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## Virtual Reality in Psychiatric Rehabilitation

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### ABSTRACT

**Background:** According to scientific literature, virtual reality is important to support the standard clinical context, in fact, digital gaming in clinical setting has been used for a variety of cognitive treatments; virtual reality can enhance cognitive, social and behavioral skills. In the light of this, the aim of this narrative review is to explore the effectiveness of virtual reality in clinical settings.

**Method:** We have conducted this study related to virtual reality in psychiatric rehabilitation, we searched on Pudmed database, and we used two key terms (“*Virtual rehabilitation*” AND “*game*”). **Results:** These findings highlighted that digital game and virtual reality, used in a variety conditions, such as, cognitive impairment, dementia, autism spectrum disorder, attention deficit hyperactivity disorder, intellectual abilities, schizophrenia, depression, anxiety, post-traumatic stress disorder, eating disorder.

**Conclusion:** There are advantages to using virtual reality interventions, and previous authors showed that virtual reality, can benefit on the health and well-being of patients.

**Keywords:** *Virtual reality, game interventions, rehabilitation.*

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## Introduction

Virtual reality is a potential instrument to improve cognitive and behavior abilities in rehabilitation treatments (Broeren *et al.*, 2008). Virtual reality and digital game, conduct patients in an immersive reality, replicating reality and allows for the stimulation of the senses. Furthermore, augmented reality enables patients to perceive a more realistic training environment, as if it were real (Välimäki *et al.*, 2021). The World Health Organization (WHO) suggested the efficacy of virtual reality (World Health Organization, 2011). Recently, a variety types of virtual games, has been created for treatments of various illnesses, such as schizophrenia, and scientific literature showed positive outcomes with these patients, for example, Choi and colleagues (2020), used digital game to train decision-making skills in a group of children with intellectual disabilities. Previous studies, explored the use of virtual reality in daily routines for patients with intellectual disability, through virtual games, to teach basic skills such making the bed (Tan *et al.*, 2022). Wangle and colleagues (2021), developed virtual games to improve cognitive functions in patients with autism spectrum disorder. An example of this type of game, described by Wangle *et al.*, (2021) in a recent study, asks subjects, in a virtual game, to touch a moving bubble, containing a colored fruit, only when the bubble find the basket of the same color as the fruit above (color matching). The findings of this study, showed an improvement in the execution of the task by the patients. According to literature cognitive rehabilitation based on immersive reality is one of the most promising new approaches to improve memory function after a brain injury. Virtual reality (VR) technologies is a potential tools for assessment and treatment in rehabilitation setting, to facilitate cognitive capacity (Broeren *et al.*, 2008). In the light of this, the aim of this study was to explore the importance of game and virtual reality in rehabilitation setting.

## Materials and Methods

### *Research Strategy*

This narrative review was conducted to PubMed database and we used two key terms (“*virtual rehabilitation*” AND “*game*”). We include studies in line with this specific issue. The inclusion criteria have been pre-specified in a protocol.

The search of PubMed database provided a total of 506 citations; no additional studies meeting inclusion criteria were identified by checking the reference list of the selected papers. After adjusting for duplicates, 70 records were screened. Of these 64 studies were excluded according to inclusion and exclusion criteria. After the screening, a total of 6 studies assessing the Gaming in rehabilitation setting, met the inclusion criteria and were included in the narrative review.

### *Identifying the research question*

We have included studies around the topic of gaming and virtual reality in rehabilitation setting.

During the selection of the studies, the PICO question was followed: "What is the effectiveness of virtual reality and digital games in rehabilitation?".

We excluded studies not in line with this topic. Moreover, exclusion criteria were review articles, book, review, editorial comments, and case reports/series.

**Table 1: List of search terms entered into the PubMed search engines for identification the studies for this review.**

Number	Search term
1	Rehabilitation [all fields]
2	Game [all fields]
3	1 AND 2
4	English [language]

## **Results**

According to scientific literature, psychiatric rehabilitation is a process that involves the knowledge of the clinician regarding mental health condition and the consequences it has on the quality life of patient. In particular, Broeren and colleagues (2008) evaluated computer games with virtual reality technology and showed that this tool improved motor performance in stroke patients. Choi *et al.*, (2020) studied digital gaming in patients with schizophrenia and showed that digital game improved cognitive functions. Tan *et al.*, (2022) studied virtual reality in patients with intellectual disabilities and highlighted that virtual reality improved social and cognitive skills. Välimäki and colleagues (2018) evaluated the effectiveness of digital gaming in rehabilitative setting, to improve cognitive performance in patients. Välimäki *et al.*, (2021) tested, through video games, the cognitive and social functioning in schizophrenic patients, and showed that this treatment improved cognitive and social performance. Wagle *al.*, (2021) developed and tested the effectiveness of short-term intervention with mobile-based games to improve visuo-spatial memory in children with autism spectrum disorder. According to these studies, patients can benefit through rehabilitation interventions with virtual reality.

**Table 2. Characteristics of the studies included in the review**

REFERENCES	AIMS	SAMPLE	TYPE OF MEASUREMENT	FINDINGS
Broeren <i>et al.</i> , (2008)	The aim of this study was to evaluate if computer games with VR technology would improve motor performance in stroke patients in a nonhospital environment.	16 hemiparetic, post-stroke subjects	-Semi-Structured Interview about the subject's perception of the VR system -BBT and ABILHAND -Trail Making Test, part B, (TMT-B) -test developed in a previous study about kinematics	After learning to use the VR system the sample showed improvements in manual dexterity.
Choi <i>et al.</i> , (2020)	This study described habits and attitudes of Internet and videogaming use among people with schizophrenia in an Asian city.	110 participants with schizophrenia	-Internet use questionnaire -Habits of video gaming questionnaire -Gaming Attitudes, Motivations, and Experiences Scales, (GAMES)	High rate of Internet use among the sample. Only a small part of them used the Internet to search information about health.
Tan <i>et al.</i> , (2022)	This pilot study aimed to explore the acceptability of the REAP program and measure changes in cognitive and professional skills on adults with intellectual and developmental disabilities.	15 adult participants with intellectual and developmental disabilities and 11 trainers.	-Feasibility Evaluation Checklist (FEC) -Neurobehavioral cognitive status exam (Cognistat) -User feedback semi-structured interview	Participants generally had positive experiences with a vocational training programme using a gamified augmented reality platform. There was a significant improvement in professional skills and cognitive skills aspects.

<p>Välämäki <i>et al.</i>, (2021)</p>	<p>This study will test the effectiveness of gaming embedded (computer game and entertainment video games) on the cognitive and social functioning of patients with schizophrenia.</p>	<p>Patient recruitment is ongoing. They will be 254 participants.</p>	<ul style="list-style-type: none"> <li>-Wechsler Memory Scale, the 3rd Edition, (WMS III) Chinese version</li> <li>-Trail Making Test, (TMT-A)</li> <li>-Sustained Attention to Response Task, (SART)</li> <li>-Wisconsin Card Sorting Test, (WCST)</li> <li>-Brief Social Phobia Scale, (BSPS) Chinese version</li> <li>-Temporal Experience of Pleasure Scale, (TEPS) Chinese version</li> <li>-General SelfEfficacy Scale, (GSE) Chinese version</li> <li>-Clinical Assessment Interview for Negative Symptoms, (CAINS) Chinese version</li> <li>-Calgary Depression Scale for Schizophrenia, (CDS-C)</li> <li>-Simpson-Angus Rating Scale, (SAS)</li> <li>-Barnes Akathisia Rating Scale, (BARS)</li> <li>-Abnormal Involuntary Movement Scale, (AIMS)</li> <li>-Mini-MMSE</li> </ul>	<p>Positive effects on symptom management and a consequent improvement in cognitive and social performance.</p>
<p>Välämäki <i>et al.</i>, (2018)</p>	<p>This study aimed to evaluate the effectiveness of the use of rehabilitative digital gaming to improve cognitive performance and well-being levels of patients with TBI</p>	<p>90 Finnish-speaking adults with Traumatic brain injury.</p>	<ul style="list-style-type: none"> <li>-The Trail Making Test (TMT)</li> <li>-Wechsler Adult Intelligence Scale-Fourth Edition, (WAIS-IV)</li> <li>-Paced Auditory Serial Addition Test, (PASAT)</li> <li>-Patient Health Questionnaire-9, (PHQ-9)</li> <li>-General Self-efficacy Scale, (GSE)</li> <li>-Behavior Rating Inventory of Executive Function-Adult Version, (BRIEF-A)</li> </ul>	<p>There were no differences between the control group and the two intervention groups both for primary outcomes (processing speed and visual tasks) and for any of the secondary outcomes.</p> <p>There is an increase in depression levels in subjects undergoing training.</p>

<p>Wagle <i>al.</i>, (2021)</p>	<p>The aim of this pilot study was to develop and test the effectiveness of short-term intervention with mobile-based games to improve visuospatial memory and autistic symptoms in ASD children.</p>	<p>14 children with Autism spectrum Disorder (ASD)</p>	<p>-Corsi-block tapping task -Autism Treatment Evaluation Checklist, (ATEC)</p>	<p>There has been no significant improvement in working memory or autistic symptoms of participants after short-term training.</p>
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**Discussion**

Recently, has increased the interest among virtual reality and digital game (Chang *et al.*, 2020). Globalization has contributed to use technology on mental health setting, and digital gaming is one of the most applications (Desseilles *et al.*, 2016). Digital gaming has enabled for mental health interventions to promote within disadvantaged cultural contexts, with poor access to mental health services. Such as, in middle and low income (MIL) countries due to deficiencies in infrastructure and attitudes towards mental health services, there is an unequal distribution of access to psychiatric treatment (Banerjee *et al.*, 2021) The lack of access of population at risk within the health services has consequences for an underestimation of psychiatric disorders (Patel *et al.*, 2010). To limit this gap in access to psychiatric care, the practice of mental health has gradually moved closer to digital mental health interventions (DMHI). Applied games are a recently successful innovation in clinical setting (Mueser *et al.*, 2013). The applications of digital mental health interventions are not limited exclusively to virtual consultations, also, to provision of psychotherapy treatment, cognitive rehabilitation, attention-enhancing exercises and biofeedback, through digital platforms (Shah *et al.*, 2018). Immersive reality, has been applied to various mental disorders, such as, schizophrenia, depression, deficit of attention and hyperactivity disorder (ADHD), obsessive-compulsive disorder (OCD), post-traumatic stress disorder (PTSD), dementia, and cognitive impairments (Fleming *et al.*, 2017). However, virtual reality has some drawbacks, such as: the security breach due to connection in different parts of the world; a possible competition between mental health professionals (because research is not able to keep pace with fast-changing technology). The lack of a therapeutic alliance (which is considered a favorable prognostic factor) and the lack of access to conventional therapeutic interventions (Aboujaoude *et al.*, 2015). Psychiatric and psychotherapeutic counselling was successfully tested during Covid-19 outbreak, contributing to improved access to telematic consultation (Dinakaran *et al.*, 2020). Recently, the

application of virtual reality (VR) to clinical setting has been a tool for evaluation and rehabilitation treatment (Kim., *et al.*, 2005). Virtual reality (VR) has found application for the treatment of patients with motor disorders, as it is able to create an environment to the therapeutic path (Viau *et al.*, 2004). Virtual rehabilitation, through the use of games in virtual reality has obtained positive results in treatment of patients with stroke (Broeren *et al.*, 2008). Previous authors, suggested that video gaming is a new intervention for social skills training in people with mental illness (Fernández-Aranda *et al.*, 2012). In patients with schizophrenia, training used video games showed positive effects on symptom management and positive consequences in cognitive and social performance (Välimäki *et al.*, 2021). In addition, the use of video game for these patients, has a valuable tool, to develop social skills and the improvement of stress management (Choi *et al.*, 2020). Scientific panorama highlighted improvements in cognitive performance (Tan *et al.*, 2022).

## **Conclusion**

Virtual rehabilitation has been evaluated in patients with cranial trauma (TBI), demonstrating improved cognitive performance (processing speed and visuo-motor tasks, attention and executive functions and working memory) (Välimäki *et al.*, 2018). A variety of authors tested the use of games to improve executive functions, especially working memory in children with autism spectrum disorder, but have found no benefits (Wagle *et al.*, 2021). Studies on patients diagnosed with ADHD showed a positive effect of the game for the improvement of time management skills, social responsibility and working memory (Bul *et al.*, 2015). Studies on subjects with Down syndrome showed improved motor performance and coordination through the use of video games (Berg *et al.*, 2012). This narrative review provided a starting point for future research to implement tele-rehabilitation and video games for treatment of psychiatric disorders.

## **Limitations**

Although the subject is interesting and leads to new goals in the field of rehabilitation, studies present in the literature are few and this gap is a limitation of this work. Another important limitation is to be found in the diversity of the sample studied (adults, children, neurodevelopmental disorders, schizophrenia, etc). Therefore, the methodologies are different and it becomes difficult to establish a single and generalizable intervention protocol. Moreover, another important limitation is that only

English-language studies were included, this is a bias.

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