

General Psychiatry **Future of mental health in the metaverse**

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ABSTRACT

The metaverse and non-fungible tokens (NFTs) were some of the hottest tech terms in 2021, according to a Google Trends search. Our review aims to describe the metaverse and NFTs in the context of their potential application in the treatment of mental health disorders. Advancements in technology have been changing human lives at an ever-increasing pace. Metaverse, also known as the three-dimensional (3D) internet, is the convergence of virtual reality (VR) and physical reality in a digital space. It could potentially change the internet as we know it, with NFTs as the key building blocks in the new expansive virtual ecosystem. This immersive 3D virtual world boasts the features of the real world with the added ability to change the surrounding environment according to individual needs and requirements. VR, augmented reality (AR) and mixed reality (MR) have been employed as tools in the treatment of various mental health disorders for the past decade. Studies have reported positive results on their effectiveness in the diagnosis and treatment of mental health disorders. VR/AR/MR have been hailed as a solution to the acute shortage of mental health professionals and the lack of access to mental healthcare. But, on the flip side, young adults tend to spend a significant amount of time playing 3D immersive games and using social media, which can lead to insecurity, anxiety, depression, and behavioural addiction. Additionally, endless scrolling through social media platforms negatively affects individuals' attention span as well as aggravating the symptoms of adolescents with attention deficit hyperactivity disorder.

We aimed to explore the ramifications of expanding applications of the metaverse on mental health. So far, no other review has explored the future of mental health in the context of the metaverse.

INTRODUCTION

It all started with Web 1.0, the 'read-only' internet. Web 2.0 replaced it as a more interactive version where the user could send information to the servers. Then social media emerged, soon followed by the inclusion of virtual/augmented/mixed reality. Now, a convergence of all these technological advances has given rise to the metaverse, which is being touted as the future Web 3.0.¹

Basic elements of virtual reality (VR) have existed for over 50 years with limited levels of immersion and interaction. Immersive VR is created by wearing a head-mounted device that uses stereoscopic displays with specialised lenses carrying motion tracking

hardware which provide the illusion of being physically present in a world that is virtual.² VR replaces the real world with a virtual one, whereas augmented reality (AR) supplements the real world with virtual content by overlaying digital images on physical objects.³ Consequently, VR allows users to feel psychologically immersed in a virtual environment, while AR provides an environment that enables users to interact with virtual objects in the real world.³ Mixed reality (MR) is a mixture of virtual and actual reality allowing real and virtual elements to interact with one another, enabling users to have more control over virtual objects as compared with AR.³

The metaverse is a digital world created using different technologies like VR, AR, cryptocurrency and the internet. Metaverse is a portmanteau coined from the words 'meta' and 'universe' taken from Neal Stephenson's science fiction novel *Snow Crash* written in 1992.¹ In the novel, avatars of real people inhabited a three-dimensional (3D) virtual world. Interest in the metaverse has blown up in recent months, with 'metaverse' and 'non-fungible tokens (NFTs)' being some of the hottest tech terms in 2021, according to Google Trends search. The metaverse is an expansive network of real-time 3D virtual simulations where users can have a deeply immersive experience of being 'inside' the internet interacting digitally with other users, objects, and environments. The virtual universe boasts all the features of the real world where people can gather, socialise, work, and play with others in a different physical space embodying unique avatars.⁴ The primitive form of the metaverse is already here, and it will evolve in ways we might not be able to foresee.¹

Web 3.0 will change the way we socialise, work, and interact. NFTs are unique digital assets that represent objects like art, music, collectible items, and in-game items.⁵ NFTs are traded online, often with cryptocurrency, and are a unit of data stored on a block chain, a digitised database that is distributed across the internet. Cryptocurrency systems like bitcoin and Ethereum, and NFTs are blockchain-based.⁵ Blockchain maintains a

secure and decentralised record of transactions guaranteeing the security of records of data without third-party control.⁵ The decentralised nature of the blockchain offers prospects for limitless business opportunities and social interaction in the metaverse.⁶ NFTs might become the building blocks of the metaverse. For example, NFT digital avatars represent real-life identities that can be used as access tokens for different locations within the metaverse.⁶

In the realms of the metaverse, NFTs could play a critical role in business ecology. NFT metaverse initiatives would expand the boundaries of exploiting NFTs for transactions of virtual property.⁶ The impact of NFT metaverse ventures would also have a considerable impact on the identification, social, and communal experiences of metaverse users. By owning NFTs, users may extend their support for certain causes or simply express their thoughts. Consequently, NFT owners with similar preferences could reach out to one another and form communities for interacting, sharing ideas, and working collaboratively.⁶

While there is much excitement around the metaverse and NFTs, what does this mean for the future of psychiatry and mental health? According to a study by the World Health Organization (WHO), mental illnesses are the leading cause of illness and disability worldwide, but between 30% to 80% of the people with mental health challenges never seek treatment.^{7,8} This may be due to numerous reasons, including stigma, lack of awareness, limited access to treatment or resources, financial hardship, inability to pay for continued treatment, and conflict with work and school schedules. The metaverse is a 3D amalgamation of social media, virtual gaming, shopping, digital art trading, real estate, and the investment market. Entering the metaverse will surely impact our reality, with possible negative and positive effects on mental health. According to Amara's law, we tend to overestimate the effect of a technology in the short run and underestimate its effect in the long run.⁹ Based on this premise, we might overestimate the ability of the metaverse to predict future outcomes while it is in its nascent stage. With the growing global mental health crisis looming over the horizon, our review aims to explore the role the metaverse will play in the epidemiology of mental health disorders.

CURRENT APPLICATIONS OF VR AND AR IN MENTAL HEALTH

Trials involving the treatment of psychiatric disorders using therapeutic tools in the metaverse have not yet been reported. However, VR, AR and MR are being used increasingly for the diagnosis and treatment of mental health disorders.³

The advantage of VR simulations lies in the fact that real-life situations difficult to replicate in person can be recreated in cyberspace. The shortage of mental health professionals can also be managed since certain VR simulations can eliminate the need for the physical presence of providers, allowing them to participate remotely from

distant locations.² Simulations in the metaverse could prove useful in the management of the following mental health disorders that have already benefited from VR.

Attention deficit hyperactivity disorder

VR-based tools have been developed to improve the diagnosis and treatment of children with attention deficit hyperactivity disorder (ADHD). Children seem to be more receptive to the engaging environments that can be elicited in VR, improving patient compliance. VR-based continuous performance tests have been used to teach patients new coping behaviours, ultimately helping them manage their symptoms and improve productivity in their day-to-day lives.³

Eating disorders

VR has also shown promise in managing eating disorders. In the VR environment, patients are exposed to various stimuli to assess which foods or environments elicit the highest levels of cravings. They can then learn how to cope with these stimuli in the safe and controlled setting of VR.^{2,10}

Anxiety, phobias and post-traumatic stress disorder

Socially anxious individuals benefited substantially from a VR social skills training session since it allowed them to engage and acquire skills in communication, which boosted their self-esteem.¹¹ Therapy in controlled VR environments has shown some success in treating phobias.¹²

VR-based exposure therapy for post-traumatic stress disorder (PTSD) permits the caregiver to personalise the virtual environment to simulate combat scenarios most relevant to the trauma experienced by individual soldiers.¹³ This enables the patient to develop appropriate responses and coping mechanisms. Many Veterans Affairs (VA) hospitals, army bases, and university centres have started treating soldiers with PTSD using a VR exposure therapy system called 'Bravemind'. It has shown promise in allaying trauma and decreasing suicidal ideation, depression, and anger. However, these VR-based therapies seem to have comparable efficacy with standard evidence-based interventions.^{12,14}

Autism

Cognitive therapy using VR for patients with autism has also shown positive results. Studies performed at the University of Texas and Northwestern University's Psychiatry Department have successfully run trials using VR programmes that use avatars to simulate job interviews and meetings. They were proven to be successful in improving life skills, as well as overall improvement in concentration, cognition, and memory.¹²

Alzheimer's disease

VR has been used to test navigational skills and improve cognition in patients with Alzheimer's disease. However, some patients did experience boredom, fear, and anxiety while using VR applications.¹²

Stress and pain management

Scenarios can be played out in VR to alleviate stress and pain by providing simple forms of distraction. Studies have shown that VR applications were more effective compared with conventional therapy in the management of depression, anxiety, fatigue, and pain.¹⁵ VR can also be used by chronically ill patients to replicate environments outside the hospital, thereby providing a change of scenery and improving mental health.¹²

Delusions, psychosis, and schizophrenia

VR cognitive therapy has also been used in the treatment of persecutory delusions,¹⁶ paranoia in patients experiencing psychosis,¹⁷ depression, and positive symptoms in schizophrenia.¹²

Limitations of VR-based applications

Although VR has been hailed as the future of mental health management, the fact remains that VR-based therapy outperforms inactive controls, but studies have shown a lack of significant improvement over conventional, evidence-based approaches. Current studies exploring the benefits of VR-based therapy also suffer from low quality of evidence, a limited number of randomised controlled trials, the lack of follow-up analysis or control groups, and the presence of heterogeneity and publication bias.¹⁴ These are the same concerns that can be raised when the metaverse is implemented for the therapeutic management of mental health.

PROJECTED BENEFITS OF THE METAVERSE ON MENTAL HEALTH

Interactions in the metaverse will likely be a heightened version of current experiences in VR, with more real and life-like encounters. It can mimic a community where you can make new friends, socialise, and maintain relationships.¹⁸ The metaverse can create opportunities for patients to consult mental health professionals by taking the form of 'avatars' in simulated environments. Since the possibilities of virtual simulation are endless, the metaverse is projected to have the potential to create multiple new avenues for the treatment of various mental health disorders. Mental health spaces have already been created in the metaverse that offer a platform for individuals to come together for group therapy sessions which may or may not be mediated by mental health professionals. Immersive spaces have also been created where individuals can practise mindfulness, meditation, or yoga.¹⁹ Many companies have already started to develop virtual mental health clinics with mental health professionals serving patients in real time.²⁰ The governments of several countries have also initiated the setting up of VR counselling and therapy associations to provide services in the metaverse.²¹ Cryptocurrency will be a form of payment for the services provided by these clinics. NFTs will be used as reward tokens that will be awarded on completion of certain goals in therapy. NFTs can further be traded in the virtual marketplace. These

virtual clinics will be especially beneficial for people with limited access to mental healthcare due to disabilities and geographical or time constraints and for those who prefer anonymity because of the stigma attached to mental illnesses. However, only time will determine whether virtual scenarios and avatars can replace the real human interactions that are a core part of conventional mental healthcare.

The recent COVID-19 pandemic was underscored by numerous lockdowns and stay-at-home orders. COVID-19-infected patients were also required to isolate at home or at medical isolation centres. Studies have shown that quarantined individuals face heightened feelings of loneliness, anxiety, and social isolation.²² Even in non-pandemic times, vulnerable populations like the elderly are often restricted in their ability to socialise with family or friends for many reasons. This is also true for physically disabled individuals who often feel frustrated by their lack of independence.

Depression, anxiety, insomnia, and PTSD were observed in people who were socially distancing from their peers, despite continued networking and social support.²³ The metaverse could potentially help mitigate these issues as the 'avatars' in the virtual world simulate real-life interactions, thereby providing adequate socialisation without running the risks of contracting the disease. One can socialise with friends and family and have meetings, get-togethers, parties, and weddings in the virtual world while maintaining social distance. Various simulated 'worlds' in the metaverse can allow the elderly to travel the world, offering them a chance to revisit the past and relive childhood memories.

The metaverse could also provide platforms where pregnant women and new mothers can join together to share experiences and challenges. This could help combat postpartum blues and offer a platform for easier access to professional help for those with postpartum depression.

Many patients with psychosis might experience regular, high levels of anxiety, which can evolve into avoidance patterns for settings that elicit feelings of distress and panic attacks. The findings of a randomised controlled trial evaluating the efficacy of VR-based cognitive therapy in lowering experiences of vulnerability and anxiety in individuals with psychosis were recently published. According to the findings, symptoms of agoraphobia improved after 6 weeks of VR therapy; the greater the intensity of symptoms, the greater the efficacy of this treatment.²⁴

In another study, 15 individuals with severe major depression were immersed in 3–8-min virtual simulations in which they practised comforting a crying avatar with words of compassion and then later switched roles and received the compassionate response themselves from another virtual body. This intervention led to significant reductions in depression severity, as well as to significant increases in self-compassion.²⁵ Receiving such support and compassion from avatars in the metaverse could lead to decreases in depression and anxiety.

PROJECTED NEGATIVE IMPACT OF NFTS AND THE METAVERSE ON MENTAL HEALTH

Digital media use, which includes internet use, social media, and online gaming, has revolutionised societies worldwide. It is estimated that nearly three-quarters of people living in developed nations make up the bulk of approximately one-fourth of the worldwide population who are online.²⁶ The hyperconnected internet stage has exploded in the last 10 years, making it one of the fastest changes experienced by humankind. Actions were taken by the WHO to limit the use of smartphones in schools after results were published implicating the role of intensive digital media use in reducing working memory capacity and the development of depression, anxiety, and sleep disorders.²⁷ Diagnosis of ADHD has been increasing in the last 10 years. The mere presence of a smartphone, even while not in use, can lower working memory capacity and lead to decreased performance on cognitive tasks. In addition, trying to resist internet use ties up working memory resources,²⁷ and the effect of such devices on fetuses of pregnant users is also unknown.

Furthermore, constant exposure to virtual profiles unknowingly inculcates the habit of comparing oneself with others, which can seriously threaten mental balance. For example, social media applications such as Instagram, Snapchat, and others come with built-in photographic filters which have the potential to distort reality, leading to unrealistic expectations of beauty and lifestyle.²⁸ Numerous studies have stated the positive correlation between the development of body dysmorphia and excessive use of photographic filters.²⁸ Body dysmorphia, in turn, can lead to untoward consequences of increased susceptibility to mental illnesses such as eating disorders, obsessive behavioural patterns, and mood disorders.²⁹ Likewise, VR, and AR 3D immersive environments that allow users to pick and choose, improve, and/or modify the appearance of their virtual avatar fundamentally function on the same principles, raising the odds of deteriorating mental health. Based on previous studies, researchers have coined a phenomenon named the 'Proteus effect', which states that individuals who spend substantial amounts of time and effort on creating their virtual self tend to imbibe the imaginary qualities and/or physical attributes, bringing about significant changes in their behaviour.³⁰ Undoubtedly, this would hold significant value in the 3D virtual 'reel life' of the metaverse.

As mentioned earlier, people are expected to gain access to the metaverse applications mainly via NFTs, which operate with virtual currency and blockchains.^{5 31} Many people and well-established content creators/artists across the globe build their virtual assets by trading, selling, and buying digital art. The general public often follows announcements of upcoming NFT projects and ends up competing against thousands of people for access to the new tokens to build virtual assets. This leads to a widely known psychological and behavioural maladaptation that goes by the name of Fear Of Missing Out (FOMO). FOMO is a widespread occurrence marked by

anxiety induced by the awareness that one may miss out on certain mentally pleasurable or rewarding activities; it is most prevalent among avid users of social media.³² A study by Gupta and Sharma³³ states that the correlation between FOMO and disruption of mental well-being is characterised by bizarre sleeping patterns, disrupted work-life balance, emotional dysregulation, and anxiety and mood disorders. Of note, according to a recent study, FOMO was the most relevant sign of perceived social media addiction.³⁴

What the metaverse pledges to do, online gaming has already accomplished for some time. VR gaming systems provide a 3D immersive set-up that feels virtually comparable to real-life experience. The virtual environment allows participants to interact in real-time.³⁵ However, according to a study, most children displaying signs of gaming addiction had poor social skills and a higher tendency to act impulsively.³⁶ Additionally, it was discovered that increased loneliness and depression, anxiety, social fears, and poor academic performance are more likely to be the aftermath of addictive behaviour than to be the cause of it.³⁶ Furthermore, there have been reports of multiple cases in Japan of individuals, known as Hikikomori, who were reluctant to leave their homes since becoming hooked to virtual gaming, increasing the likelihood of developing mood disorders such as depression and anxiety.³⁷ Internet gaming disorder has been recently added to the most recent editions of the The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) and The International Classification of Diseases (ICD-11) as the symptoms of gaming addiction and substance use disorder have much overlap.³⁸

Cybercrime has existed for a long time, with fraudsters employing incredibly advanced schemes. Despite worldwide efforts to curb and minimise the negative implications, cybercrime continues to thrive viciously.³⁹ Individualistic thought patterns and attributes severely influence the propensity to fraudulent internet activities.⁴⁰ Prior studies have reported incidents of sexual abuse in adolescents; teenagers who lacked moral and familial support were found to be more vulnerable as they resorted to exploring the virtual world in quest of external validation, making it simpler for sexual predators to take advantage of such circumstances.⁴¹ A recent article reported how a woman's 3D virtual avatar was sexually abused by other avatars in her vicinity on the VR social media platform, Horizon Worlds.⁴² The woman described the nature of that experience to be surreal and mentally traumatising.⁴² Previous research has established how negative, violent, or abusive user experiences in the virtual world can incite similar psychological and physiological responses in an individual's real world.⁴³ Such incidents can have long-term detrimental psychological effects on the victim's mental state and increase the risk for mental illness such as depression, anxiety, PTSD, or insomnia.⁴⁴

Finally, though the technological potential for expanding mental health support to those who need it

most is promising, not everyone will be able to utilize the VR devices required to enter the metaverse as cost and other constraints will limit access. In addition, vulnerable groups who could potentially benefit from the VR technology, such as older adults, may not be receptive to or capable of using these new devices, even though they have demonstrated proven benefits.

CONCLUSION

Living in a world within the metaverse could potentially lead to the worsening of specific mental health disorders. It might even lead to the identification and classification of new mental health illnesses. However, we cannot deny that the metaverse also promises abundant, easily accessible resources for those seeking to help themselves. With the anonymity of the virtual realm, more individuals may feel comfortable sharing their stories with professionals and others facing similar issues. Hence, this rapidly expanding technology could significantly improve access to mental healthcare, especially given the present acute shortage of mental health professionals. It is possible that very soon, we will see a sprawling mental health space in Web 3.0 that may revolutionise the mental health field. The metaverse has impressive potential for many segments of society, but only time will reveal how its future unfolds.

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REFERENCES

- Kim J. Advertising in the metaverse: research agenda. *Journal of Interactive Advertising* 2021;21:141–4.
- Freeman D, Reeve S, Robinson A, et al. Virtual reality in the assessment, understanding, and treatment of mental health disorders. *Psychol Med* 2017;47:2393–400.
- Goharinejad S, Goharinejad S, Hajesmaeel-Gohari S, et al. The usefulness of virtual, augmented, and mixed reality technologies in the diagnosis and treatment of attention deficit hyperactivity disorder in children: an overview of relevant studies. *BMC Psychiatry* 2022;22:4.
- Lee A. With the Metaverse hype cycle at full blast, experts take the long view. Available: <https://digiday.com/marketing/with-the-metaverse-hype-cycle-at-full-blast-experts-take-the-long-view/> [Accessed 08 Feb 2022].
- Nadini M, Alessandretti L, Di Giacinto F, et al. Mapping the NFT revolution: market trends, trade networks, and visual features. *Sci Rep* 2021;11:20902.
- Weston G. NFTs and their role in the “Metaverse”. Available: <https://101blockchains.com/nfts-and-metaverse/> [Accessed 08 Feb 2022].
- Susman D. 8 reasons why people don't get treatment for mental illness. Available: <http://davidusman.com/2015/06/11/8-reasons-why-people-dont-get-mental-health-treatment/> [Accessed 08 Feb 2022].
- Henderson C, Evans-Lacko S, Thornicroft G. Mental illness stigma, help seeking, and public health programs. *Am J Public Health* 2013;103:777–80.
- Dorn SD. Digital health: hope, hype, and Amara's law. *Gastroenterology* 2015;149:516–20.
- de Carvalho MR, Dias TRdeS, Duchesne M, et al. Virtual reality as a promising strategy in the assessment and treatment of bulimia nervosa and binge eating disorder: a systematic review. *Behav Sci* 2017;7:43.
- Kim S, Kim E. The use of virtual reality in psychiatry: a review. *J Korean Acad Child Adolesc Psychiatry* 2020;31:26–32.
- Park MJ, Kim DJ, Lee U, et al. A literature overview of virtual reality (VR) in treatment of psychiatric disorders: recent advances and limitations. *Front Psychiatry* 2019;10:505.
- Bell IH, Nicholas J, Alvarez-Jimenez M, et al. Virtual reality as a clinical tool in mental health research and practice. *Dialogues Clin Neurosci* 2020;22:169–77.
- Dellazizzo L, Potvin S, Luigi M, et al. Evidence on virtual reality-based therapies for psychiatric disorders: meta-review of meta-analyses. *J Med Internet Res* 2020;22:e20889.
- Ioannou A, Papastavrou E, Avraamides MN, et al. Virtual reality and symptoms management of anxiety, depression, fatigue, and pain: a systematic review. *SAGE Open Nurs* 2020;6:237796082093616.
- Freeman D, Bradley J, Antley A, et al. Virtual reality in the treatment of persecutory delusions: randomised controlled experimental study testing how to reduce delusional conviction. *Br J Psychiatry* 2016;209:62–7.
- Torous J, Bucci S, Bell IH, et al. The growing field of digital psychiatry: current evidence and the future of apps, social media, chatbots, and virtual reality. *World Psychiatry* 2021;20:318–35.
- Smith S. Mental health online: will the metaverse just make everything worse? Available: <https://www.dazeddigital.com/science-tech/article/55420/1/mental-health-online-internet-social-media-metaverse-illness-virtual-reality> [Accessed 15 Feb 2022].
- Cision. Hoame launches world-class virtual meditation studio for Meta Quest. Available: <https://www.newswire.ca/news-releases/hoame-launches-world-class-virtual-meditation-studio-for-meta-quest-894411947.html> [Accessed 08 Feb 2022].
- Businesswire. Revitalist to develop revitaland - virtual clinics in the Metaverse. Available: <https://www.businesswire.com/news/home/20211112005581/en/Revitalist-to-Develop-Revitaland-Virtual-Clinics-in-the-Metaverse> [Accessed 08 Feb 2022].
- Ifdil I, Situmorang DDB, Firman F. Virtual reality in Metaverse for future mental health-helping profession: an alternative solution to the mental health challenges of the COVID-19 pandemic. *J Public Health* 2022;fdac049.
- Hwang T-J, Rabheru K, Peisah C, et al. Loneliness and social isolation during the COVID-19 pandemic. *Int Psychogeriatr* 2020;32:1217–20.
- Marroquín B, Vine V, Morgan R. Mental health during the COVID-19 pandemic: effects of stay-at-home policies, social distancing behavior, and social resources. *Psychiatry Res* 2020;293:113419.
- Freeman D, Lambe S, Kabir T, et al. Automated virtual reality therapy to treat agoraphobic avoidance and distress in patients with psychosis (gameChange): a multicentre, parallel-group, single-blind, randomised, controlled trial in England with mediation and moderation analyses. *Lancet Psychiatry* 2022;9:375–88.
- Falconer CJ, Rovira A, King JA, et al. Embodying self-compassion within virtual reality and its effects on patients with depression. *BJPsych Open* 2016;2:74–80.
- Bujnowska-Fedak MM, Mastalerz-Migas A. Usage of medical internet and e-health services by the elderly. *Adv Exp Med Biol* 2015;834:75–80.

- 27 Korte M. The impact of the digital revolution on human brain and behavior: where do we stand? *Dialogues Clin Neurosci* 2020;22:101–11.
- 28 Abbas L, Dodeen H. Body dysmorphic features among Snapchat users of “Beauty-Retouching of Selfies” and its relationship with quality of life. *Media Asia* 2022;49:196–212.
- 29 Schulte J, Schulz C, Wilhelm S, et al. Treatment utilization and treatment barriers in individuals with body dysmorphic disorder. *BMC Psychiatry* 2020;20:69.
- 30 Paul I, Mohanty S, Sengupta R. The role of social virtual world in increasing psychological resilience during the on-going COVID-19 pandemic. *Comput Human Behav* 2022;127:107036.
- 31 Binance. Why NFTs are the keys to accessing the Metaverse. Available: <https://www.binance.com/en/blog/nft/why-nfts-are-the-keys-to-accessing-the-metaverse-421499824684903085> [Accessed 08 Feb 2022].
- 32 Franchina V, Vanden Abeele M, van Rooij AJ, et al. Fear of missing out as a predictor of problematic social media use and Phubbing behavior among Flemish adolescents. *Int J Environ Res Public Health* 2018;15:2319.
- 33 Gupta M, Sharma A. Fear of missing out: a brief overview of origin, theoretical underpinnings and relationship with mental health. *World J Clin Cases* 2021;9:4881–9.
- 34 Blackwell D, Leaman C, Tramposch R, et al. Extraversion, neuroticism, attachment style and fear of missing out as predictors of social media use and addiction. *Pers Individ Dif* 2017;116:69–72.
- 35 Kaimara P, Oikonomou A, Deliyannis I. Could virtual reality applications pose real risks to children and adolescents? A systematic review of ethical issues and concerns. *Virtual Real* 2022;26:697–735.
- 36 Gorman TE, Gentile DA, Green CS. Problem gaming: a short primer. *Am J Play* 2018;10:309–27.
- 37 Kim M. The good and the bad of escaping to virtual reality. Available: <https://www.theatlantic.com/health/archive/2015/02/the-good-and-the-bad-of-escaping-to-virtual-reality/385134/> [Accessed 08 Feb 2022].
- 38 Colder Carras M, Shi J, Hard G, et al. Evaluating the quality of evidence for gaming disorder: a summary of systematic reviews of associations between gaming disorder and depression or anxiety. *PLoS One* 2020;15:e0240032.
- 39 Alghamdi MI. A descriptive study on the impact of cybercrime and possible measures to curtail its spread worldwide. *International Journal of Engineering Research and Technology* 2020;09:731–5.
- 40 Monteith S, Bauer M, Alda M, et al. Increasing Cybercrime since the pandemic: concerns for psychiatry. *Curr Psychiatry Rep* 2021;23:18.
- 41 Jonsson LS, Fredlund C, Priebe G, et al. Online sexual abuse of adolescents by a perpetrator Met online: a cross-sectional study. *Child Adolesc Psychiatry Ment Health* 2019;13:32.
- 42 Basu T. The metaverse has a groping problem already. Available: <https://www.technologyreview.com/2021/12/16/1042516/the-metaverse-has-a-groping-problem/> [Accessed 15 Feb 2022].
- 43 Lee H-W, Kim S, Uhm J-P. Social virtual reality (VR) involvement affects depression when social connectedness and self-esteem are low: a moderated mediation on well-being. *Front Psychol* 2021;12:753019.
- 44 Bragesjö M, Larsson K, Nordlund L, et al. Early psychological intervention after rape: a feasibility study. *Front Psychol* 2020;11:1595.



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