Effectiveness of Augmented and Virtual Reality-Based Interventions

Subjects: Behavioral Sciences

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Interventions adopting augmented and virtual reality (AR/VR) modalities allow participants to explore and experience realistic scenarios, making them useful psycho-educational tools for mental illnesses. In the context of relatively limited studies, extant AR/VR based interventions could potentially improve knowledge, attitudes, empathy and decrease stigma regarding people with mental illness.

Keywords: virtual reality ; augmented reality ; mental health literacy

1. Introduction

About 11% of the worldwide population suffer from a mental illness [1] and these mental illnesses remain the leading cause of substantial illness burden internationally in terms of disability adjusted life years [2]. Of note, people with mental illness often face challenges such as discrimination [3] and being literate in such conditions will allow people to have better understanding of people who suffer from mental illnesses [4].

Mental health literacy is defined as the knowledge and awareness of mental illness, including prevention, identification and management of these conditions [5]. Having a good level of mental health literacy can enhance the insight into mental illness, promote early help seeking, recovery and psychosocial functioning [6] and foster better attitudes towards patients with mental illness [7]. In addition, better awareness of mental illness has been associated with better employment [8], treatment adherence [9], stronger therapeutic alliance and lower clinical severity [10]. Regarding empathy, it is the ability to stand in the shoes of others and understand another's experiences [11]. Empathy is said to have destigmatizing effects and therefore enhance positive attitudes towards people experiencing mental illness [12]. Concerning stigma about mental illnesses, it can be viewed as a set of unwarranted and negative beliefs and attitudes about mental illness, which can potentially influence discrimination, exclusion and fear of people experiencing mental illnesses [13].

Augmented reality (AR) uses technology to combine real and digital information so that participants experience the virtual and real contexts as one [14] and AR was used in the prominent Pokémon GO game [15]. Conversely, virtual reality (VR) excludes stimulus from the real-world setting. Virtual reality consists of two types: (1) desktop virtual reality and (2) immersive reality [16]. The former allows participants to control the virtual surroundings on a computer screen while immersive reality requires the use of a headset, earphones and controllers, which detects body movements to fully immerse participants in the virtual world.

AR and VR (AR/VR) technologies are gaining popularity in the field of healthcare and health professions education [17] as they allow participants to immerse in realistic simulations thus serving as a useful tool in training and learning [18]. VR has also been utilized in psychotherapy for the past two decades [19]. Since then, the use of VR as a treatment modality has grown. Of note, there are recent studies examining the effectiveness of AR/VR-based therapeutic modalities in the management of patients with neurodevelopmental spectrum conditions (such as autism spectrum disorders, attention deficit hyperactivity disorders) [20][21][22][23], anxiety disorders (such as phobias) [24][25][26][27], obsessive compulsive disorder [28][29][30], post-traumatic stress disorder [31], and cognitive impairments in the elderly [32][33]. In comparison, there are fewer studies specifically elucidating the effectiveness of AR/VR based interventions as a psychoeducational tool such as in improving understanding of mental illnesses, engendering more positive attitudes regarding people with mental illnesses [34][35] and reduction of stigma [36][37].

2. Description of Studies

The number of participants ranged from 16 to 579 in each group and included undergraduates (11 of 16 studies, 68.8%), high school students, patients, caregivers and the public, including online community. Four studies were randomized

controlled trials [36][38][39][40]. Ten studies adopted quasi-experimental design. One study was a descriptive study [41] and another a prospective cohort study [42]. Six studies were conducted in United States, three studies in Australia, two studies in Spain and one study each in Brazil, The Netherlands, Germany, Ireland and Hong Kong, respectively. Only one study examined AR-based intervention [43] while the remaining 15 studies examined the use of VR, with two utilizing a Virtual Dementia Tour intervention [44][45]. AR/VR interventions ranged from virtual interactions with characters (4 of 16 studies, 25%) [36][41][46][47], environments (4 of 16 studies, 25%) [34][38][48][49] and assuming a specific character within the study (2 of 16 studies, 13%) [40][50]. Some interventions (4 of 16 studies, 25%) also allowed the participants to experience perceptual or sensory disturbances such as auditory hallucinations [35][43][44][45]. The other interventions (2 of 16 studies, 13%) allowed participants to view scenarios of characters suffering from mental illnesses [39][42]. Please see Appendix A for Cochrane's risk of bias rating for each study.

3. Knowledge about Mental Illnesses

Nine studies examined the effects of VR interventions on knowledge and awareness of mental illness with the majority (six of nine studies) showing increased knowledge about these conditions [34][41][42][44][45][48]. In terms of nature of mental conditions, three studies examined knowledge about a range of mental illnesses [36][42][46]. Five studies examined knowledge about specific disorders, namely, psychotic conditions [34][49], dementia [44][45] and one study evaluated knowledge about both depression and schizophrenia [41]. Another study examined the effects of VR intervention on medication adherence amongst patients with schizophrenia [48].

In terms of nature of intervention, the study by Formosa et al. (2018) allowed participants to interact within a virtual reality intervention that simulated danger, and found significant improvement in knowledge about the psychotic disorder. Stigma-Stop is a video game that allows players to interact virtually with characters with mental illnesses. After utilizing Stigma-Stop, more than 85% of the high school students in Spain could identify panic disorder, depression and schizophrenia, although only slightly more than half could identify bipolar disorder [36]. This was largely congruent with the findings amongst psychology undergraduates in Spain [46]. Second Life (SL) simulation, involving players in a virtual reality environment, as a teaching modality, was deemed moderately effective as a psycho-educational modality [41]. In an earlier study, participants indicated greater understanding of schizophrenia, auditory and visual hallucinations after using Second Life intervention [49]. Among nursing undergraduates in the United States, the intervention group assigned with the VR case study was less likely to rate 'do not know' when asked about the effectiveness of hospital admission and electroconvulsive therapy indicating better knowledge [42]. One study found that reminder notes and clock in the virtual environment aided in better understanding of medication adherence [48]. Two studies used Virtual Dementia Tours whereby participants experienced changes in sensory perception while engaging in everyday tasks [44][45] with conflicting findings of improved knowledge about dementia in one study [45], but not the other [44].

4. Attitudes toward People with Mental Illnesses

Eight studies examined the effects of AR/VR based intervention on attitudes towards people with mental illness and more than half (five of eight studies) showed improvement of attitudes following the intervention [34][35][38][43][44]. In terms of the nature of mental illness, three studies examined attitudes towards a range of mental illnesses [36][42][46], three related to psychotic disorders [34][38][43] and two studies examined attitudes towards people with dementia [35][44].

For qualitative findings that were conducted in two studies in Spain, at least half of the participants felt that they were able to help the character with schizophrenia or bipolar and more than 80% of them felt being able to help the character with depression or panic disorder after following Stigma-Stop intervention [36][46]. In a separate study by Liu et al. (2020), participants from both VR and control groups acknowledged the need for external help beyond self, thus suggesting no difference in attitudes between the two groups.

5. Empathy

Seven studies examined empathy towards people either with dementia [44][45][47][50] or psychotic conditions [34][38][43], and found improvements of empathy across all studies following the intervention. Specific empathy scales included the Clinical Empathy Scale [34], Comprehensive State Empathy Scale [47], and 12 item Empathy Scale [38]. In the study by Wijma et al. (2018), improvement in empathy was observed in the "Perspective-taking" subscale of Interpersonal Reactivity Index but not in the "Person centeredness" subscale.

6. Stigma Regarding People with Mental Illnesses

Seven studies examined stigma towards people with dementia [47], psychotic illnesses [38][39][43], mixed anxiety and depression [40] or a range of mental illnesses [36][46]. Most studies (five out of seven studies) found reduction of stigma for both within [36][47] and between group comparisons [36][38][40] while two studies did not [39][43].

Amongst medical students in Brazil, stigma levels were increased post-intervention [43], and students considered the VR characters with schizophrenia more dangerous than pre-intervention. Similarly, in Germany, VR intervention increased stigma when compared with both video and no intervention control groups [39].

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