Toward a meta-vaccine future: Promoting vaccine confidence in the metaverse

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Abstract

The metaverse has a promising role to serve as a global platform and tackle one of the most intractable public health challenges; vaccine hesitancy. Active efforts in this field can enhance vaccine acceptance thus leading to better community health protection. By embracing digital health innovations, the metaverse potentially creates an interactive environment for interdisciplinary collaborations that can foster novel approaches in tackling vaccine hesitancy as well as future pandemics. This paper aims to highlight the unique areas where the metaverse can enhance vaccination confidence, educate about vaccine working principles, and offer collaborative healthcare initiatives in this virtual community.

Introduction

In 2021, Zuckerberg announced Facebook's shift to "Meta" to better parallel the company with its mission statement concerning the metaverse and the more recent technologies of the century.[1] The metaverse refers to a three-dimensional virtual world where avatars or virtual representations engage in social, cultural, and sportive activities.[2] Since its inception, the metaverse has built on additional technological elements such as IoT (internet of things), blockchain, artificial intelligence (AI), virtual reality (VR), and used in many different fields, including medicine.[3] The expansion of the metaverse was also eased by the democratization of internet access.[4]

It is no surprise that many countries including but not limited to, China, India, Saudi Arabia, and the United Arab Emirates took particular interest in the concept, with some creating a metaverse regulating authority and headquarters.[5] From a social standpoint, the development of new forms of immersive virtual experiences assists individuals in creating communities based on shared values and expressing themselves more authentically. This automatically translates to numerous applications within the health

sector, notably in telemedicine, public health, psychiatry, and surgery.[4]

Likewise, the metaverse has a role in providing a global platform to tackle one of public health's most intractable problems; vaccine hesitancy. It is well established that COVID-19 vaccination hesitancy is a significant and growing issue that necessitates creative global and digital health solutions.[6] This paper aims to highlight different areas where the metaverse might enhance vaccination

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confidence, educate about vaccine working principles, and research directions for this digital community setting.

Combatting vaccine hesitancy

The vaccine hesitancy spectrum spans individuals who refuse all vaccines (anti-vaxxers), refuse vaccines but are unsure, delay or refuse some vaccines and those who accept vaccines but are unsure.[6] In the current times, metaverse and "digital twins" can be beneficial in dealing with this issue worldwide by modeling user behaviors and simulating potential causes of vaccine hesitancy. "Digital twins" function by creating a virtual representation of the real world that mirrors the physical objects and creates a digital twin of it.[7] Simultaneously, multiple digital twins of numerous physical objects can be integrated to form a large-scale scenario that can efficiently mirror reality and provide a simulated alternative.[7] The 3C model of vaccine made by SAGE Working Group identified three main factors associated with vaccine uptake which included confidence, complacency, and convenience. The benefit of this integrated simulation (Digital Twins) is that users can find out the potential outcomes of specific actions through VR, which can help them make better decisions in reality and develop confidence, complacency and to a certain extent convenience as well, addressing all the factors defined in the 3C model.[8,9]

Among this population, metaverse can prove to be efficacious via developing interactive training modules to target fear, provide proper knowledge about its importance, and elaborate on the dangers of the disease itself. Considering that most metaverse users are from younger age groups (between ages 10 and 20), it will directly target the population that is the most vaccine-hesitant, i.e. the younger population, as shown by a study conducted in Japan.[10,11]

This emerging use of metaverse in telehealth could enable healthcare professionals to explore vaccine hesitancy among patients. Additionally, to counter vaccine hesitancy, experts can develop virtual avatar hotlines, which can help patients with concerns and queries related to vaccination. Moreover, metaverse along with coordination from healthcare professionals can form virtual patient communities where they can discuss and learn about vaccinations directly from the experts.

To prevent misinformation spread in the metaverse, strict regulation policies must be formed for the data being shared. This can be done with the help of social media companies and public health entities that can create proper protocol and policies for safe health data governance in the metaverse.[12] Cybersecurity measures currently utilized on social media such as two-factor authentication of user accounts, removal of spam accounts, suspension of misinformation-focused accounts, and labelling of content that may be potentially misguiding can be a foundation to ensuring privacy and data safety across the metaverse. Digital governance authorities, such as the one established by the United Arab Emirates for Artificial Intelligence, as well as the Dubai Metaverse strategy, is a positive step toward developing secure policies surrounding information exchange in this era.[13,14]

Promoting vaccine confidence

Vaccine confidence in the metaverse is a promising starting point for such impactful awareness. The role of "Digital Vaccines," which utilize gamification and AI-based mobile applications in the metaverse to tackle needle anxiety among children, thereby promoting vaccine confidence, is a positive step toward behavioral change in the community.[15] At a stakeholder level, companies and health organizations including Big Pharma and the FDA, need to bring more attention to the global challenge of vaccine inequity. This can be achieved by including pro-vaccine incentives in the metaverse, targeted through unique access to events, memberships, or by funding cryptocurrency rewards for vaccinated users in the community. This can, in turn, promote a sense of positive reward-seeking within the unvaccinated community. From a health system perspective, hiring digital community health workers, similar to social workers in real-life communities, can be deployed to educate the metaverse community on vaccine awareness at different virtual locations. Vaccine awareness tours can be organized in the metaverse by simulating the process of vaccine discovery, production, and deployment to the general metaverse community. This can be incorporated in the form of organized seminars, expert panel discussions in the metaverse among healthcare leaders worldwide.

Enhancing collaboration and health system strengthening

With multiple stakeholders involved in mitigating the COVID-19 pandemic, a unique obstacle was effective inter-communication and timely global collaborations. Though video conference tools enabled researchers, doctors, government officials, and other global health collaborators to hold virtual meetings, the digital barriers caused by the affordances of the traditional screen led to a lack of engagement. However, through the use of immersive head-mounted display and then use of digital twins, it is expected that meetings in the metaverse will bring the benefits of physical interaction among individuals while adhering to social distancing guidelines.

The metaverse also provides a unique circumstance in which vaccine-sufficient countries can collaborate with humanitarian organizations to help lower-income countries with their vaccination needs. There are precedents for using

this method, as CARE has collected cryptocurrency donations for use in various humanitarian aid campaigns, including for COVID-19 relief and recovery.[16]

Lastly, the metaverse and VR have been used to treat patients with various mental illnesses such as post-traumatic stress disorder (PTSD).[17] This can be translated to be helpful in vaccination efforts by alleviating vaccination hesitancy among patients with mental disorders as well. Therefore, the metaverse can be used as a platform for such patients and psychiatrists to work together to alleviate vaccine concerns and fears.

Limitations to the meta-vaccine approach

The relative newness of the metaverse means that many people are entirely unaware of it, and even those involved in it have a long way to go to utilize what it has to offer fully. A survey of consumers in the USA revealed that only 47% could accurately define what the metaverse was.[18] The acceptance of any digital innovation is also multifaceted. It has roots in the individual's perceptions of its usefulness, ease of use, and the external influence of societal norms and cultures on these factors.[19] Previous studies of attitudes and adaptation to various forms of technology revealed that individuals between the ages of 50 and 67 exhibited notable "technophobia," an extreme and irrational fear of technology.[20] This would entail that a significantly large, vulnerable population might be unwilling to participate altogether. Bearing in mind that nearly 700 million people live below the poverty line, with a daily income of below $2.15 in 2017, making the metaverse available to such a large population is a considerable challenge.[21] Furthermore, these populations cannot be supported by their governments, which are struggling to fulfill basic requirements, and therefore cannot prioritize the development of the required digital infrastructure to support the establishment of the meta-vaccine approach. It is worth noting that the current state of health system burden on a global scale along with limited time, training, and resources in high clinical load settings poses as an active challenge to the implementation of additional interventions, including those conducted in the metaverse for vaccine awareness. Such a situation deserves more attention and can result in a disparity in digitalization between different regions of the world.

Prolonged use of VR headsets can result in headaches, dizziness, nausea, and visual problems.[22,23] Myopia, a leading burden in ophthalmology with 32% of the world's population affected in 2019, will become even more prevalent.[22,24,25] In the elderly population, discomfort, notably dizziness, following prolonged use of VR headsets may also lead to reduced interaction and conversation with their families.[26] Additionally, the use of VR has been noted to cause disruption of normal development of coordination strategy in children of ages 1–7 years with regular exposure. Promotion of the metaverse and the subsequent increase in users can lead to a lapse in cybersecurity.[27] Other concerns are the regulation of medical services to prevent fraud and the uncertainty of effective application of governing laws such as the US Health Insurance Portability and Accountability Act (HIPAA). Managing misinformation on such a platform is also a problem that comes to mind when considering the expansive use of the metaverse for vaccine promotion and other ventures.[28]

The implications of the meta-vaccine initiative could be further assessed using existing models of innovations in the telepsychiatry field. Situmorang et al. discussed the possibility of conducting "rapid telepsychotherapy" using the metaverse as a one-session intervention for the mental health needs of patients.[29] A similar approach can be implemented for "rapid vaccine awareness" sessions where metaverse users can enter a vaccine awareness session in order to educate themselves in a concise yet visually appealing manner during their time in the metaverse. Future research is warranted on the impact of such rapid-acting interventions in vaccine awareness using the metaverse, particularly with the younger populations being the majority of current metaverse users. With high levels of digital literacy in this population, it is imperative that vaccine confidence can be built in an effective way due to the increased accessibility, connections, and acceptance of this technology by the youth. Recommendations are being made for universities to offer metaverse education in their curricula, which further strengthens the theory of building meta-vaccine education sessions as part of the academic courses.[30]

Conclusion

There is a tremendous need for increased understanding of the potential the metaverse has in public health promotion, particularly in raising net vaccination confidence. Furthermore, embracing the concept of digital health, the metaverse creates a virtual environment for interdisciplinary collaborations that allow a proactive position in tackling future pandemics.

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