

MEDICAL ROBOTS IN KAZAKHSTAN: CURRENT STATE AND PROSPECTS FOR DEVELOPMENT

Aigerim A.N., Erikzhan A.A., Ulbala B.K., Ulan D.A., Anargul A.S.

Almaty Technological University, Almaty, Kazakhstan

Abstract: This article explores the use of medical robots in Kazakhstan, describing their current achievements and areas of application and analyzing the benefits and limitations of these technologies in healthcare. The conclusion discusses the prospects for further development and integration of medical robots in Kazakhstan, as well as a comparative analysis with other countries.

The development of medical robots has become an important part of modern medicine, contributing to improved quality of service and treatment efficiency. In Kazakhstan, the introduction of robotics in medicine began relatively recently, but it has already shown significant potential in fields such as surgery, diagnostics, and rehabilitation. The purpose of this article is to examine the current state of medical robots in Kazakhstan, identify the main achievements and prospects, and analyze their strengths and weaknesses.

One of the well-known medical robots used in Kazakhstan is the Da Vinci robotic surgical system (Fig.1). This robot is used in leading clinics in the country, such as the National Scientific Center of Surgery and the Medical Center of the President's Administration.



Figure 1 - Da Vinci Robotic Assistant as Innovative Technology Enhancing the Field of Surgery [1]

The Da Vinci system allows surgeons to perform complex minimally invasive operations with high precision through robotic "arms," remotely controlled.

Advantages of Da Vinci: Ensures high precision, minimizes postoperative complications, reduces patients' rehabilitation period.

Limitations: High cost of equipment and maintenance, need for specialized training of medical personnel.

Diagnostic Robots. Robots for diagnostics and remote monitoring are also beginning to be used in Kazakhstan. Diagnostic robots provide doctors with new capabilities for examination and monitoring, minimizing patient intervention. This is especially beneficial for treating chronic diseases that require constant monitoring [2]. For example, there are robots that assist in conducting ultrasounds and diagnosing cardiovascular diseases. These technologies allow doctors to obtain highly accurate data, improving diagnostic accuracy and reducing human error.

Advantages: Reduces staff workload, high data accuracy, remote monitoring capability.

Limitations: High cost and limited availability, dependence on technical support.

Rehabilitation Robots: In Kazakhstan, robots are also used for rehabilitating patients who have suffered strokes or injuries to the musculoskeletal system. An example is the ReWalk exoskeleton, which helps patients regain mobility. These robots are used in major medical centers and specialized clinics.

Advantages: Increases rehabilitation efficiency, speeds up patient recovery, reduces the workload of medical staff.

Limitations: Long adaptation and training period for the patient, high cost of equipment.

Key Achievements in the Use of Medical Robots in Kazakhstan.

The use of medical robots in Kazakhstan has significantly improved the precision of surgical operations and reduced the risk of complications. The

implementation of such systems in Kazakhstani clinics also helps shorten patients' hospital stays, enhancing the accessibility of medical services.

Comparative Analysis of Achievements in Kazakhstan and Other Countries

While Kazakhstan is actively developing the field of medical robotics, this sector has already reached high levels of maturity in many countries worldwide. For example, in the United States and Germany, the use of Da Vinci robots has become standard for a range of complex surgical operations, such as tumor removal and cardiac surgery. In South Korea and Japan, robotics is actively integrated into rehabilitation, where robots assist in restoring motor functions and caring for elderly patients [4].

Although Kazakhstan currently lags behind leading countries in the adoption of medical robots, the country shows significant progress in mastering robotic technologies and their application in clinics. With the support of the government and private investors, Kazakhstan may integrate more robotic systems for diagnostics, surgery, and rehabilitation into its medical system in the future [3].

Benefits and Limitations of Using Medical Robots

Benefits:

1. High precision in operations and diagnostics, minimizing human error.
2. Shortened rehabilitation period, which is especially relevant for surgical patients.
3. Reduced workload on medical staff due to the automation of certain tasks.
4. Improved treatment quality and reduced complication rates.

Limitations:

5. High cost of robots and their maintenance, limiting widespread adoption.
6. Shortage of qualified personnel who can operate such devices.
7. Dependence on technical support and the need for frequent equipment upgrades.

8. Limited accessibility for certain patient categories, especially in remote regions [7].

Prospects for the Development of Medical Robots in Kazakhstan

The development prospects for medical robots in Kazakhstan include the creation of educational programs to train specialists who will work with robotic systems. With the growing interest in the concept of Medicine 4.0, increased investment in robotics and artificial intelligence technologies can be expected. This will create opportunities to develop national robotic systems tailored to the needs of Kazakhstani clinics.

In the future, it is anticipated that medical robotics will be used in telemedicine, providing access to high-quality medical services for people in remote areas. Additionally, automating routine procedures such as diagnostics and rehabilitation will help allocate healthcare resources more efficiently [5-7].

Conclusion

The development of medical robotics in Kazakhstan shows high potential for improving the quality of medical services. Each year, the integration of robotics in healthcare grows, fostering an innovative environment and improving accessibility to healthcare. However, for full implementation, it is necessary to develop infrastructure, train personnel, and ensure government support.

References:

1. <https://health-travel.kz/robotizirovannaya-hirurgiya-da-vinci/>
2. Alemasov, R., & Zhumataeva, A. (2022). "Robotics in healthcare in Kazakhstan: current achievements and development prospects". *Journal of Medicine of Kazakhstan*, 48(3), 24-30.
3. The Association of Healthcare of Kazakhstan. (2023). "Introduction of robotic systems in clinics in Kazakhstan: analysis and review". Access from <https://www.healthcare.kz/reports>
4. International Association of Robotics (IFR). (2022). "World Robotics Report: Healthcare Robotics". IFR. Access from <https://ifr.org/healthcare-robotics>
5. Da Vinci Surgical System. (2023). "The official website of the Da Vinci system". <https://www.davincisurgery.com>

6. American Journal of Robotic Surgery. (2022). "Advancements in Medical Robotics in Emerging Markets". 14(1), 58–70.

7. The United Nations (UN). (2023). "Digitalization and robotics in the healthcare system of developing countries." The UN Report. Access from <https://www.un.org/health-report> McKinsey & Company. (2022). "The Future of Robotics in Healthcare: Global and Regional Trends". <https://www.mckinsey.com>