

Review Article

The Importance Foresight Internet of Things, Virtual Reality and Telemedicine in Health Care

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Abstract

Background: Future studies are the science of shaping the future, in a conscious, scientific, and future-thinking way that protects people from surprises from a storm of dramatic changes and developments. Foresight is a systematic way of looking at the long-term future and making appropriate decisions. This knowledge is a type of study method that strives to unite and integrate the talents and abilities of individuals to create a desirable and ideal future for themselves. Researchers with different research methods emphasize the study of various technological solutions to increase the quantity and quality of healthcare delivery. We need deeper research to get a good understanding of these technologies. The development of health technologies can improve health levels, living standards, and economic growth, and some of these technologies such as telemedicine, the Internet of things, the 3D virtual world, etc. Have reduced medical costs and medical malpractice. Nevertheless, new technologies related to diagnosis, prevention, and rehabilitation will lead to changes in the methods of healthcare delivery. So various technologies create new and different demands and due to widespread changes in health technologies, foresight, and future thinking in health technologies are of great importance. **Objective:** These studies provide valuable insights into the future trends and potential impacts of emerging technologies. This information helps healthcare providers and policymakers make more informed strategic decisions about technology investments and implementation. Also helps healthcare organizations identify and mitigate potential risks associated with the adoption of new technologies, ensuring a smoother and more successful implementation process. this study aims to highlight the importance of digital health development (telemedicine, Internet of Things, 3D virtual world) and their foresight. **Main Ideas:** In summary, healthcare technology development is crucial for strategic planning, efficient resource allocation, improved patient care, and fostering innovation, all of which contribute to the transformation of healthcare delivery. **Conclusion:** Therefore, a special focus on foresight and the construction of new digital technologies in health to better manage time, and resources, and increase speed and accuracy in health services is essential. So, engineers and medical science professionals need to take a forward-thinking view and pay attention to uncertainties and spaces full of changes and the prediction of future demand in healthcare organizations is an essential element of the planning process.

Keywords

Foresight, Health Technologies, Digital Health, Telehealth, The Internet of Things, Virtual Worlds

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1. Introduction

The future is a constant topic and never stops, and with the right foresight, it can be built as we want. Health is associated with various environmental, social, cultural, economic, and political threats and to deal with these threats it is necessary to use Foresight as an opportunity to promote people's health [1]. The smartest activity is to think about the future and prepare to deal with it because the factors affecting health and hygiene systems are always associated with change, uncertainty, and complexity [2, 3].

These studies in health technologies attempt to discover a complex chain of impacts, thus identifying the forces that shape the future, and taking measured steps to build the future by diminishing the effect of uncertainty [4]. Nevertheless, technologies are changing very quickly and rapidly penetrating the lives of people and organizations. This digital revolution is gradually transforming our societies [5]. In this regard, healthcare delivery systems are also under increasing pressure to improve their performance and are no exception to these developments [6] and these developments cause such questions: What are the effects of digitization and the Internet of things in healthcare? Does it lead to unemployment or increased demand for healthcare services? What are the achievements of these innovations in the future of health? [5]. Overall developments in health technologies are also changing the way healthcare services are delivered and increasingly moving towards personalized medicine, outpatient healthcare delivery, and patient empowerment [7]. Society's demand is also changing for a variety of reasons, especially with the arrival of new technologies [8] and increasing population awareness, enabling health service recipients to make more informed decisions about their health [9]. The aging population, changing needs, increasing incidence of chronic disorders, and digitization are some of the challenges facing the healthcare delivery system. So the transformation of technology changes the health care market. So scientists and professionals in this field need to be familiar with these changing trends in health technologies and alternative technologies, to improve the quality of Health Services [8]. Digital health and the use of new health technologies benefit various stakeholders, such as doctors, patients, online platforms pharmaceutical companies, etc. [10]. For example, the pandemic caused some emerging diseases, such as the COVID-19 pandemic, to increase the adoption of digital health technologies as new technology helped reduce disease transmission [9]. Today, health technologies are not limited to common technologies such as health information technology (IT), telemedicine, and personalized medicine [11], and some health technology tools offer completely new features, such as digital tablets that are connected to a microcircuit and activated in contact with fluids in the patient's stomach, and technologies in this field will have more diverse and different capabilities in the future [11]. Healthcare applications, including health applications on smartphones, are increasingly used by healthcare pro-

professionals and patients, and these programs help achieve a variety of goals, such as information management, time management, access to health records, communication, and counseling, patient management and monitoring, clinical decision-making, and Medical Education [12]. Therefore, the emergence of new technologies is changing the way health services are delivered and demanded. So scenarios are needed to analyze and predict future changes. This process can lead to a better understanding of the needs and challenges associated with these developments [13]. However, there are concerns about the lack of global coverage and access to these technologies [9]. There are also few studies on the implications of people accessing and using digital health technologies [14] and these issues are essential to be examined in terms of privacy, ethics, and law [15]. As mentioned, without a doubt, health and the way health services are delivered in the coming decades will be very different from today. Future studies and Foresight should focus on the infrastructure of health technologies to reduce uncertainty, which is why these studies are considered tools for intelligent engineering of different futures, in other contexts [16].

2. Materials and Methods

Narrative reviews, deeply rooted in a distinct research tradition, serve as a method of knowledge consolidation [17]. Often labeled as non-systematic [18], and their enormous value to medical educators and researchers is undeniable [18]. Unlike a systematic review that focuses on a specific question in a defined context and uses a set method to integrate the findings of similar studies, a narrative review provides a comprehensive summary of a wide range of studies [18]. Narrative reviews are often useful for topics that require meaningful synthesis of research evidence that may be complex or extensive and require detailed descriptions and interpretations [17] and that are used to create new insights and deep thinking about a variety of topics [17]. This narrative reviews the Narrative review process lacks established standards or protocols [19]. The process of conducting a Narrative review can be divided into four stages [18-20]: Step 1. Searching: Narrative reviews, unlike systematic reviews, typically do not have a specific research question or a defined search strategy. However, the inclusion of a search narrative, which details the decision-making process in formulating a literature search strategy, can enhance transparency in literature searching and foster more engagement and discussion among stakeholders, experts, and users of research also, it can improve the review's comprehensibility and reproducibility. Hence, in this study, we conducted an unrestricted search using relevant keywords across multiple databases, including PubMed, Scopus, and Web of Science, Google Scholar, without adhering to a specific strategy. We also did a free

search with the same keywords on Google, without adhering to a specific strategy. In our research, we meticulously reviewed a variety of reliable sources. This included not only articles and books but also the websites of reputable organizations.

Step 2. Determine Keywords: When authors publish their research; they highlight several keywords so that others can locate their work during database searches. In our study, we used a range of keywords to find resources related to the intended study objectives, such as future studies, technologies Foresight, health technologies assessment, digital health, telehealth, telemedicine, the Internet of Things, the Internet of Things in medical, Virtual worlds 3D, Virtual worlds 3D in health, Virtual worlds 3D in medical, healthcare, etc.

Step 3. Evaluate Abstracts and Articles: Once the search is completed and all duplicates are discarded, the abstracts of the remaining articles should be reviewed to ensure they address your review question. In this research, we did not import the search results into any reference manager. Instead, we reviewed them directly on the web pages. Our process initially involved checking the titles. If a title seemed relevant to our study's objectives, we proceeded to screen its abstract in a new tab. If the abstract was relevant, we then screened the full text. Any material that aligned with our study's purpose after this thorough examination was incorporated into our final study.

Step 4. Record Results, Summarize, and Synthesize: The findings from the articles you have discovered should be summarized synthesized, and incorporated into your writing as needed. Once the final studies were identified, we extracted the pertinent data from each. Given that the information related to our study's objectives was primarily textual—comprising statements, letters, and words—we employed content analysis for its examination. Consequently, we merged any content that shared similar meanings or concepts.

Our research aligns with a type of narrative review category called General Literature Review. A general Literature Review provides an overview of the key aspects of a topic, serving as the introduction to a thesis or dissertation, guided by the research objective or hypothesis. This type of narrative review offers a summary of the essential elements of a topic and is guided by the research objective or hypothesis [21].

3. Main Text

The use of new technologies in health will increase the quality of access to healthcare and diversify the different ways of healthcare delivery [22], and Foresight will lead to the promotion of results and increase preparedness for future changes [23] in the following paragraphs, we will examine in detail the importance of examples of new technologies in health, which are explained as follows:

3.1. Telemedicine

Telemedicine is very valuable for providing health care to

patients in remote areas and patients whose movement is difficult, impossible, or costly for various reasons [24, 25]. The use of telemedicine can be useful and effective in reducing waste of resources, reducing travel time and costs, and positive changes in patient attitudes before and after surgery [26]. These technologies have the potential to increase the efficiency and effectiveness of Health Services [26]. Their use is also increasing and in 2020 due to the COVID-19 pandemic, telemedicine benefits became evident and proven [27]. To improve quality, health technologies must be constantly evaluated by health technology assessment, so that they can adapt to the needs of the day and the demands of patients or be replaced if necessary [28, 29]. These technologies in many diseases such as diabetes, hypertension, and chronic obstructive pulmonary disease have both improved service performance and reduced hospital admission rates [26, 30]. So, such health technologies reduce patients' time to access health care by 56 percent compared to traditional health services [31-33]. According to the above, there is a lot of practical potential for telemedicine in improving the service of patients in different environments, and it can deliver service without obstacles such as long distances and difficulties, emergency patients, stigma-related diseases such as alcohol consumption or addiction, mental disorders and even in controlling communicable diseases and caring for noncommunicable diseases, as well as saving money and time, increasing patient satisfaction and improving clinical outcomes [26, 30, 34]. So, these healthcare technologies should be able to change and adapt to the conditions of demands and suppliers [15, 34].

3.2. The Internet of Things in Health and Medicine

The Internet of Things (IoT) represents an interconnected complex, from anyone, anything, anytime, anywhere, any service, or any network [35]. One type of Internet of Things is the Internet of Medical Things. The Internet of medical objects is the technology that integrates wireless sensors into medical equipment, connects them to the Internet, and connects patients, hospital staff, and equipment to see a revolution in modern medicine. In general, the goal of the Internet of Things is to provide infrastructure to simplify exchanges between objects safely and reliably [36].

3.2.1. We're Going to Look at the Applications of the Internet of Things in Medicine and Digital Health as Follows

The world's population is increasing, so the Internet of Things can meaningfully improve the quality of life of older people. For example: if a small device is used in senior clothing, the elderly person's vital signs can be sent to a doctor or treatment center if they are outside the limit or when a person falls to the ground and cannot get up, an alert is sent [37]. One of the most important applications of the Internet of Things in medicine is the monitoring of vital signs and spe-

cific parameters of people with chronic and common diseases such as heart disease, diabetes, and respiratory diseases [38]. The unwillingness to be hospitalized for a long time and even the desire of several patients to live in climatic villages without advanced medical facilities are among the reasons for using the Internet of Things [38]. Another application of the Internet of Things is that it allows access to an integrated information system. This feature allows the availability of specialists and treatment staff (doctors, nurses, radiologists, etc.) to all medical information a patient has in various locations [39]. Other benefits of using the Internet of Things in medicine include reduced cost of treatment, and reduced number of deaths from hospital infections [40]. The new technology also enables the understanding, diagnosis, and treatment of the disease correctly and effectively through communication between physicians in large hospitals and physicians in small hospitals. In other words, they reduce the information gap, thus emphasizing the development of technologies related to the prevention, diagnosis, and treatment of diseases.

3.2.2. Challenges Ahead in the Use of the Internet of Things

Although the IOT has made a huge transformation in medicine, it has also posed challenges due to its high sensitivity. For example, the dissemination of medical misinformation causes people to die and at a later stage distorts the credibility of health centers.

Some of these challenges include:

(i). Quality of Service

The provision of Health Services is highly sensitive and requires quality assurance of services in terms of important parameters such as reliability, maintenance, and level of service.

In this regard, it is useful to quantitatively measure each parameter within the framework of the Internet of Things network and health care. In addition, the availability and sustainability of the system are a priority for providing quality assurance of service [41].

(ii). Dynamics

The Internet of Things in the field of Medicine and health should have the necessary dynamics and flexibility to be able to support patients and clients at health service centers anywhere and anytime [41].

(iii). Security and Data Protection

Security on the Internet of Things should be thoroughly investigated at all levels [42].

(iv). Integrated Technology

Another challenge is the importance of integrating infor-

mation systems. It is essential to update all healthcare devices and sensors for the use of the Internet of Things at the lowest cost and time. The result is integrity, compatibility, and flexibility in integrating existing devices with the Internet of Things [41].

3.3. Virtual Worlds 3D in Health and Medicine

One of the most recent internet technologies is the 3D virtual world. Virtual worlds are 3D virtual environments, freeing users from the constraints of location or time [43-45]. VR is defined as an educational instrument that uses computer technology to generate a tridimensional (3D) picture or environment that can be interacted with in a seemingly real or physical way [46, 47]. VR is a broad concept that has many different tools and applications.

3.3.1. Key Classification of Virtual Reality

Virtual reality is a broad concept that encompasses the following three categories of simulators: screen-based VR simulators, virtual worlds, and immersive VR environments [48]. First, screen-based VR simulators, this kind of simulator require very little set-up time and can be used repeatedly by learners for practice in different pathologies and with several anatomical variations [48]. Also, this sort of VR has usually been used to develop technological psychomotor skills, such as for endoscopic surgery [47, 49]. Second, virtual worlds are three-dimensional virtual environments based on multiplayer online gaming, allowing users to free themselves from geographical proximity or time constraints (individual connection and full-time access) [48]. For health professionals, medical furniture, instruments, devices, tools, and characters are added to create dedicated medical virtual worlds [48]. The use of virtual worlds representing a clinical setting has been used in training emergency personnel on the management of mass-casualty or major incident situations [43-45]. Lastly, immersive VR environments combine three-dimensional imaging [48, 50]. Immersive VR refers to a user in a virtual environment during which time his or her perception of the real world is disconnected [50].

3.3.2. Necessity to Use the 3D Virtual World in Medicine

For many years, the provision of a variety of health care to face-to-face interventions was patient and physician. The patient had to go to the health care center and see a physician, while some services did not require the patient to be present. This method of healthcare delivery prevents waste of patient and physician time and develops services for patients [51]. In addition, the demand for the provision of health services based on new digital technologies is increasing worldwide. Accordingly, 40 million new healthcare jobs are expected to be created by 2030 [52]. Some of these services offered in the virtual world are very close to the real world, and the experiences of the doctor and the patient are simulated in it. It can

also be used as a supplement alongside traditional healthcare delivery systems [11, 28].

4. Conclusion

Health and wellness are certainly of great value and importance because they are healthy human resources that, through their continuous efforts and activity, increase productivity, and efficiency and ultimately increase economic growth and development of nations. Since the world around us is a chaotic world full of complexity and uncertainty, the healthcare market is no exception, and every day our health is affected by new diseases or unknown diseases affected by a digital world in the future, etc., which is a reflection of uncertainty in this market. These uncertainties are inherently present in both health service providers (doctors) and health service recipients (patients). In other words, neither doctors have any certainty about their prescription, nor do patients have enough knowledge about their characteristics and treatments. In such circumstances, we are seeing other changes that will affect health. such as lifestyle changes, dietary changes (from home to fast food - from plant to industrial), changes in the pattern of diseases (from infectious to chronic), air and environmental pollution, and climate change. These changes and many others that are currently unknown to us will cause changes in health care and health needs. The consequences of many of these changes affect the future of health technologies, and we are forced to change and develop technologies in the face of these changes. So connecting communication, human-computer interactions, integration, and communication between the real and virtual worlds requires more upgrades, and these limitations need to be lifted to make these technologies more efficient in the future, and researchers need to pay attention to this. We need to develop a variety of medical equipment, health technologies, training, and research in the medical and emergency service, accidents caused by plane crashes, natural disasters, and climate change, and due to the lack of appropriate technologies, impose huge psychological and financial costs on the health system of countries every year.

Abbreviations

VR	Virtual Reality
3D	Three-dimensional
IOT	The Internet of Things

Author Contributions

Zahra Heydarifard: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Software, Visualization, Writing – original draft

Mohsen Jalilzadeh: Investigation, Resources

Hamid Pourasghari: Project administration, Validation,

Visualization

Mohammad Reza Maleki: Supervision, Validation, Writing – review & editing

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Conflicts of Interest

The authors declare no conflicts of interest.

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