What Role Does Virtual Reality Play in Healthcare

Gisela Ruiz

George Mason University

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Introduction

In today's world, technology has become an integral part of our lives, and keeping up with these new advances has become necessary. We use technology to communicate and access important aspects of life, such as scheduling doctor's appointments and utilizing resources within the healthcare system. Virtual reality (VR) is a technology that is gaining recognition in the healthcare environment. While VR is well-known in the gaming industry, it is increasingly being recognized as a powerful tool in healthcare. This is demonstrated in medical training, patient treatment, and rehabilitation environments. Healthcare professionals are currently investigating the impact of using VR in their treatments. VR has the potential to transform the healthcare industry and change the world. However, there are significant challenges involved in integrating VR into healthcare, including security, ethical, legal, and social concerns. Despite these obstacles, the use of VR technology in healthcare is expected to grow in the future (Virtual Reality Security - IEEE Digital Reality, n.d.).

Current Use of Virtual Reality in Healthcare

How is VR currently used and impacting healthcare? VR is versatile and can assist doctors in delivering clinical services, not only in the hospital setting but can expand to provide services within a patient's home and other environments. This enables patients, including people in socioeconomically vulnerable communities and people who are elderly or have disabilities, to access needed healthcare services when in person is difficult; this has a practical impact on patients to complete treatment and monitoring regimens. VR is used in a number of treatment domains to treat patients, such as pediatric diagnostics and treatments, pain management, mental health, and telemedicine, to name a few (Center for Devices and Radiological Health, Augmented reality, and virtual reality in medical devices, n.d.).

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Also, currently, VR is used in healthcare for surgical planning and training, allowing surgeons to practice procedures using detailed 3D simulations of patient anatomy. VR is being used in mental health treatments, such as exposure therapy for PTSD, by creating controlled environments to help patients confront and manage their fears (Mairi Therese Deighan et al., 2024). Some benefits of VR include increased access to necessary health care, improved healthcare professionals' ability to prepare for certain treatments and streamlined diagnoses. Some security concerns involve cybersecurity risks and privacy risks.

Security Aspects of Virtual Reality in Healthcare

Security in the healthcare environment is always an important concern to address and be a priority. Security in VR systems revolves around protecting private medical information, providing secure access, and preserving device integrity are the three main focuses of security in VR and healthcare. Data privacy and confidentiality of personal health information (PHI) exposure is a concern with VR systems that can collect sensitive health data, which must be protected under the Health Insurance Portability and Accountability Act (HIPAA) (Virtual Reality Security - IEEE Digital Reality, n.d.).

Another security concern is that unauthorized access to VR systems could lead to breaches of PHI because VR applications often collect extensive data about users, including biometric data, which could be exploited if not properly secured. Device and network security vulnerabilities and other related hardware may have security flaws that can put them at risk of unauthorized access. Overall, the main goal is to protect patient personal information, in which VR systems frequently handle personal health information; data privacy is essential and must comply with HIPAA (Virtual Reality Security - IEEE Digital Reality, n.d.). These issues bring to light ethical, legal, and social concerns within the healthcare environment when protecting PHI.

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Ethical, Legal, and Social Implications of Virtual Reality in Healthcare

Technology has opened opportunities to provide healthcare services via means other than traditional personal visits between healthcare professionals and patients, such as VR, generally defined as a computer-generated 3D world accessed via a head-mounted display and commonly used in devices such as computers, tablets, or smartphones. VR presents a transformative potential in healthcare, offering enhanced access to healthcare services and alternative therapeutic options. However, its integration also raises ethical, legal, and social implications. These include the doctor-patient relationship, quality of care and safety, fairness, and confidentiality (Rudschies & Schneider, 2024).

The legal and ethical implications of VR technologies in healthcare include the issue of registration, licensing, and practice. Patients from different places may use VR, which may have different legal frameworks and whether doctors need to be licensed to offer such services. Also, these types of technology in the healthcare process are sensitive personal and medical data, and one of the most important legal implications is safeguarding privacy, confidentiality, and data protection. Other ethical concerns are the misuse of VR with patients who are at risk or contribute to mental health risks such as anxiety, depression, detachment from the environment/reality, and cybersickness. Another concern is that language can potentially cause the exclusion of certain social groups because the technology and specific languages might not be able to understand and interact with some groups of people with speaking disabilities (Rudschies & Schneider, 2024).

Another implication is that VR applications in the healthcare domain may have social implications, such as healthcare professionals' competencies and information technology (IT) skills needing to expand and consistently be updated based on VR technology updates. This can

also be an issue for patients as they may not know how to use VR tools/technology or be limited in their physical abilities to operate them. Also, patients should be given a choice over whether and how they want to participate in these types of VR services. First, the patient should be provided transparency about the systems and clear information about a system's intentions, purpose, scope of use, and limitations, including how data is used, which could be helpful for patients making an informed decision. Also, they should have the right and access to report concerns about the safety or quality of the VR service, and healthcare professionals should have tools in place to resolve any problems or even discontinue using the VR. Another social implication is barriers to using VR in healthcare for patients who lack access to the required technology or the internet, which may increase the inequality between those well-skilled in using digital technologies and those who are not (Rudschies & Schneider, 2024). While there seem to be many concerns with regard to legal, ethical, social, and security aspects of VR, the current use appears to include more use of these technologies, which provides the outlook that in the future, this will only expand into the Healthcare environment and used as a standard practice with continues learning upkeep.

The Future Role of Virtual Reality in Healthcare

These technologies have already played an important role in every area of functioning, including for entertainment purposes, and are now being used in health care. Also, many psychological, physical, and cognitive aspects of health can be treated using VR. Looking ahead, the role of VR in healthcare is poised for significant expansion. The healthcare system has started to transition into a more virtual experience. COVID-19 and the rise of telehealth increased this. These developments, however, are just the beginning. In the near future, VR technology could revolutionize areas such as surgical training, chronic pain management, and

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mental health support, offering new hope and possibilities for healthcare professionals and

patients (NextMed Health, 2023).

      VR is not a required standard part of healthcare due to economic, equipment limitations,

legal/ethical, and social concerns. However, in light of the range of VR tools available and the

diverse areas in which VR can be applied, the future role of VR applications will be seen as

being used but not limited to medical education, such as nursing, dentistry, and surgery training.

Based on these practices, the role of healthcare delivery and health management will look

different in the future. Eventually, more and more outpatient care, preventive care, long-term

care, and well-being services would move to virtual delivery and VR system services based on

patient agreement and specific medical treatment (NextMed Health, 2023).

Conclusion

      VR is increasingly being used in healthcare settings not only to train healthcare providers,

assist with pain management, and provide telemedicine but also to improve doctors' performance

and serve as an educational tool. However, there are ethical, legal, and social implications to

consider in a constantly changing technology environment. Doctors and patients need to keep up

with new technology to provide information and education on its use and effectiveness for each

patient. Economic concerns regarding access to equipment, adequately trained users, and safety

for all people of any age also need to be addressed. While VR is commonly used as a tool, in the

future, more VR systems and/or procedures will be implemented to streamline patient care.

Ultimately, the future will involve technology that integrates into the healthcare system to

broaden, facilitate, and maintain patient security while tailoring the quality of care to the patient's

needs. This means that VR technology is here to stay and will expand over time, requiring people

to learn and adapt to more technology when they visit their doctor. Some people will adapt

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quickly, and others will need time to learn and update their computer skills. However, healthcare

and medical care should not be hindered because of an individual's ability to use or not use these

technologies.

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References

Center for Devices and Radiological Health. (2024, September 6). Augmented reality and virtual

reality in medical devices. U.S. Food and Drug Administration.

https://www.fda.gov/medical-devices/digital-health-center-excellence/augmented-reality-

and-virtual-reality-medical-devices

This FDA source provides valuable information regarding augmented and virtual reality,

explaining their potential impact on healthcare. It demonstrates that these new types of

technology, such as VR, will provide new treatments and diagnostics, changing how and

where care is delivered. Physicians, patients, and caregivers can also enlist AR/VR to

help them prepare for or perform specific treatments or procedures. This source is helpful

because it explains how VR impacts medical devices. Also, there are risks related to

using the devices, such as physical and visual issues.

Deighan, M. T., Simpson, D., Brigden, A., & Cater, K. (2024). Perspectives of healthcare

professionals on the use of immersive virtual reality in teenage and young adult

oncology: a qualitative interview study. *BMC Digital Health*, *2*(1), 1–

15. https://doi.org/10.1186/s44247-024-00071-2

This article provides information on the applications of VR in healthcare and how it

continues to grow. It also provides challenges from the perspective of clinicians and

healthcare staff, specifically from teenage and young adult oncology. This study focuses

on the knowledge gap regarding the use of VR in cancer care by interviewing different

medical staff. The study demonstrated that despite the effort to adopt VR, many practical

and ethical challenges must be addressed to implement VR in hospitals successfully. This

is relevant to this present research paper because it provides that while staff in the

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medical field are open and receptive to using VR systems, there are many other aspects of

VR to explore and challenges to address.

How Virtual Reality in Healthcare Is Changing Medicine | Built In. (n.d.). Builtin.com.

https://builtin.com/articles/ar-virtual-reality-healthcare

This source provides information on how VR is used in different medical treatments and

procedures, such as mental health and within the autistic community. It explains that VR

has become a convenient mental health tool for treating conditions such as post-traumatic

stress disorder (PTSD). It also emphasizes that VR is a rapidly advancing technology.

This source is helpful as it shows that VR is versatile and can expand into different areas

within the healthcare environment. Also, it provides that doctors may implement more

VR use as it advances and more people become familiar with the tools.

Kammler-Sücker, K. I., Löffler, A., & Flor, H. (2023). Effects of personalized movement models

in virtual reality on pain expectancy and motor behavior in patients with chronic back

pain: a feasibility study. *Virtual Reality : The Journal of the Virtual Reality

Society*, *27*(4), 3581–3598. https://doi.org/10.1007/s10055-023-00800-4

This study is based on cognitive-behavioral therapy (CBT). Including chronic pain

addressed by teaching patients to reduce pain behaviors by exploring if personalized

virtual movement models, similar to VR, can influence fear of pain, motor avoidance,

and movement-related pain and function. This study was a randomized controlled trial,

with participants in which self-reported pain expectancy, engagement, functional

capacity, and pain during movements, were analyzed along with range of motion. The

study explained that personalized virtual movement models may provide an additional

tool for exposure and exercise treatments. This is relevant because VR is a valuable tool

for pain management treatment.

NextMed Health. (2023, June 10). *The Future of VR/AR & Extended Reality in Healthcare |*

Rafael Grossmann at NextMed Health. YouTube.

https://www.youtube.com/watch?v=UmSIMBGwW_Y

This video source, Dr. Rafael Grossmann, provides an overview of the emerging

possibilities for AR/VR (Extended Reality). He is a surgeon and educator who uses VR

in surgical and medical education environments. He speaks about closing the gaps in

healthcare and education through technology and humanity. He used examples of how

airplane pilots use VR simulators to train and compared how it will expand in the near

future in the medical environment, especially in surgery. This source is relevant because

more medical professionals are speaking and supporting using these technologies to

advance the medical field when treating patients.

Rudschies, C., & Schneider, I. (2024). Ethical, legal, and social implications (ELSI) of virtual

agents and virtual reality in healthcare. *Social Science & Medicine*, *340*, 116483.

https://doi.org/10.1016/j.socscimed.2023.116483

This article provides information that VR applications broaden the opportunities in

healthcare from the analog world into a virtual realm. Also, it gives consideration to the

legal, ethical, security, and social aspects of VR. Specifically, the doctor-patient

relationship, privacy and data protection, justice, fairness, and equal access. Also, issues

of accountability, liability, and safety will be discussed within a review of the existing

literature to analyze the ethical, social, and legal ramifications of VR applications in

healthcare. This article is relevant to the current paper because it provides current legal

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and ethical concerns regarding medical practices when using VR systems and how they

will impact the expansion in the future. It also raises different relevant social

implications, such as language barriers and physical limitations regarding people with

disabilities.

Virtual Reality Security - IEEE Digital Reality. (n.d.). Digitalreality.ieee.org.

https://digitalreality.ieee.org/publications/virtual-reality-security

This source provides information about security threats. Including how to address the

threats and safeguard information when using the VR system. It provides a perspective on

how rapidly evolving VR (augmented reality) can be used for good or bad purposes. It

also offers suggestions and tips for good security and staying safe when using virtual

reality. This source is relevant because it sheds light on cybersecurity, physical security,

and general use. This would also be a concern regarding user security issues in a

healthcare environment.