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The Impact of Smart Technologies on the Medicine 4.0 Transformation in the Context of the Technological Revolution

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ABSTRACT

The article examines the impact of smart technologies on the transformation of healthcare 4.0 in the context of the technological revolution, which is defined by the introduction of telemedicine and mHealth, sensors and digital device technologies that have truly evolved in 4.0 and expanded, thanks to new technologies that have made wireless interaction between devices possible. The methodology includes the use of such methods as computer science, axiological, system analysis and synthesis, Agile method, as well as general philosophical methods, which allowed us to analyze the contradictory nature of the impact of smart technologies on the transformation of medicine 4.0. The article analyzes telemedicine and mHealth, which provide remote access and management of medical services. The directions of artificial intelligence and machine learning implementation that are changing the healthcare sector are identified. The place and role of the 3D printing industry for medical applications and nanotechnology are investigated. The essence of the Internet of Things (IoT) as a global network and technologies of interconnected devices and their application in the medical sector is clarified.

KEYWORDS: Smart technologies, transformation of medicine 4.0, telemedicine, mHealth, artificial intelligence.

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El impacto de las tecnologías inteligentes en la transformación de la Medicina 4.0 en el contexto de la revolución tecnológica

RESUMEN

El artículo examina el impacto de las tecnologías inteligentes en la transformación de la Medicina 4.0 en el contexto de la revolución tecnológica, definida por la introducción de la telemedicina y la sanidad móvil, los sensores y las tecnologías de dispositivos digitales, que han evolucionado realmente en 4.0 y se han ampliado con nuevas tecnologías que han permitido la interacción inalámbrica entre dispositivos. La metodología incluye el uso de métodos como el informático, el axiológico, el de análisis y síntesis de sistemas, el método Agile, así como métodos filosóficos generales, que permitieron analizar el carácter contradictorio del impacto de las tecnologías inteligentes en la transformación de la Medicina 4.0. El artículo analiza la telemedicina y la sanidad móvil, que facilitan el acceso y la gestión a distancia de los servicios médicos. Identifica las áreas de inteligencia artificial y aprendizaje automático que están cambiando el sector sanitario. Se exploran el lugar y el papel de la industria de la impresión 3D para aplicaciones médicas y la nanotecnología. Se aclara la esencia del Internet de las Cosas (IoT) como red global y tecnologías de dispositivos interconectados, y su aplicación en el ámbito médico.

PALABRAS CLAVE: Tecnologías inteligentes, transformación de la Medicina 4.0, telemedicina, mHealth, inteligencia artificial.

Introduction

Healthcare is one of the most important industries, the development of which makes it possible to treat many, sometimes rare, diseases. This has become possible mainly due to technological advances in the medical sector, which have allowed us to better understand humanity. Technology plays a vital role in this area, allowing us to understand the human body better. However, progress is not possible without removing the barriers to a better and healthier future. These obstacles include rising healthcare costs, growing inequality, and climate change.

The presence of technology in healthcare applications is creating new opportunities for patients and healthcare professionals to live in a more sustainable environment and even fight once incurable diseases. Technologies such as artificial intelligence (AI), machine learning, virtual care, the Internet of Medical Things and 5G are just a few examples of advances that are improving medical structures. In recent years, we have witnessed a true technological revolution in healthcare. We have not only improved the way we treat many

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diseases that were incurable just a few years ago, but we are also laying the groundwork for a future where we can prevent many diseases with the help of digital devices. Humanoid robots could care for the sick and elderly, and we could potentially treat people by genetically modifying their cells. Perhaps medical technology will bring us closer to what we consider immortality.

Let's take a look at some of these dramatic technological advances and how they are changing the world. Medical technology is changing the healthcare industry in many ways. Not only will people be able to take better care of themselves, but they will also have digital assistants that will give them real-time suggestions on how to be healthier. Prevention and diagnostics are likely to become more accurate thanks to the data obtained. Personalised devices such as prostheses and orthoses will become cheaper, making it possible to significantly improve people's lives. Many incurable diseases today will become treatable and life-saving. The technological advances we see today are impressive, and much of their potential has yet to be unlocked (Nikitenko, et al., 2022a).

The purpose of the article is the theoretical and practical aspects of the digital technologies' (Voronkova et al. 2023) impact on the transformation of medicine 4.0 in the context of the technological revolution: 1) to analyse telemedicine and mHealth, which provide an opportunity to remotely access and manage healthcare services; 2) to identify areas of implementation of artificial intelligence and machine learning that are changing the healthcare sector; 3) to study the place and role of the 3D printing industry for medical use and nanotechnology; 4) to clarify the Internet of Things (IoT) as a global network and technology of interconnected devices and applications in the medical sector. The object of research is the transformation of medicine 4.0 in the context of the technological revolution as a social and economic phenomenon. The subject of the study is the impact of smart technologies on the transformation of healthcare 4.0 in the context of the technological revolution (Voronkova et al., 2022a).

1. Literature review

We rely on Altrade, Dagogo "From Einstein to artificial intelligence: science and technology that changed the world" (2021); Bostrom, Nick "Superintelligence. Strategies and dangers of smart machines development" (2020); Diamandis, Peter & Kotler, Stevens

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"The future is closer than it seems. How technology is changing business, industry and our lives (2021).

Dixon, Patrick "The future of (almost) everything. How will the world change over the next hundred years" (2021), which describe the development of digital technologies in the field of medicine and point to new areas that use smart technologies. In this study, we focus on the author's article by Voronkova, Valentyna, Nikitenko, Vitalina, Bilohur, Vlada, Oleksenko, Roman, & Butchenko, Taras (2022). The conceptualisation of smart-philosophy as a post-modern project of non-linear pattern development of the XXI century. Cuestiones Políticas, Vol.40, No 73 and Voronkova V.G., Andriukaitene R. Trends in the development of the philosophy of medicine of the XXI century in the context of foreign experience. Collection of materials of the III All-Ukrainian scientific and practical conference with international participation "Socio-ethical and deontological problems of modern medicine (non-medical problems in medicine)" (24-25 February 2022). Zaporizhzhia: ZSMU, 2022, which gave a start to the study of this topic and contributed to the deepening of its conceptual and categorical apparatus.

The scope of the literature review includes works that relate to the context of Industry 4.0, with a focus on aspects related to the healthcare sector. industry 4.0, cyber-physical systems, Cloud Computing (CC), Internet of Things (IoT); and health-related keywords, such as: health, smart hospitals, smart healthcare, healthcare services. A major role was played by Gemel, Gary & Zamnini, Michele (2021). Anthropocracy. Creating companies in which people are above all / trans. from English Dmitry Kozhedub. Kyiv. 336, which outlines new advances in healthcare made possible by digital breakthrough technologies. The study aimed to select different approaches to technology in order to demonstrate the evolution and progress of the healthcare sector based on research in universities and companies. Furthermore, it sought to present the current state of the art and gap analysis of different levels of integration components by analysing different proposals existing in the literature of Hlebova, N., Oleksenko, K., Oleksenko, R., & Afanasieva, L. (2021). Subjunctive aspects of sociological support of the modern teacher formation process in the development context of the new Ukrainian school system. Linguistics and Culture Review, 5(S1), 439-450; Kyrychenko, M., Nikitenko, V., Voronkova, V., Harbar, H., & Fursin, A.A. (2021). The search for new forms of personal expression in the era of postmodernism. Amazonia Investiga. 10 (42), 248-254. The authors' articles

Nikitenko, Vitalina A., Voronkova,Valentyna H., Andriukaitiene, Regina & Oleksenko, Roman I. (2021). The crisis of the metaphysical foundations of human existence as a global problem of post-modernity and the ways of managerial solutions Propósitos y Representaciones; Nikitenko, Vitalina, Voronkova, Valentyna, Shapurov Alexander, Ryzhova Iryna, & Oleksenko Roman (2022). The Influence of Digital Creative Technologies on the Development of Education and Medicine International Journal of Health Sciences; Nikitenko V.O, Voronkova V.G, Oleksenko R.I. Medicine of the future in the context of philosophical understanding. Collection of materials of the III All-Ukrainian scientific and practical conference with international participation "Socio-ethical and deontological problems of modern medicine (non-medical problems in medicine)" (24-25 February 2022). Zaporizhzhia: ZSMU, 2022; Oleksenko Roman, Voronkova Valentina & Nikitenko Vitalina (2019). Examination of digital reality as a factor in achieving the stability of society in stochasticity (uncertainty, instability, bifurcation) conditions. Quarterly German scientific/popular science bulletin "Results of the scientists' work: sociology, criminology, philosophy and political science. Cherep A.V. (2013). Practical foreign experience of medical insurance and Cherep A.V., Vasilieva S.I. (2010). Development of innovation activity in Ukraine in modern conditions concerns the innovation activity underlying various discoveries in the field of medicine.

The analysis of the literature on this issue has shown that this topic is the most relevant and has practical significance, as health is a global problem that affects everyone.

2. Research methodology

The impact of technological progress, especially in the field of healthcare, has had a positive impact on medicine and its interventional practices, as new techniques and methods have emerged at all times that can improve the diagnosis and treatment of many diseases. To analyse the impact of digital technologies on the transformation of healthcare 4.0 in the context of the technological revolution, we should use the informational method, based on the exponential increase in information determined by the Bid Data law, the management of the DataSphere, medical information and its activities.

In recent years, healthcare, driven by information technology and artificial intelligence applications, has contributed to real transformations through the creation of intelligent sensor projects and robotic algorithms that ensure patient comfort and safety

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and can be monitored from home. The informational method has made it possible to show that the combination of medical knowledge with engineering principles and practices forms Health/Medicine 4.0. Evidence shows that the benefits of technological advances aimed at Health/Medicine 4.0 are recognised as effective, but organisations that want to have these systems should be aware that the implementation process can be a complex task that requires the ability to withstand the impact of several factors, the main one being human resistance to new technologies.

One of the methods is the Agile method, which is based on adaptive practice to new technologies, the need for medical doctors to apply these technologies in their practice, and the ability of doctors to implement new technologies to learn new diagnostic methods and improve their skills. The AGILE methodology helps managers to overcome chaos, entropy, uncertainty, various bifurcation points and facilitate the search for an attractor (point of attraction) in the complex digital world. In this context, artificial intelligence, digital glasses, holograms, 3D printing, the Internet of Things, and Big Data stand out as the main innovative tools and enablers of technologies applied to Health 4.0 (Nikitenko, et al., 2022 b). The combination of knowledge, information, methods and new technologies in medicine provides many other benefits for the entire community. The axiological (value-based) method has played a major role, as the emergence of innovations in all medical fields has already become visible, especially in surgery (cardiology, brain, etc.), which benefits patients and doctors through the accuracy and speed of information needed to save lives and brings new values with it. In order to present the achievements of Health 4.0, it was necessary to apply the method of system analysis and synthesis, to identify the main reasons for medical resistance to the introduction of technological systems, especially in terms of electronic records. To analyse the impact of digital technologies on the transformation of Health 4.0 in the context of the technological revolution, general philosophical methods were used, including analysis and synthesis, abstraction, specification, generalisation, historical and logical, and cross-cultural analysis (Appello, 2019).

3. Results and discussion

3.1. Telemedicine and mHealth, augmented and virtual reality Telehealth and mHealth

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Telemedicine and mHealth provide an opportunity to remotely access and manage healthcare services. This is made possible by the use of digital information and communication technologies. When these services are available via mobile phone, we talk about mHealth. The benefits and challenges of this new form of healthcare are numerous: 1) providing people living in poorer communities with a less expensive way to access healthcare and education; 2) developing accessible and practical services for people with limited mobility or people living in isolated areas; 3) online access to healthcare professionals wherever they are; 4) improving communication between healthcare team members and their patients; 5) providing support for self-care and learning; 6) helping doctors share their knowledge and diagnose diseases. This allows patients to communicate with nurses and doctors, receive prescriptions, make appointments and check examination results online, hold virtual meetings, and conduct online psychotherapy during the pandemic.

Sensors and digital device technologies that have truly evolved and expanded, made possible by new technologies that have enabled wireless communication between devices. Today, most wearables on the market are used primarily for fitness monitoring, GPS location tracking and quick text messaging. However, these devices have unrivalled potential, especially in the healthcare sector, as they can track heart rate, sleep and movement, and use the data to make health recommendations. By analysing the user's heartbeat, they can detect irregular rhythms and recognise a heart attack, contacting emergency services, thus saving lives. Digital devices and other sensors are becoming more sophisticated, more reliable and more complete. In the future, we may have sensors implanted in our bodies that collect data about our vital functions around the clock, which will become so sophisticated that they will even be able to predict diseases (Bostrom, 2020).

Augmented reality and virtual reality. Thanks to mobile devices and special media such as smart glasses, we can experience augmented and virtual reality. Augmented reality (AR) is a technology that integrates digital information into the user's real environment. It can add images, sounds, and sensory stimuli to the everyday world. Virtual reality (VR), on the other hand, recreates a virtual world that may be similar or completely different from the world we live in. These two technologies are probably on the verge of a complete revolution in the healthcare industry. In medicine, augmented reality can be used to view

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the veins in a patient's body, project images from X-rays or computed tomography, and even be used to guide doctors during surgery. Virtual reality is transforming medical care, starting with medical training, and can simulate any medical situation. VR has proven to be very effective in helping patients cope with pain and anxiety. There are several ways to use augmented and virtual reality (AR and VR) in healthcare. These technologies allow for a multidimensional combination of digital and physical environments. The development of augmented reality is mainly dependent on artificial intelligence. As already mentioned, cancer can be detected using image recognition. VR can be used in physiotherapy in areas such as mental trauma, where it can cure phobias. Doctors using AR glasses can overlay computed tomography and 3D scanning data to look inside patients' bodies. Microsoft is one of the developers of glasses that provide a mixed reality experience with HoloLens. As the technology evolves and combines augmented reality and virtual reality, it is enabling us to go beyond simple virtual examinations to achieve a variety of medical procedures that are performed remotely, such as full surgical procedures using robotics. In Japan, for example, medical robots are caring for the elderly (Diamandis & Kotler, 2021).

Robot assistants. Raphael Hostettler runs the company Devanthro, and his team is working on a humanoid robot that can replicate the way people move using artificial muscles. One of the possible applications of this robot is to become a device for caring for the elderly and sick. Indeed, nurses can remotely control robots using wearable devices such as AR glasses and controllers, and they do not need to be physically present, as they will be able to remotely support several people at the same time. The price of their service will be significantly lower than that of a full-time caregiver, and the elderly and sick will be able to afford this service without leaving their homes or moving to a nursing home. This is just one example of the hidden potential of recent technological advances (Altrade, 2021)

3.2. Areas of artificial intelligence and machine learning implementation that are changing the healthcare sector

Artificial intelligence and machine learning. Artificial intelligence and machine learning are strengthening healthcare. Among the advances, artificial intelligence (AI) has become a strong point in electromedical engineering, as AI can reduce the number of deaths and prevent as well as reduce medical errors, particularly in healthcare. However, both of these fields are extremely complex, and to fully develop their potential, people are required

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who can combine AI and medical knowledge. Because machine learning algorithms can mimic human cognition, they can be used to analyse, present and understand complex medical data. For example, these technologies can: 1) understand a patient's symptoms by analysing their vital signs; 2) make a diagnosis by comparing symptoms with a large database; 3) detect diseases such as cancer; 4) use predictive analytics to prevent a disease before it occurs 5) gain a deeper understanding of diseases and their treatments by analysing medical images and comparing data; 6) help develop individualised medical treatments; 6) facilitate the creation of personalised healthcare plans and digital assistants to help people get cheaper treatment. Artificial intelligence is developing in many sectors, including healthcare. With numerous applications, such as reviewing patient information and other data, as well as the ability to develop new drugs and improve the efficiency of diagnostic procedures, AI is one of the most important healthcare technologies. Machine learning, a type of AI, is having a huge impact on the healthcare industry. Recently, this technology has made it possible, for example, to analyse computed tomography scans to treat the effects of the coronavirus. But there are several other applications of artificial intelligence that go beyond fighting the pandemic. Today, digital imaging of a specific area potentially affected by cellular mutations is a key element of modern histopathology techniques. Artificial intelligence in medicine promises to provide summary and panoramic views of individual medical data, improve decision-making, avoid mistakes such as misdiagnosis and unnecessary procedures, help order and interpret appropriate tests, and recommend treatment. Another example is Microsoft, which has created an AI technology for radiation called Project InnerEye. This project demonstrates how AI can improve clinicians' ability to organise radiotherapy 13 times faster (Dixon, 2021).

Data integration and predictive analytics in combination with artificial intelligence and other technologies Data integration and predictive analytics provide a deep understanding of patients' conditions. However, this raises concerns about the presence of robots, including whether they can actually replace humans and take over their jobs. AI will not replace doctors, but rather assist them by providing suggestions for diagnoses, medications, and treatment plans based on a patient's medical records, history, and current symptoms. Medical staff will be able to use the results of this in-depth analysis of medical data to improve patient outcomes, reduce costs, and increase staff satisfaction (Kevin, 2018).

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Robotic surgery, or surgery with the help of robots, is one of the incredible results of artificial intelligence in medicine. It is important to emphasise that today robotic surgeries are still performed by humans. Perhaps in the future, hyper-intelligent machines will perform operations on their own, but for now, there is always a human behind the machine. Robotic surgery allows doctors to perform complex operations with greater precision, flexibility and control than conventional methods. They also allow for less invasive techniques that often result in shorter recovery times. The most commonly used clinical robotic surgical systems consist of two parts: an arm equipped with a camera connected to a high-definition 3D screen, and several arms with surgical instruments attached. The surgeon moves the arms using controllers.

3.3. The place and role of the medical 3D printing industry and nanotechnology

The medical 3D printing industry has exploded over the past few years. Initially, it was used in areas such as construction, architecture, electronics and automotive. Recently, its application has increased: the aerospace, energy and medical sectors are interested in 3D printing and the results are impressive. Firstly, anatomical models of patients can be 3D printed, which have proved incredibly useful in preparing doctors for surgery, reducing time and improving accuracy. Medical instruments can also be 3D printed. 3D printing of prostheses is constantly growing. Instead of buying an expensive, standardised prosthesis, people in need can now choose to have their individual, more affordable prosthesis 3D printed. In this way, the user can even choose the design they prefer, and 3D printers can print custom insoles and orthotics (devices to support limbs and facilitate movement). Bioprinters use cells and biomaterials to print tissue-like structures. The development of 3D bioprinting can help solve the problems associated with organ transplants, as it will be possible to print the required organ on demand. 3D printing is used in the healthcare industry to make external prostheses, cranial or orthopaedic implants and personalised breathing stents. However, it has also demonstrated its value in surgical planning and has been used in complex open-heart surgery and even in a full face transplant performed at the Cleveland Clinic. The Wexner Medical Center at the Ohio State University is working on a system that should allow for the imprinting of living cells, bones, and even organs in patients' bodies using robotic surgery equipment. This could save the lives of people fighting cancer. In this way, we can make a connection with bioprinting, with 3D printing

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of organs. Although it may seem unrealistic, this idea is already undergoing clinical trials. Organs tested in clinical settings for 3D bioprinting include ears, corneas, bones, and skin (Gemel, & Zamnini, 2021)

Engineering aimed at creating electronic healthcare projects is strongly present in clinics and large hospitals. This practice aims to maintain the correct structure of the healthcare sector by implementing various tools and processes that benefit medicine. Electromedicine uses mathematical tools, as well as physical and chemical processes, to make connections with biological functions, creating theories of understanding the human body in order to use techniques and methodologies. As such, artificial organs have been established as a basis for effective research, in addition to the important equipment associated with implants, among other practices. The result of this convergence has been the growth of large hospital centres and important systems and projects created to combat and prevent various types of diseases. One of the most favoured areas is orthopaedics, in addition to the cardiorespiratory speciality, as it has important elements available for research. In fact, not only medicine, but also various branches of the biological sciences have made extraordinary progress. Thus, it is known that the success that has occurred in the biomedical field is the result of the diverse knowledge contained in mathematics, physics, engineering, information technology, among other fields of knowledge related to the exact sciences (Mokliuk, 2022).

Lananomedicine is a branch of medicine that uses nanotechnology to prevent and treat diseases. As the name suggests, it does so on a nanometre scale - one nanometre equals one billionth of a metre. Nanomedicine uses biocompatible nanoparticles and nanorobots to detect and act on diseases. Nanotechnology is largely a scientific field, with numerous areas of interest: drug delivery, vaccine development, antibacterial agents, diagnostic and imaging tools, portable devices, and implants. In the field of diagnostics, nanoparticles contribute to the formation of anatomical and functional images, can be designed to provide contrast in the area of interest and transmit information after being introduced into the body. Diseased tissue can be separated from healthy tissue directly in the human body. In the treatment of diseases, nanoparticles can be used as carriers of pharmaceutical agents. In recent years, research has focused on cancer treatment. Nanoparticles can be programmed to retain a drug during transport through blood compartments and release it when it reaches an

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intracellular target. These implants could potentially repair damaged tissue (Kyrychenko, et al., 2021).

3.4. The Internet of Things (IoT) as a global network and technology of interconnected devices and applications in the healthcare sector

The Internet of Things (IoT) refers to a global network of interconnected devices, as well as the technology that enables communication between devices and between clouds. Its applications in the healthcare sector, often referred to as the Internet of Medical Things, include advanced medical technologies such as wearable sensors, 5G-enabled devices and remote patient monitoring. Among the innovations created by the IoT is the smart pill, which transmits information to doctors and caregivers from inside the patient's body (the so-called Internet of Bodies). Smart pills are swallowable sensors that can record various physiological measurements and can also be used to measure the effects of medications and verify that the patient has taken them correctly. Other features of virtual care include security, location services, teleconferencing, record management, secure messaging, healthcare provider ratings, visit history, and portable connectivity. Additionally, primary care facilities and clinics can now act as remote hospitals, for example, to perform routine ultrasounds on pregnant women and share data remotely for virtual collaboration.

Digital therapies are a solution for patients with chronic conditions that require ongoing care. This care can include symptom monitoring, modification of medication therapy, and behavioural modification. These digital therapies can be prescribed to a patient by their doctor and can be accessed via a computer or smartphone app. Commercially available bedside monitoring devices are another example of remote care. They allow medical staff to electronically monitor the condition of their patients. Some of these devices are described here.

Healthcare wearables in the context of IoT innovation: wearable devices or wearable technology are a group of electronic devices that can be worn as accessories, implanted in the user's body, integrated into clothing, or even tattooed on the skin. Smartwatches, for example, can remotely monitor a patient's condition, providing information on heart rate, blood oxygen saturation and vital signs. Wearable devices such as pedometers and various sensors can also measure a patient's physical health. However, smartwatches are not the only ones that improve medical diagnosis of a patient's condition. This also applies to

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biopatch technology and smart hearing aids. Biopatches can better understand a person's vital functions. The sound insulation of hearing aids can also be improved by artificial intelligence.

Cancer immunotherapy, also called immuno-oncology, is a technique that is revolutionising the world of medicine, mainly because it makes it possible to treat incurable diseases. Immunotherapy is based on the idea that cancer can be treated by genetically modifying a patient's cells to work in concert with their immune system. It stimulates the activity of the immune system to help eliminate cancer. Immunotherapy does not damage healthy cells, unlike chemotherapy. It uses the body's immune system to detect and eliminate specific cancer cells, slowing the growth of tumours (Kaiku, 2017)

Sustainability and decarbonisation. As the world strives to ensure a more sustainable future, the healthcare sector is also trying to help preserve the environment, for example by providing eco-labelling. Globally, eco-labelling is a voluntary technique for certifying and labelling environmental performance. Within a particular category, eco-labelling identifies products or services that are more environmentally friendly. Therefore, companies are investing in environmentally friendly label printing systems for laboratories, hospitals, clinics and healthcare facilities. These printers are also useful for healthcare professionals who can print confidential labels that can display account/patient information, medications, medical alerts, cardholder cards, etc. Another method the healthcare industry is focusing on is decarbonisation. With the European Union's increasingly ambitious decarbonisation targets, it is necessary to take action across all sectors to monitor and reduce the carbon footprint. One such sector is healthcare, which accounts for 5% of total emissions. The impact of smart technologies on the transformation of healthcare 4.0 In the context of the technological revolution, smart technologies are becoming an increasingly present factor in the current reality, indicating that there have been advances in medicine that have increased the life expectancy of the population. New facts, such as the emergence of robots, have led to the emergence of advanced technologies with a corresponding alliance between the medical and technical fields. As a result, diagnoses are becoming more and more certain.

According to the analysis, research and development are the key words for success in this area. Trade barriers and personal interests need to be broken down to truly achieve excellence in healthcare and benefit everyone, not just the interests of a minority. Thus, a healthcare professional working to find a way to heal people must recognise the need for

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healthcare engineering. In addition, it is important that the government creates policies that facilitate the connection of the biological and precision fields, as in modern medicine we already talk about artificial intelligence as an auxiliary tool in medical data collection and medical record analysis, contributing to better clinical and hospital organisation. It is already a fact that the benefits of information technology systems in the field of medicine are undoubtedly superior to traditional methods. Thus, the electronic method offers a better and more flexible channel of communication between doctors and other healthcare professionals, reduces the number of treatment errors, transcription and costs associated with paper handling and archiving, among other things. To further motivate medical users, applications created with the help of new technologies aimed at simulating real-life situations are now being applied to professional training to reduce or even eliminate the resistance presented by doctors who are of a certain age and unfamiliar with computer systems (Kunderevych, 2022).

The Internet of Things (IoT) refers to a global network of interconnected devices, as well as the technology that enables communication between devices and between clouds. Its application in the healthcare sector, often referred to as the Internet of Medical Things, includes advanced medical technologies such as wearable sensors, 5G-enabled devices and remote patient monitoring. Among the innovations created by the IoT is the smart pill, which transmits information to doctors and caregivers from inside the patient's body (the so-called Internet of Bodies). Smart pills are swallowable sensors that can record various physiological measurements and can also be used to measure the effects of medications and verify that the patient has taken them correctly. Other features of virtual care include security, location services, teleconferencing, record management, secure messaging, healthcare provider ratings, visit history, and portable connectivity. Additionally, primary care facilities and clinics can now act as remote hospitals, for example, to perform routine ultrasounds on pregnant women and share data remotely for virtual collaboration (Martin, 2021)

Conclusions

The impact of technological progress, especially in healthcare, has had a positive impact on medicine and its interventional practices, as new techniques and methods have emerged at all times that can improve the diagnosis and treatment of many diseases. In

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recent years, medicine linked to information technology and artificial intelligence applications has contributed to real transformations, for example, through the creation of intelligent sensor projects and robotic algorithms that ensure patient comfort and safety and can be monitored from home. In this regard, the combination of medical knowledge and engineering principles and practices forms Health/Medicine 4.0. It is worth noting that such logistics can increase the chances of success in the prevention and treatment of many diseases. The evidence shows that, in short, the benefits of technological advances towards Health/Medicine 4.0 are recognised as effective and that investing in training to upskill healthcare professionals is one way to go, but organisations that want to have these systems in place should be aware that the implementation process can be a complex task that requires the ability to withstand the impact of several factors, the main one being human resistance to new technologies.

According to the World Health Organisation, mental health problems are on the rise worldwide. Over the past ten years, the number of mental illnesses and substance use disorders has increased by 13%, mainly due to demographic changes (2017). Today, 1 in 5 people live with a disability due to mental health problems. Recently, this impact has been mainly driven by the use of social media and the COVID-19 pandemic. Over the past year, several new technologies have been developed to continue to meet the needs of mental health patients. As much is now done online, a large number of psychologists and psychotherapists are providing consultations via video. There is also digital therapy (DTx), and some apps allow you to see patients and offer an initial diagnosis. Therefore, medical staff are trying to find solutions to help as many people as possible. Artificial intelligence in mental health is not only common in applications, but can also be used to detect diseases with symptoms, including a variety of mental symptoms caused by chemical changes in our brains, such as dementia. There are many types of dementia, but Alzheimer's is one of the most common. It is characterised by problems with reasoning, memory, and communication. One of the best strategies for treating dementia or, in certain circumstances, eliminating the origin of the symptoms is to detect it early.

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