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Evolving Healthcare 4.0 with Secure Patient Data Accessibility in Medical Organization through IOMT

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Abstract **- The healthcare industry has seen a radical change from version 1.0 to version 4.0. Electronic health records (EHRs) were introduced with version 2.0, while version 1.0 was primarily targeted towards doctors. One benefit of the proliferation of IoT technologies—which includes telemedicine, cloud computing, fog computing, and the Internet of Things—is the improvement in data communication and the shift toward a patient-centered approach to healthcare. Nevertheless, it has always been challenging to design a secure technique for healthcare 4.0. Email accounts, messages, and reports belonging to patients could be vulnerable to hackers if healthcare providers employ an unsecured technique. On the other hand, a safe healthcare system may make everyone happy, from patients to caregivers. In order to prevent authorized user components of E-healthcare systems from compromising data, further precautions must be taken when storing, accessing, and exchanging patient medical information on the cloud. To date, numerous cryptographic algorithms have been developed to ensure the safety of medical records whether stored, transmitted, or accessed via the cloud. However, these traditional solutions failed to meet the demands of electronic health record security in areas such as computational efficiency, service side verification, user side verifications, the absence of a trusted third party, and robust security. The capacity of blockchain-based security solutions to offer robust protection for data storage and sharing with minimal computational effort has recently garnered a lot of interest. Academics mostly focused on Bitcoin technology when they discussed the blockchain. Recently, there has been a surge in interest in using the blockchain for secure healthcare record management. This study presents a comprehensive review of existing blockchain-based solutions for medical data security, including those that utilize and do not utilize cloud computing. Several approaches based on blockchain are implemented and evaluated in this article. Results from this study that support new Healthcare 4.0 technologies include research gaps, difficulties, and a future roadmap based on the findings.**

Keywords: Blockchain; Web 4.0; IoT; Healthcare; Security.

I. INTRODUCTION

The healthcare industry is poised to benefit greatly from the cutting-edge technology that will accompany the impending fourth industrial revolution. Workers can be empowered to make data-driven decisions with the help of medical 4.0 technologies that provide them with real-time information. Consequently, they are in constant communication with the patients and kept informed. When people are given the power to make their own decisions, they are able to use that power to their full potential. Even if the use of automation will keep growing, people will still be the main attraction. By tailoring data and suggestions to each individual customer, IT solutions go above and beyond to aid buyers. Smart factories, enhanced automation, and other forms of smart technology all contribute to more informed data, which in turn helps to produce things more efficiently and effectively at every stage of the value chain [1].

Manufacturers of medical equipment are becoming more adaptable to meet customer demands through mass customization, with the ultimate goal of achieving efficiency with a lot size of one in many cases. More information transparency and better decision-making could result from combining data gathered from the manufacturing floor with other operational data from the company in a smart factory [2].

Everyone is well-informed enough to make fact-based decisions, which improves decision-making. Since the data is readily available in healthcare, there is an extra incentive to innovate in production. As a whole, people will be more productive as they won't have to waste time looking for anything. But this is still not enough to prevent the majority of health sciences companies from meeting the defined standards and from enjoying the full benefits of Industry 4.0. Industry 4.0 will take production to the next level by increasing efficiency, productivity, and safety [3].

It is becoming more feasible to predict if a patient's illness will become a serious problem in the future as the number of digital touchpoints with which they engage increases. Patients can be better profiled and their anatomy understood thanks to the medical devices' huge data volumes.

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Predictive health analysis has been and will remain simplified as a result of the desire to retain electronic health information. Using technology, healthcare needs such as medication and equipment may be assessed in real-time. With the advent of mobile technology that enables remote communication, medical personnel will have the ability to remain connected regardless of their location. Several healthcare software solutions are now being developed with the aim of improving patient satisfaction and communication between hospitals and patients [4].

Digital health advancements aim to improve accuracy and efficiency while also exploring new methods to mix technology. Emerging technologies including the internet of things (IoT), blockchain, augmented reality (AR), medicine, and electronic medical records (EMRs) could bring together several sectors in healthcare. There are countless possible uses for the Internet of Things (IoT), including telemedicine, better patient-doctor communication, reduced risk of infectious disease transmission, and other user-level data-gathering smart sensor technologies. Better illness detection and treatment capabilities, as well as better patient care overall, are within reach with the help of digital health tools. New health tracking and information-gathering tools have emerged thanks to apps for smartphones, social media, and the internet [5].

Utilizing data and intelligence to operate as autonomously as feasible, clients can personalize Intelligent Factories to meet their unique requirements, and clients can develop Intelligent Products that monitor and enhance performance over time with the support of Industry 4.0. Keeping up with the competition requires many firms to quickly go online, but not all industries can thrive only through remote employment. This is partly due to a lack of preparation and knowledge. Industry 4.0, the age of smart linked machines and robots, is on the horizon, and in order to be prepared and a part of it, we need to rethink our companies, improve our skills, and redirect our investments [6].

Conventional manufacturing, industrial platforms, and healthcare procedures and treatments can all be enhanced with the support of cutting-edge innovation according to Medical 4.0. According to their findings, spending on such items is expected to rise in the coming months. Investments in things with a longer time horizon for return, however, may remain stable, go up, or down. Use of telemedicine systems built on state-of-the-art, developing technologies allows for efficient management and prevention of infections. When a medical emergency occurs, these technologies may detect any abnormal patient behavior and alert the right people right away [7].

Using an augmented reality goggles or smartphone software, technicians can fill their field of view with data from the supply chain, asset management, and preventative maintenance. Cooperation between humans and machines offers always-on methods to save costs and work faster. Virtual reality goggles allow patients to access the hospital from any location. Improved communication and service to clients may result from remote workers, partners, and customers working together in a shared virtual environment. Companies in the manufacturing sector have been slow to acknowledge the value of cyber-physical systems and cybersecurity. Connectivity between operating equipment in the field and that in the factory allows for more efficient processes throughout the digital transformation to Industry 4.0, which is important to consider when developing a cybersecurity policy that covers both types of equipment [8].

Many companies struggle to understand the real state of their assets because data is stored and processed in separate silos. Consequently, there is a significant amount of inefficiency and unnecessary downtime. When maintenance and manufacturing are out of sync, capacity is wasted and possibilities for high-priority orders are lost. A shift from reactive to proactive data-driven asset performance is achieved through the use of intelligent assets. There is continuous upkeep of intellectual property and integration of all processes [9]. Digital twins, or virtual copies of a company's operations, production lines, buildings, and supply networks, have been made possible by the digital revolution known as Industry 4.0. A digital twin is built using data collected from internet-connected devices, sensors, PLCs, and other such items. Improving productivity, optimizing operations, and creating novel goods are all possible with the help of digital twins for manufacturing. In order to find ways to reduce downtime or increase capacity, manufacturers may test changes to the process [10].

II. LITERATURE REVIEW

Despite the widespread use of the word "e-health" recently, few have attempted to define or explain what it means. The word has gone from being used rarely prior to 1999 to becoming a "buzzword" for "Internet medicine" and anything related to healthcare services provided through computers. Executives and staff in the business world first used this term in marketing, not in the classroom. They are more careful with the term's use than with others that end in "e-words," such as "e-solution," "e-business," and similarly [10].

It went on the ways in which the Internet is changing the healthcare industry. According to Intel, "a collaborative effort by healthcare and high technology industry leaders to realize

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the full potential of the Internet's role in healthcare delivery" [11] is how e-health is defined. According to modern online definitions, e-health is the intersection of healthcare IT, public health, and business. It provides health-related information and services using the web and associated technologies. The term "e-health" encompasses not just the technological components of healthcare but also the mentality and approach to improving healthcare on a local, national, and international scale through the use of ICTs.

Some of the parts that make up e-health include EHRs, electronic consultations, decision support systems, and telemedicine. Connectivity to programs that highlight the risks of drugs or drug groupings is one of the benefits of computer-generated prescriptions. Nowadays, computers are an essential part of the majority of healthcare procedures that initially record patient information electronically [12].

Challenges of E-Health

Numerous new e-health solutions have surfaced to address the needs of contemporary practice, made possible by recent technological advancements. The correct technical framework, system integration, standards, and social, ethical, and economic considerations are significant challenges to the widespread use of e-health and the provision of more effective, high-quality healthcare.

Given the prevalence of modern communication networks, it is anticipated that e-health systems will fulfill the following requirements [13,14,15]. In order to address the needs of the health system, e-health interventions encompass a wide range of digital and mobile technology. With this taxonomy, we hope to provide health program planners with a common vocabulary to describe the many roles that e-health systems play, with a focus on the public health sector. All of our categories are based on the concept of an e-health intervention, which is a distinct use of digital technology to achieve healthcare objectives [1,5]. Figure 1 shows the most up-to-date classifications of e-health systems according to the improvement of technology. Three possible approaches to classify e-health systems are healthcare 4.0, the Internet of medical things (IoMT), and wireless body area networks (WBANs).

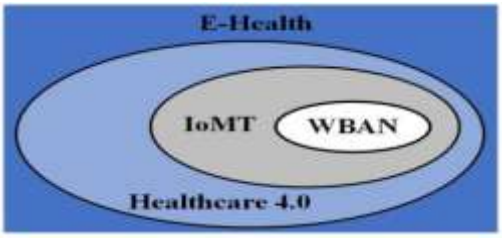

Figure 1: Organization of electronic health records

In wireless blood-area networks (WBANs), small nodes record physiological data such as glucose, temperature, BP, and HR. The idea behind these networks is to make it possible for people to get long-term health monitoring from doctors and nurses without having to change their routines. With a network of small, low-power, and minimally invasive sensors worn by the patient or implanted into their body, a WBAN system can monitor a person's vital signs and other physiological data. A central monitoring system, or "sink node," receives data wirelessly from the sensors [16]. The IoMT refers to a network of interoperable medical apps and devices that are linked to electronic health records (EHRs). This innovation has provided medical practitioners with real-time diagnostic data and decision-support information. The IoMT's dense medical device component includes wearable tech, RMSs, and medical implants [8]. The system gathers data from various medical devices, transmits it to a database or central system, and then analyzes it to determine a patient's health status or enhance healthcare procedures. The objectives of IoMT include better patient outcomes, lower healthcare expenditures, and more efficient healthcare delivery [17]. As its name implies, WBAN focuses on collecting data from the human body and monitoring physiological parameters. To be sure, the human body is just one part of the larger ecosystem of medical devices and technologies that make up IoMT [18].

III. METHODOLOGY

This study aims to investigate the state-of-the-art digital technology that was used to create Medical 4.0 and to list all of its practical healthcare applications. It is based on a literature review. In order to find papers that were pertinent to "Medical 4.0 technologies (All technologies)" and "Healthcare," several databases were searched. These databases included Scopus, Google Scholar, Science Direct, and Research Gate. A large number of articles dealing with these subjects have been discovered. Lastly, the papers that are most applicable to healthcare are selected and evaluated critically. In order to achieve the study's overarching goals, as well as to generalize and offer suggestions based on the results, this report is suitable. The purpose of this research is to have a better understanding of Medical 4.0 healthcare technology by reviewing the relevant literature.

Progressive steps for Medical 4.0 implementation

Medical 4.0 deployment in healthcare structures is illustrated in Fig. 1, which explains the basic progressive processes. Collecting patient data and keeping track of their medical history is the first step. Smart systems, including AI, ML methods, the IoT, cloud computing, etc., are used to further process this collected patient data. At the completion of this execution procedure, the analyzed data is compiled and

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enhanced patient records are prepared. The end result is a patient or consumer who is completely satisfied.

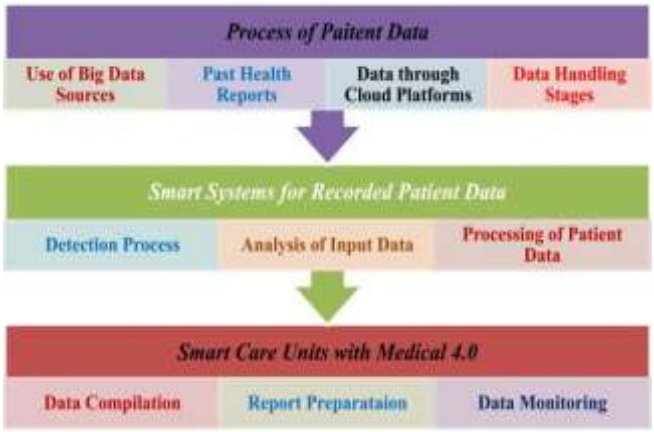

Figure 2: Procedures for carrying out medical 4.0

Improving operational performance is the primary objective of implementing Medical 4.0 technologies, with a focus on health and safety. There is, therefore, a tight relationship between the increasing use of Medical 4.0 and AI-based technologies in production processes. Artificial intelligence (AI) can be employed to support or even supervise the execution of industrial processes by analyzing data flows that are common to different technologies. The corporate sector can make use of machine learning in multiple ways. Deep learning algorithms are widely used in automated process control systems, which are widely used in the process industries. Corporate asset management systems also employ ML approaches to determine when equipment need inspections and maintenance, maximizing uptime and minimizing downtime.

Using cutting-edge simulation software, novel materials, and technologies like 3D printing, manufacturers can easily produce limited edition, one-of-a-kind items for individual customers. A robust Industry 4.0 plan necessitates the integration of production processes with a transparent and efficient supply chain, which is essential to industrial operations. This alters the process by which producers acquire inputs and distribute outputs. There is a shift toward Industry 4.0, creative manufacturing, and enhanced performance, which complement the focus on digitization. The Internet of Things (IoT) and Industrial Internet of Things (IIoT) work together to make these smart factories a reality.

The introduction of a more precise therapy approach is made possible by connecting medical areas to technological equipment. Assisting patients in taking an active role in their own healthcare, pulsometers and other wearable devices are crucial. By collecting and transmitting data, IoT devices help improve healthcare by giving doctors a clearer picture of patient conditions and their treatment options. With the help of AI, healthcare providers may avoid becoming sidetracked by patients' competing needs and instead concentrate on providing the highest quality treatment possible. With the help of chatbots powered by artificial intelligence, patients can better understand their treatment plan by answering a series of pre-programmed questions. Patients can choose the best options based on their feelings and filter queries based on diagnoses without bias or judgment. By attending to patients' urgent needs, this approach exemplifies a courteous and efficient means of communication for delivering high-quality diagnosis.

Regular mealtimes are a regular sight for any hospitalized patient who stays for more than a day. But people eat at different times, and it could be annoying if you can't eat frequently when it's most convenient for them. Modern medical practice aspires to include technological advances that allow for better understanding of each patient's unique eating habits, including when and how they prefer to eat. Many hospitals and clinics have started their own gardens in an effort to serve patients with healthier, more locally sourced food, and others have done the same. Through the use of IoT, hospitals may automate production processes and lower the total cost of employing a gardening crew. Internet of Things (IoT) health devices, such pulsometers, digital thermometers, fitness trackers, and other similar items, encourage people to take better care of themselves. In the event that a prompt diagnosis is necessary, these devices allow users to monitor their vital signs, record them, and transmit them to a doctor.

Healthcare companies analyze all collected data and use it to create customer-centric tech models that help streamline the current healthcare system. The acquired data is totally reliant on the modification and implementation of suitable technologies to meet the healthcare needs of individuals. When it comes to patients, most healthcare models observe slow testing and show results in long-term usage behavior when it comes to data evaluation and coming up with novel solutions. Patients in need of immediate medical attention cannot afford to have their comments delayed for data collecting. As a time-consuming method that yields a distinct set of data for every patient, concentrating on patient safety in order to ascertain the probability of an outcome is not without its challenges.

IV. APPLICATIONS OF MEDICAL 4.0 TECHNOLOGIES FOR THE HEALTHCARE SECTOR

Medical 4.0 opens up more access to patient data, which in turn allows for various new ways to track a patient's health and wellness. Digitalization has improved our lives, yet parents still have a hard time limiting their children's access to online entertainment. One major advantage of telehealth over

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in-person solutions is the reduction of contact between patients, healthcare personnel, and other patients, while still offering a considerable patient experience. The blockchain revolution has a lot of potential benefits for the healthcare business. The interoperability of blockchain technology is a major advantage in the healthcare industry. The security of healthcare information is enhanced through the use of public-private partnerships. Wearable technology allows doctors to access patient records in real-time without ever leaving their homes.

Thanks to technological advancements in healthcare, it is now much easier for doctors and patients to communicate. Medical staff have a variety of options for communicating, including e-mail, cell phones, and texting. Additionally, doctors may use social media and internet platforms to collaborate with other professionals, produce films and webinars, and more. Thanks to teleconferencing, people can now have conversations regardless of their physical location. Electronic medical records allow for the centralization and storage of all relevant patient data, including medical history, test results, diagnoses, and other relevant information. Better, more personalized treatment and the possibility to spot patterns in people's health are both made possible by the data. The use of medical billing systems greatly improves the efficiency of healthcare facilities. Personalized treatment plans devised by these medical experts can help patients avoid readmission to hospitals and other unneeded medical interventions. Medical technology facilitates better communication, gives access to massive amounts of data, and supplies crucial study data. Questions can be posted by patients at any time and from any location using their mobile phones, and doctors can react quickly and effortlessly. It ensures that patients receive prompt guidance regardless of their illness, which boosts confidence and trust. Medical 4.0 has the following major uses:

Telemedicine

Remote delivery of healthcare services, including testing and consultations, is referred to as telemedicine, telehealth, or e-medicine. Medical professionals can now assess, diagnose, and treat patients remotely through telemedicine. In a telemedicine consultation, patients can use their own devices or go to a dedicated kiosk. A real-time two-way dialogue between patients and doctors is possible. This device allows patients to keep track of their core body temperature, blood sugar levels, and blood pressure. The relatively new idea of telemedicine allows for the delivery of clinical services, such as medical diagnosis, intervention, or treatment, through the use of telecommunication technology.

Beyond clinical services, telehealth covers a broader spectrum, including remote patient monitoring and individual medical instruction. The widespread spread of the COVID-19 pandemic has heightened public health concerns, which has coincided with an upsurge in the utilization of telehealth services during the past few years. More people are staying home from work and school in an effort to lower their risk of infection, making it harder for people to get medical care. For millions of individuals across the globe, telemedicine apps are now essential for health promotion and disease prevention. This technology allows patients who are unable to physically visit a healthcare center to still receive the medical treatment they need. Healthcare practitioners can improve patient diagnosis and treatment with the use of telehealth technologies in patient encounters.

Sensors and wearable technology

Improved healthcare, less stress for doctors, and more options for patients to get treatment outside of hospitals, such in the comfort of their own homes, are all possible outcomes of these technological developments. Instead than relying solely on calorie and step tracking, they track a user's weight, sleep patterns, activity, and food intake, empowering them to make more informed health decisions. To help those who live far away or outside of the medical facility who are struggling with weight and health issues, some patient advocacy groups are even using it. A wide range of goods, including blood samples, pharmaceuticals, and freezers, rely on wireless sensors manufactured by Sensor Metrix at healthcare institutions including hospitals and labs. Patients with long-term health issues, such as the elderly, can have their progress and difficulties monitored more effectively and with less expense when wearable monitors are integrated with other data sensor sources. Using this sensor, invasive operations are not necessary to detect abnormalities associated with irritable bowel syndrome (IBS) and colon cancer. Although there have been wireless medical gadgets on the market for a while, their main function has been to assist doctors during tests and monitor critical patient data.

Connecting buildings and organizations is becoming more common, which improves administration and access. Data processing and exchange with providers can be accelerated by this cross-device link.

Smart monitoring can lead to better treatment strategies and disease prevention by assisting in identifying early indicators of illness. By recording vital signs and communicating this information to healthcare providers, the device also aids in the management of conditions such as diabetes and prostate cancer. The location-as-a-service component of this service allows for the easy tracking of both

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patients and medical devices. Improving asset management and patient flow, as well as raising staff and patient satisfaction, are aims of the solution. Whether for clinical efficiency, home tracking, or general health monitoring, all of these technologies contribute to a situation where health problems can be tracked and addressed more effectively.

These days, patients are more likely to interact with medical technology and devices when they seek treatment. Internet of Things (IoT) technology is being more and more acknowledged by the healthcare industry for its revolutionary nature. Computer and processing power advances, wireless technology, and downsizing are driving innovation in linked medical equipment.

It is impossible to separate the health of the user from the reliability and excellence of such medical devices. There should be zero compromise on vaccine safety at any point in the "research, development, manufacturing, transportation, and usage" cycle. It is crucial for monitoring vaccine temperatures and humidity levels and sounding alerts when they rise above a certain threshold. A COVID-19 vaccine, like all others, needs to be prepared at low temperatures to be effective. Once the vaccine has left the facility but is still in transit to the end user, a data recorder equipped with sensors can identify any disruptions in the cold chain and alert the user in time to prevent any permanent harm.

Every patient is unique and requires a tailored approach to their healthcare. The same holds true for keeping tabs on patients. Patients with heart conditions may need to have their blood pressure checked more frequently. This allows for the use of a remote stethoscope to monitor the pulse rate. To manage a rare condition, one must routinely visit multiple doctors and engage in meticulous planning. They can save patients' lives by staying ahead of treatment alternatives using remote patient monitoring.

Modern diabetes care includes state-of-the-art glucose monitors that allow patients to track their blood sugar levels in real time. Connected to an insulin pump, these devices automatically suspend insulin injections while keeping tabs on the patient's blood glucose levels. Glucose data collection and storage in a hospital information system could be facilitated by this system design. It enables doctors to access patient data in real time. Now, devices with pill-shaped sensors can be swallowed by patients. After the sensors have processed the data, they send the information to a patient's mobile app, which will help the patient remember to take their medication at the correct times. The majority of medication overdoses occur because people neglect to take their medication as prescribed. Patients are sure to take their medications as prescribed with the help of this ingestible sensor. Medical professionals are also making use of ingestible sensors to aid in the more accurate diagnosis of inflammatory bowel syndrome (IBS) and colon cancer.

V. CONCLUSION

Successful healthcare implementations of medical 4.0 cover a wide range of technologies. The element is the same, and when put together, they create capabilities that weren't possible before. The advancement of Medical 4.0 technologies has allowed healthcare providers to make better decisions. Insights into patients' and doctors' physiological states gleaned from sensor data are invaluable. These advancements in technology make remote health monitoring systems more efficient. Modern healthcare that is "smart" makes use of state-of-the-art IoT technologies to improve the standard of care. The Medical 4.0 innovations proposed at the Smart Factory will soon find their way into a wide variety of industries, from healthcare to consumer goods. Medical 4.0 has allowed healthcare facilities to greatly enhance the quality of care and supplies provided to patients. Some of the many advantages made possible by digital healthcare software solutions include the following: the ability to help medical professionals spot serious illnesses earlier, the elimination of medical errors, and the facilitation of teamwork in the treatment of medical cases. The entire workflow is made faster, smoother, and more efficient by this healthcare revolution. Most hospitals have a lot of data to manage, but with digitalization, management and staff can speed up procedures to better care for patients. Medical 4.0 aims to streamline processes, enhance the patient experience, and lower the cost and increase accessibility of on-demand medical care. Improve the patient experience and boost interoperability with the help of conveniently managed online appointments, electronic health records, and unified platforms for data transfer. With the use of blockchain technology, AI-enabled medical equipment, and social media, e-commerce, online transactions, and financial data, telemedicine can scour the web for trends and patterns.

REFERENCES

[1] Gupta A., Singh A. Healthcare 4.0: Recent Advancements and Futuristic Research Directions. *Wirel. Pers. Commun*. 2023;129:933–952. doi: 10.1007/s11277-022-10164-8.

[2] Vyas S., Bhargava D., Khan S., Bhargava D. Artificial Intelligence for Health 4.0: Challenges and Applications. River Publishers; New York, NY, USA: 2023. *Healthcare 4.0: A Systematic Review and Its Impact over Conventional Healthcare System;* pp. 1–17.

[3] Shamshad F., Khan S., Zamir S.W., Khan M.H., Hayat M., Khan F.S., Fu H. Transformers in Medical

ISSN (online): 2581-3048
Volume 9, Issue 1, pp 175-181, January-2025
https://doi.org/10.47001/IRJIET/2025.901022

Imaging: A Survey. *Med. Image Anal.* 2023;88:102802. doi: 10.1016/j.media.2023.102802.

[4] Grivcheva-Panovska V., Craig T.J., Longhurst H., Bara N., Panovska I. Global Perceptions of the Current and Future Impacts of COVID-19 on Hereditary Angioedema Management. *Allergy Asthma Proc.* 2022;43:e1–e10. doi: 10.2500/aap.2022.43.210099.

[5] Krishnamoorthy S., Dua A., Gupta S. Role of Emerging Technologies in Future IoT-Driven Healthcare 4.0 Technologies: A Survey, Current Challenges and Future Directions. *J. Ambient Intell. Humaniz. Comput.* 2023;14:361–407. doi: 10.1007/s12652-021-03302-w.

[6] Beheshti L., Kalankesh L.R., Doshmangir L., Farahbakhsh M. Telehealth in Primary Health Care: A Scoping Review of the Literature. *Perspect. Health Inf. Manag.* 2022;19:1n.

[7] Ashfaq Z., Rafay A., Mumtaz R., Hassan Zaidi S.M., Saleem H., Raza Zaidi S.A., Mumtaz S., Haque A. A Review of Enabling Technologies for Internet of Medical Things (IoMT) Ecosystem. *Ain Shams Eng. J.* 2022;13:101660. doi: 10.1016/j.asej.2021.101660.

[8] Dwivedi R., Mehrotra D., Chandra S. Potential of Internet of Medical Things (IoMT) Applications in Building a Smart Healthcare System: A Systematic Review. *J. Oral Biol. Craniofac. Res.* 2022;12:302–318. doi: 10.1016/j.jobcr.2021.11.010.

[9] Ge H., Li L., Zhang D., Ma F. Applications of Digital Medicine in Oncology: Prospects and Challenges. *Cancer Innov.* 2022;1:285–292. doi: 10.1002/cai2.37.

[10] Usak M., Kubiatko M., Shabbir M.S., Viktorovna Dudnik O., Jermsittiparsert K., Rajabion L. Health Care Service Delivery Based on the Internet of Things: A Systematic and Comprehensive Study. *Int. J. Commun. Syst.* 2020;33:e4179. doi: 10.1002/dac.4179.

[11] Calegari L.P., Fettermann D.C. A Review of E-Health Technologies Applications. *Int. J. Bioinform. Res. Appl.* 2022;18:318. doi: 10.1504/IJBRA.2022.126742.

[12] Akinyemi O.R., Sibiya M.N., Oladimeji O. Communication Model Enhancement Using Electronic Health Record Standard for Tertiary Hospital. *SA J. Inf. Manag.* 2022;24:10. doi: 10.4102/sajim.v24i1.1472.

[13] Rodriguez Santana I., Mason A., Gutacker N., Kasteridis P., Santos R., Rice N. Need, Demand, Supply in Health Care: Working Definitions, and Their Implications for Defining Access. *Health Econ. Policy Law.* 2023;18:1–13. doi: 10.1017/S1744133121000293.

[14] Wang C., Wu X., Qi H. A Comprehensive Analysis of E-Health Literacy Research Focuses and Trends. *Healthcare.* 2021;10:66. doi: 10.3390/healthcare10010066.

[15] Hussey P. Health Informatics. *Springer International Publishing; Cham, Switzerland:* 2021. Introduction to Nursing Informatics; pp. 1–13.

[16] Singh S., Prasad D. Wireless Body Area Network (WBAN): A Review of Schemes and Protocols. *Mater. Today.* 2022;49:3488–3496. doi: 10.1016/j.matpr.2021.05.564.

[17] Razdan S., Sharma S. Internet of Medical Things (IoMT): Overview, Emerging Technologies, and Case Studies. *IETE Tech. Rev.* 2022;39:775–788. doi: 10.1080/02564602.2021.1927863.

[18] Qadri Y.A., Nauman A., Zikria Y.B., Vasilakos A.V., Kim S.W. The Future of Healthcare Internet of Things: A Survey of Emerging Technologies. *IEEE Commun. Surv. Tutor.* 2020;22:1121–1167. doi: 10.1109/comst.2020.2973314.

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