Letter to Editor

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Extended Reality Technologies in Respiratory Care

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Dear editor

In recent years, the convergence of digital technologies and healthcare has paved the way for innovative approaches to respiratory care and rehabilitation. Among these technologies, the metaverse and Virtual/Augmented Reality (VR/AR), also known as Extended Reality (XR), stand out as promising tools with the potential to revolutionize the management of respiratory conditions such as Chronic Obstructive Pulmonary Disease (COPD) and the care of Intensive Care Unit (ICU) patients. This scientific exploration reminds the applications of these technologies in improving respiratory health outcomes, highlighting their benefits, challenges, and future directions.

The metaverse, a concept popularized by science fiction, has now become a tangible reality with advancements in virtual reality, digital twinning, the Internet of Things (IoT), and blockchain technology (1). It represents an interconnected virtual universe where users can interact with digital environments and each other in real-time. In the context of healthcare, the metaverse offers opportunities for immersive training, telemedicine, and patient education (2).

Virtual and augmented reality technologies have gained traction in various medical specialties, including critical care medicine and pulmonary rehabilitation. VR/AR simulations provide immersive learning experiences for healthcare professionals and patients alike, fostering better understanding and adherence to treatment regimens. In the context of respiratory care, VR/AR holds immense potential for enhancing pulmonary rehabilitation, respiratory therapy, and patient education (3).

COPD is a prevalent respiratory condition characterized by airflow limitation and respiratory symptoms. Pulmonary rehabilitation plays a crucial role in improving the quality of life and functional capacity of COPD patients. However, accessibility and adherence barriers often limit the effectiveness of traditional rehabilitation programs. Virtual reality interventions offer a solution by providing personalized exercise regimens, interactive training modules, and remote monitoring capabilities, thereby overcoming barriers to participation and improving patient outcomes (3). AR visualizations allow clinicians

to explain complex respiratory conditions to patients. Interactive 3D models of lungs, airways, and alveoli facilitate understanding and empower patients to actively participate in their care.

The ICU is a critical setting where patients with severe respiratory conditions require intensive monitoring and intervention. VR/AR technologies offer novel approaches to simulating clinical scenarios and improving patient outcomes (4). Virtual environments allow clinicians to practice emergency procedures, refine their decision-making skills, and familiarize themselves with ICU equipment and protocols. Moreover, VR/AR-based patient education tools can empower ICU patients and their families to better understand their condition and participate in their care (3).

Medical procedures could also be performed with more accuracy and safety using AR models. For instance, during bronchoscopic procedures, AR overlays can provide real-time guidance, highlighting anatomical structures and aiding in accurate navigation. This enhances diagnostic precision and reduces procedural risks.

Moreover, Mixed Reality (MR) environments enable trainee respiratory therapists and physicians to practice critical interventions, such as intubation or ventilator management, in realistic settings. These simulations bridge the gap between theory and hands-on experience. MR platforms also facilitate multidisciplinary discussions. Experts from different locations can virtually examine patient data, discuss treatment plans, and provide real-time guidance to on-site teams.

While the integration of the metaverse and XR technologies holds immense promise for respiratory care, several challenges need to be addressed. These include technological limitations, cost considerations, regulatory hurdles, and concerns regarding data privacy and security (5). Future research efforts should focus on optimizing the usability, scalability, and effectiveness of XR interventions, as well as exploring their long-term impact on patient outcomes and healthcare delivery models.

The metaverse and virtual/augmented reality technologies offer unprecedented opportunities to transform respiratory care and rehabilitation. By harnessing the immersive capabilities of these technologies, healthcare providers can enhance training, improve patient engagement, and optimize clinical outcomes for individuals with respiratory disease. The medical community needs to familiarize itself with these emerging technologies to utilize them in the near future.

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Conflict of Interest

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References

1. Sun M, Xie L, Liu Y, Li K, Jiang B, Lu Y, et al. The metaverse in current digital medicine. CHE 2022;5:52-7.

2. Murala DK, Panda SK, Dash SP. MedMetaverse: medical care of chronic disease patients and managing data using artificial intelligence, blockchain, and wearable devices state-of-the-art methodology. IEEE Access 2023;11:138954-85. Available at: https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=10348578

3. Patsaki I, Avgeri V, Rigoulia T, Zekis T, Koumantakis GA, Grammatopoulou E. Benefits from incorporating virtual reality in pulmonary rehabilitation of COPD patients: a systematic review and meta-analysis. Adv Respir Med 2023;91(4):324-36.

4. Dieck MC, Jung T, Kim YS. XR and metaverse: proceedings of the 8th international XR-metaverse conference 2023, Las Vegas, USA. 1st ed. Springer Nature; 2024. 283 p.

5. Yang D, Zhou J, Chen R, Song Y, Song Z, Zhang X, et al. Expert consensus on the metaverse in medicine. Clin eHealth 2022;5:1-9. DOI:10.1016/j.ceh.2022.02.001