. da S., CRUZ, L.N., SCHLATTER, R., et al., 2022. Time-Driven activity-based costing as a strategy to increase efficiency: an analyses of interventional coronary procedures. *The International Journal of health planning and management*, vol. 37, no. 1, pp. 189–201.

FERRALLELLI, M., 2023. *¿Cómo Abordar La Inteligencia Artificial En El Aula?* Ciaesa: Buenos Aires.

GIORDANO, C., BRENNAN, M., MOHAMED, B., RASHIDI, P., MODAVE, F. and TIGHE, P., 2021. Accessing Artificial Intelligence for Clinical Decision-Making. *Frontiers in Digital Health*, vol. 3:645232.

GOPAL, G., SUTER-CRAZZOLARA, C., TOLDO, L. and EBERHARDT, W., 2019. Digital transformation in healthcare – architectures of present and future information technologies. *Clinical Chemistry and Laboratory Medicine*, vol. 57, no. 3, 328–335.

GOSAK, L., PRUINELLI, L., TOPAZ, M. and ŠTIGLIC, G., 2024. The ChatGPT effect and transforming nursing education with generative AI: Discussion paper. *Nurse Education in Practice,* vol. 75: 103888.

HARWICH, E. and LAYCOCK, K., 2018. *Thinking on its own: AI in the NHS*. London: Reform, 2018.

HERNANDEZ, I., TELLO, J., BELDA, C., URENA, A., SALCEDO, I., ESPINOSA-ANKE, L. and SAGGION, H., 2017. Savana: re-using electronic health records with artificial intelligence. *International Journal Interactive Multimedia Artificial Intelligence,* vol. 4, no. 7, pp. 8–12.

HE, J., BAXTER, S.L., XU, J., XU, J., ZHOU, X. and ZHANG, K., 2019. The practical implementation of artificial intelligence technologies in medicine. *Nature Medicine,* vol. 25, no. 1, pp. 30–36.

JIANG, F., JIANG, Y., ZHI, H., LI, H., MA, S., WANG, Y., DONG, Q., SHEN, H. and WANG, Y., 2017. Artificial intelligence in healthcare: past, pres-

ent an future. *Stroke and Vascular Neurology*, vol. 2, no. 4, pp. 230–243. DOI: 10.1136/svn-2017-000101.

YOUSEFI, M., YOUSEFI, M., FERREIRA, R.P.M., KIM, J.H. and FOGLIATTO, F.S., 2018. Chaotic genetic algorithm and Adaboost ensemble metamodeling approach for optimum resource planning in emergency departments. *Artificial Intelligence in Medicine,* vol. 84, pp. 23–33.

KERMANY, D.S., GOLDBAUM, M., CAI ,W., VALENTIM, C.C.S., LIANG, H., BAXTER, S.L., MCKEOWN, A., YANG, G., WU, X., YAN, F., DONG, J., PRASADHA, M.K., PEI, J., TING, M.Y.L., ZHU, J., LI, C. and HEWETT, S., 2018. Identifying medical diagnoses and treatable diseases by image-based deep learning. *Cell,* vol. 172, no. 5, pp. 1122–1131.e9.

LAUKKA, E., HAMMAREN, M. and KANSTE, O., 2022. Nurse leaders' and digital service developers' perceptions of the future role of artificial intelligence in specialized medical care: An interview study. *Journal of Nursis Management*, vol. 30, no. 8, pp. 3838–3846.

LOGAR ČUČEK, M., 2023. Odličnost vodenja - na vrednosti temelječa zdravstvena obravnava v zdravstveni negi prispeva k dvigu produktivnosti in zadovoljstvu pacientov. In: LOGAR ČUČEK, M., ed. *Estetski posegi v kirurgiji obraza in njen potencial v zdravstveni negi in oskrbi na KO za maksilofacialno in oralno kirurgijo v UKC Ljubljana, Ljubljana, 9. dec. 2023.* Ljubljana: Zbornica zdravstvene in babiške nege Slovenije – Zveza strokovnih društev medicinskih sester, babic in zdravstvenih tehnikov Slovenije, 2023, pp. 117–122.

NANCY, R., 2019. How artificial intelligence is changing nursing. *Nursing management*, vol. 50, no. 9, pp. 30–39.

NECHER, M., PETERSSPN, L., NYGREN, J.M., SVETBERG, P., LARSSON, I. and NILSEN, P., 2023. Innovation in healthcare: leadership perceptions about the innovation characteristics of artificial intelligence - a qualitative interview study with healthcare leaders in Sweden. *Implementation Science Communications,* vol. 4, no. 1, p. 81.

PEDRÓ, F., 2020. Applications of Artificial Intelligence to Higher Education: Possibilities, Evidence, and Challenges. *IUL Research,* vol. 1, no. 1, pp. 61–76.

PELCYGER B., 2017. Artificial intelligence in healthcare: Babylon Health & IBM Watson take the lead. *Prescouter* [online] [viewed 8 august 2024]. Available from: https://prescouter.com/2017/12/artificial-intelligence-healthcare.

POSNETT, J., 2022. Value-based procurement in wound care. *Wounds UK*, vol. 18, no. 1, pp. 42–49.

REDDY, S., FOX, J. and PUROHIT, M.P., 2019. Artificial intelligence-enabled healthcare delivery. *Journal of the Royal Society of Medicine,* vol. 112, no. 1, pp. 22–28.

RONQUILLO, C., PELTONEN, L.-M., PRUINELLI, L., CHU, C., BAKKEN, S., BEDUSCHI, A., CATO, K., HARDIKER, N., JUNGER, A., MICHALOWSKI, M. et al., 2021. Artificial intelligence in nursing: Priorities and opportunities from an international invitational think-tank of the Nursing and Artificial Intelligence Leadership Collaborative. *Journal of Advanced Nursing,* vol. 77, no. 3, pp. 3707–3717.

SALAS-PILCO, S. Z. and YANG, Y., 2022. Artificial Intelligence Applications in Latin American Higher Education: A Systematic Review. *International Journal of Educational Technology in Higher Education,* vol. 19, no. 1, pp.1–20.

SEIBERT, K., DOMHOFF, D., BRUCH, D., SCHULTE-ALTHOFF, M., FÜRSTENAU, D., BIESSMANNN, F. and WOLF-OSTERMAN, K., 2021. Application Scenarios for Artificial Intelligence in Nursing Care: Rapid Review. *Journal of Medical Internet Research*, vol. 23, no. 11, pp. 1.

SHAH, P., KENDALL, F., KHOZIN, S., GOOSEN, R., HU, J., LARAMIE, J., RINGEL, M. and SCHORK, N., 2019. Artificial intelligence and machine learning in clinical development: a translational perspective. *NPJ Digital Medicine,* vol. 2, no. 69.

TANG, A., TAM, R., CADRIN-CHÊNEVERT, A, GUEST, W., CHONG, J., BARFETT, J., CHEPELEV, L., CAIRNS, R., MITCHELL, J.R. and CICERO, M.D., 2018. Canadian association of radiologists white paper on artificial intelligence in radiology. *Canadian Association of Radiologists (CAR),* vol. 69, no. 2, pp. 120–135.

TOPOL, E., 2019. High-performance medicine: the convergence of human and artificial intelligence. *Nature Medicine*, vol. 25, no. 1, pp. 44–56.

VEALE, M., 2018. Logics and Practices of Transparency and Opacity in Real-World Applications of Public Sector Machine Learning.

VILLANI, C., 2018. For a meaningful artificial intelligence [online]. [viewed 6 August 2024]. Available from: https://www.iris-france.org/110108-villanis-report-defence-at-the-age-of-ai/.

WATSON, R., 2024. The potential and pitfalls of artificial intelligence in nursing. *Obzornik zdravstvene nege*, vol. 58, no. 1, pp. 4–6.

ZLATANOVA, N. and VELJKOVIĆ, L., 2023. Artificial intelligence and how it works. In: TEKAVČIČ VEBER, M. and KOVAČIČ, M., eds. *Artificial intelligence and the rights of older persons.* Ljubljana: Litteralis, d. o. o., pp. 16–21.

ZLATANOVA. N., 2023. Examples of currently developing AI uses in the field of medicine. In: TEKAVČIČ VEBER, M. and KOVAČIČ, M., eds. *Artificial intelligence and the rights of older persons.* Ljubljana: Litteralis, d. o. o., p. 23.