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Where do we stand? An overview of reviews regarding the current status of virtual reality applications in alcohol use disorder

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Abstract. The current overview of reviews aims to evaluate the progress of VR use in AUD, emphasizing its present status in terms of assessment and treatment applications. *Methods.* The literature search was conducted using terms like “virtual reality” and “alcohol”, “substance”, “addiction”, or “addictive” on databases such as Web of Science, Embase, PubMed, and the Cochrane Library. *Results.* Seven narrative and systematic reviews published between 2014 and 2021 were identified as targeting the use of VR in addictive behaviors including AUD. In total, 33 studies targeted the use of the VR technology in AUD, although 18 studies were duplicated in the reviews. Overall, the two main applications of VR in AUD were: 1) *assessment* (mainly using VR-based cue-exposure paradigm targeting craving elicitation during exposure to alcohol-related cues and contexts), and 2) *treatment* [generally VR-cue exposure therapy (VR-CET) to reduce responses (e.g. craving) to alcohol-related cues and contexts]. In all studies, VR was successfully implemented as an assessment or treatment approach (and outweighed control conditions). *Discussion.* The reviews emphasize that VR is an ecologically valid instrument in AUD and is a better alternative to traditional cue-exposure techniques due to its technical features. Limitations and future research directions regarding the use of VR in AUD are discussed.

Keywords. Virtual Reality, Alcohol Use Disorder, Overview, Reviews

1. Introduction

For the past two decades, Virtual Reality (VR) applications have increased exponentially in the field of mental health. Despite its wide acknowledgment in the treatment of *anxiety disorders* (e.g. phobias) or *trauma and stress-related disorders* (e.g. post-traumatic stress disorder, PTSD), there is still much research needed to determine the clinical potential of VR in alcohol use disorder (AUD) [1,2]. The current *overview of reviews* aims to evaluate the progress of VR use in AUD, emphasizing its present status in terms of clinical applications, limitations, and future research directions. This overview intends to examine the highest level of empirical evidence regarding the implementation of VR technology in the assessment and treatment of AUD.

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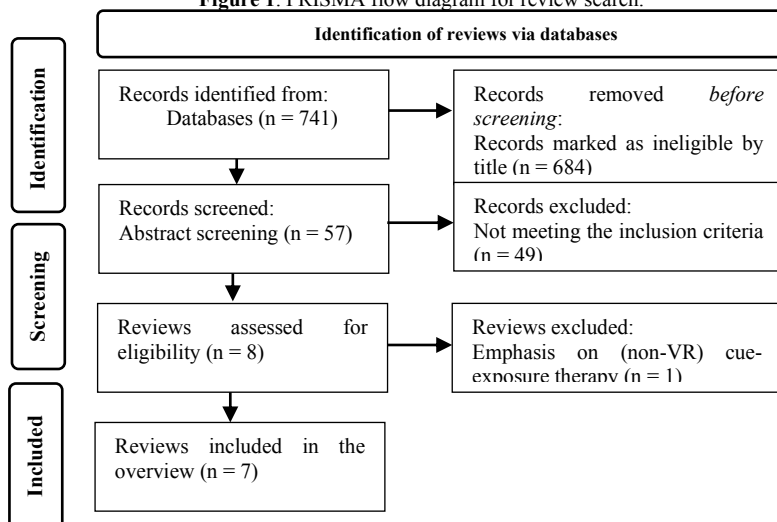
2. Methods

The literature search was conducted using pairing terms like “virtual reality” and “alcohol”, “addiction”, “substance” or “addictive” (addictive behaviors) on databases such as Web of Science, Embase, PubMed, and the Cochrane Library. Inclusion criteria consisted of publications targeting the clinical applications of VR in AUD (e.g. assessment, treatment), systematic and narrative reviews, meta-analyses, and overall syntheses reported in English.. Regardless of the target of the manuscripts (e.g. applications of VR in all substance use disorders, SUD), only studies emphasizing the use of VR in AUD were depicted in this overview. Studies from the same reviews focused on the use of VR in other alcohol-related patterns like light drinking, heavy drinking, or binge drinking were not considered in this overview. PRISMA guidelines were followed for data search and reporting (Figure 1) [3].

3. Results

Seven reviews (two narrative and five systematic reviews) published between 2014 and 2021 included studies targeting the applications of VR in AUD alongside other SUDs (e.g. nicotine) and behavioral addictions (e.g. gambling) [1-2,4-8]. To date, no meta-analyses have been published on this topic due to limited existing research. In addition, only one narrative review was solely focused on this topic (VR use in the treatment of AUD), although the review included studies with non-clinical and sub-clinical samples (e.g. light and heavy drinking, binge drinking, nicotine-dependent problematic drinking patterns) [4]. Of the total studies included in the seven reviews, 12 studies targeted *VR-based assessment* in AUD (of which seven studies were duplicated), and 21 studies targeted *VR-based treatment* for AUD [mainly virtual reality cue-exposure therapy, (VR-CET), of which 11 studies were duplicated]. In total, there are currently five original studies in the literature regarding the use of VR as an assessment instrument, and 10 original studies using VR as a treatment instrument in AUD. In terms of the main addressed mechanisms, *alcohol craving* was the core component of VR assessment and treatment in all AUD studies reported in the reviews. Other mechanisms like anxiety, social, personality, and behavioral features of AUD, self-efficacy and motivation for change, as well as coping skills were addressed. In the reviews [1-2,4-8], VR applications were mainly based on the principles of *cue-exposure technique*, implying exposure to virtual alcohol-related cues and contexts (e.g. alcoholic beverages, alcohol-related environments like pubs). The participants in the studies were AUD individuals (versus healthy participants) ranging from members of Alcoholics Anonymous (AA), treatment seekers, and non-treatment seekers. Regarding the clinical samples, there was inconsistent data in two systematic reviews referring to one manuscript [9], in which participants were reported as “alcohol dependent” [5] versus non-AUD individuals [2]. Nevertheless, the authors in the original manuscript reported participants as individuals “with no history of alcohol-related disease” [9]. Considering the objectives and the

Figure 1. PRISMA flow diagram for review search.



inclusion criteria in the current overview, the study [9] was not considered in the systematic review by Ghiță and Gutiérrez-Maldonado as the sample consisted of non-AUD participants [2].

The VR technology implied hardware like head-mounted displays (HMDs),-interactive computer programs (based on drinking patterns in countries where the studies were conducted, e.g. South Korea, United States, Spain). In several reviews, the type of VR equipment was highlighted, whereas other reviews did not put emphasis on it (see Table 1).

Regarding the outcomes of the reviews, VR was successful in inducing significant levels of alcohol craving and assessing different AUD features (e.g. self-efficacy, personality or social factors). The data was consistent across different studies conducted in several countries with varied VR equipment. Regarding VR treatment, interventions were based on several *VR-CET sessions* (e.g. eight or 10 sessions), *training through games* and tasks such as *VR-based approach-avoidance programs* for AUD participants. The control conditions reported in the reviews were healthy participants (non-AUD), treatment as usual (TAU), or cognitive-behavioral therapy (CBT). The data indicated that VR-based interventions were superior to control conditions as depicted by self-reported instruments (paper-and-pencil or visual analog scales, VAS, which were embedded during the VR exposure procedures to explore momentary levels of alcohol craving for instance) and (neuro)physiological instruments (Table 1). However, despite its promising results, there are several limitations emphasized in the reviews: a) studies included small sample sizes (only one study included a large sample size), b) none of the reviews highlighted rigorously conducted randomized controlled trials following the CONSORT guidelines, and c) a lack of follow-up data of the participants (none of the reviews reported longitudinal data).

Table 1. Evidence of narrative and systematic reviews.

Article (by year of publication)	Type of review	Aims (N*/N**)	Primarily addressed mechanisms	Population characteristics	VR equipment	Outcomes
Hone-Blanchet et al. (2014)	SR	Assessment: 3* Treatment: 1*	Alcohol craving	AUD vs. healthy participants; Non-treatment seeking AUD individuals;	Interactive computer programme and HMD	VR assessment – successful elicitation of alcohol craving in alcohol-related VR environments vs. neutral VR environments; VR treatment – VR-CET outweighed CBT in AUD (a significant decrease in craving was obtained)
Durl et al. (2018)	SR	Assessment: 1** Treatment: 1**	Alcohol craving	AUD individuals; AA members;	Interactive computer programme and HMD	<i>Similar outcomes as reported by Hone-Blanchet et al. (2014)</i>
Ghiță and Gutiérrez-Maldonado (2018)	SR	Assessment: 2* + 2** Treatment: 4* + 1**	Alcohol craving; social, personality and behavioral AUD; Self-efficacy and motivation for change; Coping skills	AUD vs. healthy participants; Non-treatment seeking AUD individuals; AA members	Interactive computer program and HMD	Consistent results among different studies regarding the applications of as an assessment and treatment instrument to either elicit or to decrease levels of alcohol craving as part of VR-CET [data were supported by self-reported instruments (e.g. paper-and-pencil instruments), but also other measurements (e.g. EEG and PET-CT)]; ***Inconsistent data with the review by Hone-Blanchet et al. (2014)
Trahan et al. (2019)	SR	Treatment: 1**	Alcohol craving	AUD participants	N/A	VR-CET outweighed CBT; alcohol craving was significantly reduced (as recorded by EEG alpha and self-reports)
Segawa et al.	SR	Assessment:	Alcohol craving	AUD	HMD	<i>Similar outcomes with reviews</i>

(2020)		1** Treatment: 1**		participants; Healthy participants		by Ghiță and Gutiérrez-Maldonado (2018) and Hone-Blanchet et al. (2014)
Lebiecka et al. (2021)	NR	Assessment: 2** Treatment: 2* + 2**	Alcohol craving Anxiety	AUD N/A	N/A	Summary of existing studies as reported in previous systematic reviews (Segawa et al., 2020; Ghiță and Gutiérrez-Maldonado, 2018 and Hone-Blanchet et al., 2014)
Tsamitros et al. (2021)	NR	Assessment: 1** Treatment: 3* + 5**	Alcohol craving	AUD participants	N/A	VR interventions (VR-CET/VR games/VR approach-avoidance training) were superior to control conditions

AA – Alcoholics Anonymous; AUD – alcohol use disorder; EEG – electroencephalogram; HMD – head-mounted display; N/A – not available/mentioned; NR – narrative review; PET-CT – Positron Emission Tomography and Computed Tomography; SR – systematic review; VR-CET – virtual reality cue-exposure therapy; *N – AUD studies included in the reviews excepting studies targeting other substances; N** – duplicated AUD studies (studies reported in previously published reviews); ***The inconsistent data refers to the manuscript by Cho et al. (2008) [9], in which participants were reported as AUD (in Hone-Blanchet et al., 2014) [5] versus non-AUD individuals (in Ghiță and Gutiérrez-Maldonado, 2018) [2].

4. Discussion

Regarding its *assets*, VR technology has been successfully implemented as an assessment and treatment instrument in AUD with an emphasis on alcohol craving, regardless of the AUD population (AA, treatment seekers vs. non-treatment seekers). The reviews underline that VR is an ecologically valid instrument in AUD and is a better alternative to traditional cue-exposure techniques due to its technical features (e.g. sensory inputs, immersion). Future larger-scale randomized controlled trials, including follow-up data of the participants, are fundamental to determine the efficacy and effectiveness of VR applications in AUD [2]. *Cybersickness*, *user experience*, the *sense of presence* during VR exposure, *perceived realism* of the VR cues and environments, and *patient-reported outcomes* are significant key aspects for further research. In addition, the added value of implementing other therapeutic approaches (e.g. coping skills training) alongside VR-CET should also be considered [1]. Another research opportunity is to examine the potential of VR-CET as a continuing care tool in AUD for relapse prevention. As technologies progress rapidly, adding other instruments (e.g. eye-tracking within HMDs or the use of wearables during the exposure protocol) may determine further insights about the AUD mechanisms. Although challenging, exploring the generalization of VR-based intervention effects in daily-life situations is essential in AUD. One common recommendation in all reviews was to accelerate research regarding the use of VR, particularly in the treatment of AUD [1-2,4-8]. Therefore, despite its promising clinical potential, it is still premature to draw solid conclusions about the efficacy and effectiveness of VR use in AUD considering the insufficient research and limitations depicted in seven reviews.

References

- [1] Segawa, T., Baudry, T., Bourla, A., Blanc, J. V., Peretti, C. S., Mouchabac, S., & Ferreri, F. Virtual Reality (VR) in assessment and treatment of addictive disorders: A systematic review. *Frontiers in Neuroscience* **13** (2020), 1–14.
- [2] Ghiță, A., & Gutiérrez-Maldonado, J. Applications of virtual reality in individuals with alcohol misuse: A systematic review. *Addictive Behaviors* **81** (2018), 1-11.
- [3] Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *British Medical Journal* **372** (2021), 71.
- [4] Lebiecka, Z., Skoneczny, T., Tyburski, E., Samochowiec, J., & Kucharska-Mazur, J. Is Virtual Reality Cue Exposure a promising adjunctive treatment for alcohol use disorder? *Journal of Clinical Medicine* **13** (2021), 2972.
- [5] Hone-Blanchet, A., Wensing, T., & Fecteau, S. The use of virtual reality in craving assessment and cue-exposure therapy in substance use disorders. *Frontiers in Human Neuroscience* **8** (2014), 1–15.
- [6] Durl, J., Dietrich, T., Pang, B., Potter, L. E., & Carter, L. Utilising virtual reality in alcohol studies: A systematic review. *Health Education Journal* **77** (2018), 212–225.

- [7] Trahan, M. H., Maynard, B. R., Smith, K. S., Farina, A. S., & Khoo, Y. M. (2019). Virtual reality exposure therapy on alcohol and nicotine: A systematic review. *Research on Social Work Practice* **29** (2019), 876-891.
- [8] Tsamitros, N., Sebold, M., Gutwinski, S., & Beck, A. Virtual Reality-based treatment approaches in the field of substance use disorders. *Current Addiction Reports*, (2021), 1-9.
- [9] Cho, S., Ku, J., Park, J., Han, K., Lee, H., Choi, Y. K., ... & Shen, D. F. Development and verification of an alcohol craving-induction tool using virtual reality: craving characteristics in social pressure situation. *CyberPsychology & Behavior* **11** (2008), 302-309