

AI: Opportunities, Capabilities and Limits

THE JOURNAL 2022

Henrique Martins et al.
Hospitals-on-FHIR: Preparing Hospitals for European Health Data Space

Rafael Vidal-Perez
Artificial Intelligence and Echocardiography: Are We Ready for Automation?

Konstantinos Petsios et al.
Artificial Intelligence in Radiology: Realities, Challenges and Perspectives from a Tertiary Cardiac Centre in Greece

Sai Pavan Kumar Veeranki et al.
Learning From Each Other: An Artificial Intelligence Perspective in Healthcare

Elmar Kotter
Integrating Decision Support and AI in Radiology

†Werner Leodolter
Clinical Decision Support – Benefits and Application in Healthcare





Telemedicine Care Combined with AI: Capabilities & Benefits

Charlotte Hubault | e-Health Consultant | Comarch Healthcare | Brussels, Belgium

An overview of the application of AI (artificial intelligence)-enabled systems in telemedicine and the Comarch healthcare strategy to develop building blocks of this new care system.



Key Points

- The management of chronic disease and geriatric disorders is one of the biggest challenges for healthcare systems.
- Telemedicine solutions bring innovative answers to the needs of healthcare providers.
- AI (artificial intelligence)-enabled systems can unlock the potential of telemedicine at every step of the patient pathway.
- AI-based virtual medical assistants can support telemedicine tools in the development of preventive medicine.
- Systems combining telemedicine and AI technologies can support healthcare providers to make the right diagnosis and choose the right treatment.
- Beyond remote monitoring, AI technologies enable the distant delivery of care to specific groups of patients thanks to smart robots and chatbots.

Introduction

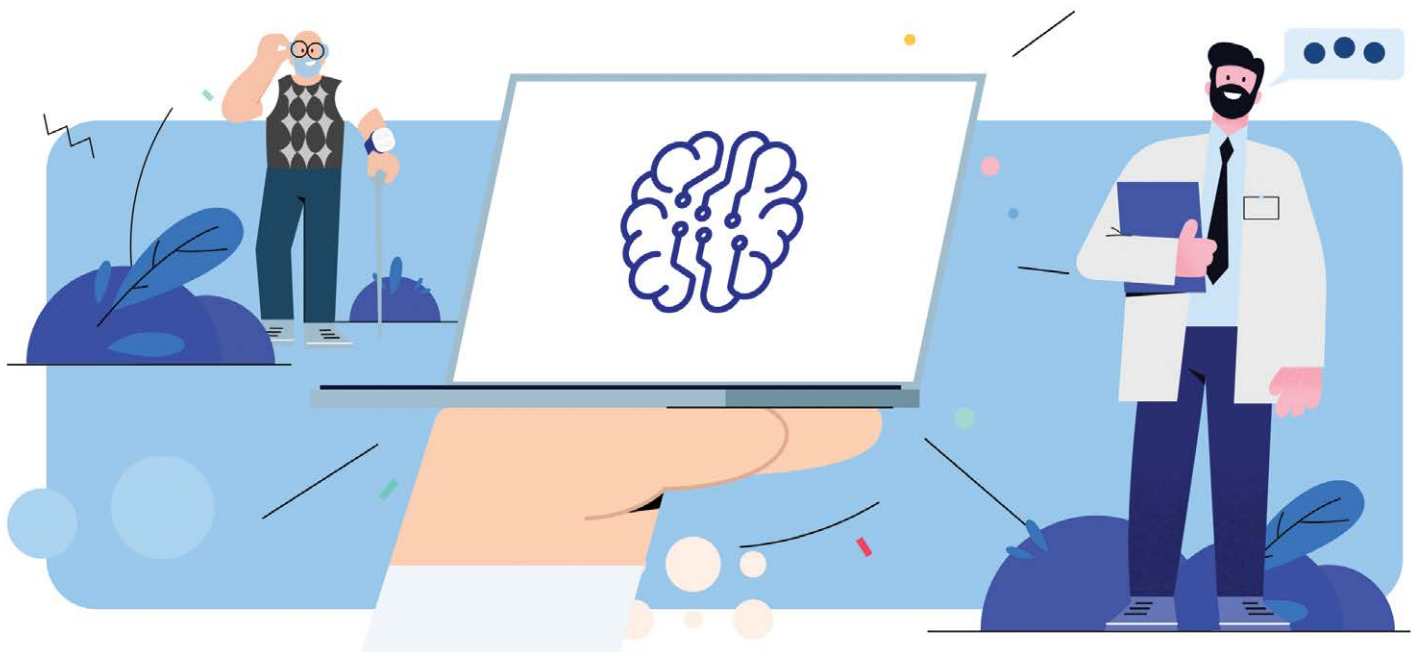
The management of chronic disease and geriatric disorders such as cardiovascular disease, osteoporosis, diabetes, dementia and obesity is one of the biggest challenges for our healthcare systems. The population of patients affected by these disorders is dramatically growing, while the nature of a chronic condition requires prompt and continuous care. In this context, telemedicine solutions bring innovative answers to the needs of healthcare providers suffering from work overload, while proposing more fluid care pathways and better quality of life for patients.

Telemedicine systems, from preventive care to telediagnosis, remote monitoring and treatment management, are based on the digital exchange of data between patients and healthcare players. This data-driven positioning paves the way for the use of another key innovative trend in the healthcare ecosystem: AI (artificial intelligence)-enabled systems. Indeed, AI is the key lever for developing the potential of telemedicine at every step of the patient pathway, with different levels of maturity and various benefits. This paradigm is the core of the Comarch healthcare strategy, as the company is actively developing building blocks of this new care system enabled by telemedicine and AI.

AI-based virtual medical assistants supporting remote preventive care

Preventive care is the key to countering the development of chronic disorders in healthy populations, as well as for those who find self-care challenging. In this area, telemedicine solutions such as patient-operated applications and self-diagnostic booths paired with connected medical devices are great tools to help individuals engage with preventive care. AI-based virtual medical assistants can be used in this particular case. They generate synchronous and task-oriented computer-generated dialogue with the patients, similar to a dynamic questionnaire that directs the conversation to collect relevant health-related data. In addition to enhancing data collection, AI medical assistants can also generate automatic pre-diagnosis and health advice based on the generated data.

[Comarch](#) has brought to the market two patient-operated applications for preventive care: a health diary in the shape of a mobile application, [Comarch HealthNote](#), and a self-diagnosis booth, [Comarch Diagnostic Point](#). Both solutions are continuously developed and improved, notably thanks to [AI tools](#) such as the medical assistants cited above.



AI combined with telemedicine supporting health-care providers to analyse clinical data

The saturation of healthcare facilities unfortunately leads to delays in diagnosis as patients encounter difficulties getting appointment quickly. It is even more critical in the context of complex diseases that require several appointments with different specialists in order to make a diagnosis. This organisational barrier is now overcome by a new patient pathway based on telemedicine and AI. Instead of performing physical visits, clinical data can be generated remotely through a connected medical device or phone camera (for example, ECG data in cardiology, face pictures in genetics, skin pictures in dermatology). Data are then transmitted to healthcare providers through a telemedicine application which is where AI comes into play. Algorithms based on machine learning are able to analyse these single points of data to propose a diagnosis, by comparing them with huge quantities of existing data. The Los Angeles County Department of Health Services foresees the related benefits in the context of diabetic retinopathy, for example, as a new protocol for diagnoses using an AI analysis tool will enable diagnosis using only retinal pictures (Varshneya 2021).

In addition to analysis of single points of data, AI can also unlock the management of the huge amount of data generated remotely during long-term testing or screening. These large sets of data require powerful AI-enabled algorithms to expedite the diagnosis process. At Comarch, we already offer cardiac telemonitoring services, which analyse and detect silent atrial fibrillation in a 30-day ECG examination thanks to AI tools (Wiśniewski 2021).

AI systems can also perform remote triage of patients by

analysing early signs of deterioration thanks to connected medical devices and a patient-operated application. For example, the Department of Health Science and Technology at Aalborg University (Denmark) recently launched a clinical study aimed at testing an AI-enabled algorithm in telemonitoring to predict exacerbations in patients with COPD (Secher et al. 2022).

Decision-making tools supporting treatment decisions and AI applications improving treatment adherence

Systems combining telemedicine and AI technologies can support healthcare providers when deciding on the most suitable treatment for each individual. While telemedicine applications allow the collection of real-time data, AI-algorithms can perform rapid analysis of this information to provide the most relevant proposal for treatment based on the current condition of the patient. The [NextDREAM Consortium Group](#) headed a large-scale study assessing the efficiency and safety of an automated AI-based decision-support system which produces a full insulin titration recommendation and personalised management tips for healthcare providers who are remotely monitoring patients with diabetes. The study demonstrated that remote insulin adjustments suggested by the [AI advisor](#) perform as well as expert physician dosage changes.

In the context of remote care, AI application also improves treatment adherence. Indeed, when patients are at home, it makes it harder for healthcare providers to supervise the intake of medicine – and adherence is a key success factor for each drug-based therapy. For this reason, the AiCure company developed a mobile application dedicated to schizophrenia. It



integrates with a face recognition system and checks whether prescribed drugs have been taken. During their pilot study in 2017, the company reported an 89.7% drug adherence rate [compared to 71.9% for traditional drug adherence monitoring] (Bain et al. 2017).

mobile body and screen for patient-doctor communication. The camera moves in accordance with the doctor's instructions, and the robots can measure clinical parameters of the patient thanks to telemedicine functionalities [for example, electronic stethoscope, blood pressure, temperature, ECG and pulse-oximetry] (AIP Conference Proceedings 2018).

AI is the key lever for developing the potential of telemedicine at every step of the patient pathway

AI-enabled robots and chatbots delivering care in the context of telemedicine

Beyond remote monitoring, AI technologies enable the distant delivery of care to specific groups of patients thanks to smart robots and chatbots. Indeed, it is now a priority to create new care delivery ensuring better access and continuity of care to counter the lack of availability of healthcare providers, and to reduce the high costs of homecare. To this end, some synchronous and task-oriented computer-generated dialogues have been developed for mental health applications. They allow constant access to care for this target group, which may require assistance at any time of the day.

Elderly people could also benefit from AI-enabled care with the development of smart robots assisting them in their daily tasks and in the management of their health issues. For example, the Dr Rho Medical Telepresence Robot allows elaborate teleconsultations to be carried out thanks to its

Conclusion

Regarding the various applications of the combination of telemedicine and AI presented here, three main categories of solutions can be identified, each at different levels of maturity. First, the AI-based decision-making tools supporting healthcare providers in making a diagnosis or selecting the relevant treatment are quite mature, as they are already in use in various care facilities. AI virtual assistants who support patients during self-diagnoses or deliver care in the context of mental health issues (for example) are promising solutions but have not yet been integrated into care practices. Last, smart robots also represent a great opportunity to unlock telemedicine capabilities, but are still at the development stage. Indeed, the two last applications require additional clinical studies to prove their efficiency and their safety, and represent large investments in research and development at the technological and organisational levels. ■

REFERENCES

AIP Conference Proceedings 1933. 040009 (2018). Available from <https://aip.scitation.org/doi/abs/10.1063/1.5023979>

Bain EE, Shafner L, Walling DP et al. (2017) Use of a Novel Artificial Intelligence Platform on Mobile Devices to Assess Dosing Compliance in a Phase 2 Clinical Trial in Subjects With Schizophrenia. *JMIR Mhealth Uhealth*. 5(2):e18.

Secher PH, Hangaard S, Kronborg T et al. (2022) Clinical implementation of an algorithm for predicting exacerbations in patients with COPD in telemonitoring: a study protocol for a single-blinded

randomized controlled trial. *Trials* 23, 356.

Varshneya R (2021) The Growing Role of Artificial Intelligence in Telehealth. *MedTech Intelligence*. Available from <https://www.medtechintelligence.com/column/the-growing-role-of-artificial-intelligence-in-telehealth/>

Wiśniewski M (2021) AI vs Human: The Use of Artificial Intelligence for Medical Analysis. *HealthManagement The Journal*. 21(8):476-477.