

A Systematic Review on The Efficacy of VRET For Agoraphobia

Baoqing Pan *

Shenzhen International Foundation School, No. 8 Yizhan 4th Road, Shenzhen, 518000, China

* Corresponding Author Email: s.cindy.pan@sifc.net.cn

Abstract. This systematic review paper aims to evaluate the efficacy of Virtual Reality Exposure Therapy (VRET) for Agoraphobia, a severe psychological disorder characterized by avoidance behavior and sometimes panic attacks. The paper presents a qualitative assessment of 15 studies published after 2000, using Scopus databases. The experiments were evaluated for eligibility based on their abstracts and full content, and only English-language published articles were included. The review shows that VRET is a promising therapy for Agoraphobia, with similar efficacy to In Vivo Exposure (IVE), but with certain advantages such as better control over exposure content and higher patient satisfaction. However, implementing VRET may be difficult for some patients due to cybersickness and higher costs. The paper concludes with a diagram of the 15 experiments evaluated and emphasizes the importance of further research on the efficacy of VR therapy for anxiety disorders, including Agoraphobia.

Keywords: VRET, Agoraphobia, Scopus databases, evaluation.

1. Introduction

Agoraphobia (PDA) is a severe psychological disorder characterized by the appearance of avoidance behavior. Patients find themselves unable to remain in an area that they are afraid of; some experience panic attacks when they face a particular situation or environment, causing immense suffering and disturbance to their daily lives [1]. To mitigate the symptoms, treatment, including CBT (cognitive-behavior therapy) or medication such as paroxetine and venlafaxine, is recommended to patients [2,3]. For typical situations, CBT was conducted through psychoeducation and possibly (IVE)in vivo exposure, which requires patients to face their fears directly. VR (virtual reality) has been well-developed as technologies have progressed in the past few years. VR is a computer-generated simulation that mocks the surroundings through an HMD or a CAVE system. Sound, interactions, visual tracking, and high-resolution video output nowadays elicit the feeling of presence and immersion among experiencers. With an increasing amount of improvement to contemporary VR technologies, the possibility of VR being conducted as a formal medical treatment for psychiatric disorders and agoraphobia, as well as pain management and neurorehabilitation, is facilitated [4].

A new promising therapy, namely VRET (virtual reality exposure therapy), which could be the ideal solution to replace the traditional treatment for agoraphobia, has been developed. Several experiments tested the effectiveness of VRET and ended with a positive result, indicating that the efficacy of VRET is generally similar to IVE. Researchers claim that VRET has some advantages over IVE. In several cases, the patient did show a slightly higher adherence to VRET than IVE since VR can be used as a transitional tool before real exposure. Although VRET also elicits the anxiety of the participants as IVE did, participants essentially have great satisfaction with the overall treatment when they follow the entire schedule. Moreover, environments constructed through inexpensive software allow better control of the exposure content. The therapist can stop the program if participants suffer from either cybersickness or panic attacks. Besides, personalized scenes with controllable crowdedness and environment can be addressed to different patients, allowing them to improve by facing the exact conditions they're most afraid of [5].

Nevertheless, implementing VR in PDA treatment is worthless for some researchers. On the one hand, even though cybersickness has not appeared in every patient, this difficulty can't be overcome with contemporary efforts, which means VRET cannot be the ideal treatment for some patients. In

addition, the economic value of VRET or purchasing a VR device for participants or therapists is a concern. VRET yields a generally equal, sometimes greater or lesser efficacy of IVE regardless of its higher price. Recently, several papers published within two years are related to systematic reviews on the efficacy of VR therapy on anxiety disorder [6,7]. Even though these reviews included a discussion of agoraphobia, an overview that specifically evaluates the efficacy of VR therapy or VRET for agoraphobia is still absent [8,9].

This systematic review presents 15 experiments related to VRET with a diagram and evaluates the efficacy of VRET.

2. Method

This paper used Scopus databases to look for first-hand experiments (systematic reviews, scoping reviews, protocols, evaluation essays, etc. are removed) published in English after 2000. Source types such as unpublished literature, conference reviews, and other informal texts are also excluded. No articles are excluded from the title because the possibility of using an agoraphobia-related assessment for the evaluation of the overall decrease of anxiety for experiments that do not specify agoraphobia is also considered. Articles with no or uncertain aim given abstract are not excluded before checking the eligibility. Moreover, 4 copies of the same experiment are found to be eliminated. One experiment might be invalid because the assessment for agoraphobia is only tested on ACQ, and the data for this single PDA-related questionnaire is not shown. However, the researchers in the article did include ACQ in their research assessment but didn't explain the reason for their missing data. This particular experiment is included because the small number of similar studies and other assessments are all shown to represent an improvement in anxiety. Still, this exception is highlighted in the diagram, and its bias is explained in the description. Biased evaluations are not involved in this paper since this revision is written solely by one author, and the result can differ from the evaluation if reviewed by another person.

It is important to note that one of the findings after screening is from an inaccessible source, such as a published textbook, that requires a certain amount of payment to view [1]. Due to the limited access to this source, it is eliminated from this paper. 1 follow-up report, 1 case study, and 3 unfinished papers with relative topics are excluded for unreliable or zero data (Table 1).

The following content is inserted into the browser before being screened:

TITLE-ABS-KEY (agoraphob* OR PDA AND vr OR virtual AND reality AND therapy OR treatment OR vret) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "re") OR LIMIT-TO (DOCTYPE , "ch") OR LIMIT-TO (DOCTYPE, "bk") OR LIMIT-TO (DOCTYPE , "no")) AND (LIMIT-TO (LANGUAGE , "English"))(Fig.1).

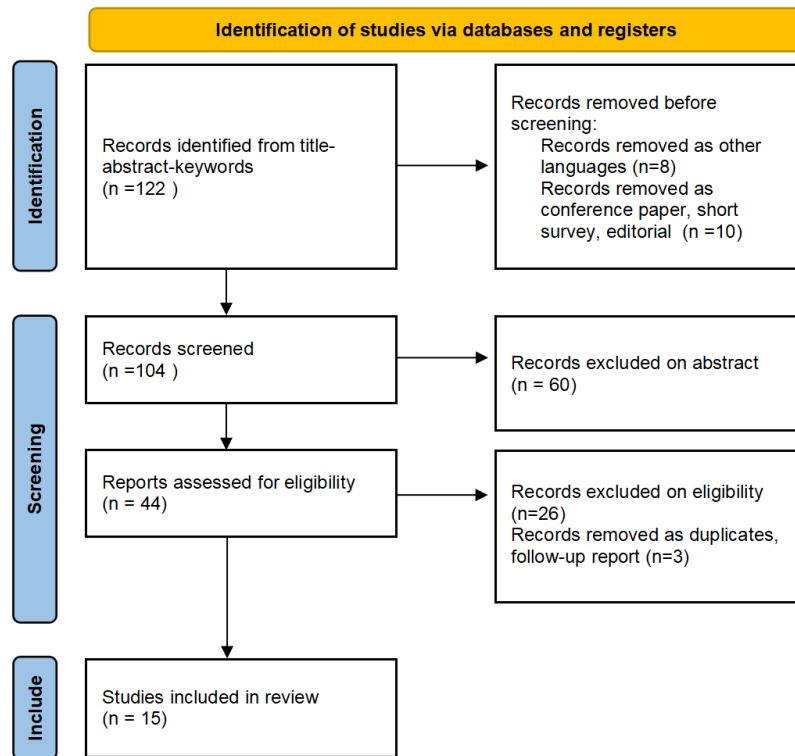


Figure 1. PRISMA flow diagram for selection (Photo/Picture credit: Original)

Table 1. Description of selected studies

Study	Description	Sample	VR environment	Device	Method	Assessment	Result
Vincelli F.(2003)	ECT(VRET+CBT) versus CBT	12 females were randomly assigned to ECT/CBT/WL	VEPD(4 virtual environments develop for panic disorder)	Glasstron PLM-A35 HMD InterTrax 30 Pentium IV A joystick	ECT-8 sessions with a distinct task CBT-12 sessions protocol	BDI-II;STAI;ACQ;FQ;SUDs;	VRET>CBT except for general anxiety
Choi Y.-H.(2005)	ExCT(VRET+CBT) versus PCP(panic control program)	ExCT(n=20) PCP(n=20)	/	/	ExCT=4 weekly sessions (120min group therapy+30min individual VRET) PCP= 12 weekly sessions (120min)	BDI;STAI;ASI;PBQ;ACQ;BSQ;HES	ExCT=PCP for short-term but inferior in long term
Botella C.(2007)	VRET versus IVE versus WL	IVE(n=12) VRET(n=12) WL(n=13)	6 scenes from Panic-Agoraphobia	Pentium III 60Hz rest frequency 640 × 480 resolution V6 HMD + headphone	2 sessions on psychoeducation 6 sessions VRET/IVE 1 session on relapse prevention (60min)	Fear and Avoidance Scales; PA Record;PDSS;ASI FQ-A;BDI;MS;CGI	VRET=IVE Both groups improved significantly than WL
Peñate W.(2008)	VRET(VRET+CBT) versus CBT for efficacy	VRET(n=21/16/15) CTB(n=16/13)	7 environments designed on OpenGL	Nvidia Quadro FX3000 2 video-projectors Glasses with polarized filters DTS 7.1 audio system A joystick	1 session psycho-education 2 sessions identify and manage phobic situation 8 session VRET/IVE (35-45min each)	CIDI;AQ; ACQ;BSQ; BAI;BDI-II ;SUA;BAT	VRET≥ CBT in post-treatment and follow-up except the general agoraphobia score (could be explained by higher initial score for VRET)

Pérez-Ara M.A.(2010)	Examine the efficacy of VR/IE (VR Interoceptive Exposure) versus IET	VR/IE(n=14) IET(n=15)	Adapted from Botella C. (2007)	/	2 psychoeducation sessions 6 exposure sessions (VRET-50 min) (IET-VR exposure 25min +IE(standard exercise elicit physical sensations)	ADIS-IV-L; Fear and Avoidance Scales; ASI;PDSS	VR/IE=IET Both significantly reduced all clinical variables in the long term
Lorenzo M.G.(2011)	Compare the efficacy of six combined treatment	CBT+paroxetine (n=11) CBT+venlafaxine(n=11/9) CBT-VRET+paroxetine(n=11/9) CBT-VRET+venlafaxine(n=11/10) WL(paroxetine/venlafaxine) (n=11,9)	7 scenes from Peñate (2008)	/	3 sessions on psychoeducation 7 sessions VRET/CBT 20-30mg/day for paroxetine 37.5-75mg/day for venlafaxine	CIDI;AI;BSQ;ACQ; BAI;SUA;BAT	All groups are statistically effective VRET>CBT>paroxetine/venlafaxine
Malbos E.(2011)	VR/IE(VR only/VRO) versus VR/IE+VRC	n=10, randomly assigned to VRC/VRO	9 VEs constructed by GLE	Virtual Realities HMD 42 Pro Polar S810i HR monitor	10 weekly sessions VRO=8VR+2 neutral sessions VRC=8VR+2Cognitive Therapy (90min)	PQ;SUD;DASS 21;ASI;ACQ MIA;BAT;PA/w	VRC=VRO Inexpensively constructed VEs are proven to be effective
Meyerbröcker K. (2011)	Compare the efficacy of CAVE and HMD in VRET	CAVE(n=6) HMD(n=5)	/	HMD Crystal Eyes active stereo glasses 8 Projectors CAVE Dell precision T3500 Dell Optiplex 760 Nvidia FX 1400	4 psychoeducation sessions 6 VRET through CAVE/HMD	PDSS;MI;ACQ	No significant difference between the two Both led to an overall improvement
Malbos E.(2013)	Compare the efficacy of VRET only(VRO) with VRET plus cognitive therapy (VRC)	n=18, randomly assigned to VRC/VRO	9 VEs constructed by GLE	Virtual Realities HMD 42 Pro Polar S810i HR monitor Graphics-orientated notebook	10 weekly sessions VRO=8VR+2 neutral sessions VRC=8VR+2Cognitive Therapy (90min)	PQ;SUD; DASS 21; ASI;ACQ; MIA;SSQ; BAT;PA/w	Outcomes of the two groups are not significantly difference
Meyerbrocker K.(2013)	CBT+VRET versus CBT+vivo	VRET(n=19/10) vivo(n=18/10) WL(n=18/16/15) [Allocation: VRET(n=8/6),vivo(n=7/5)]	7 scenes with manipulated crowdedness	HMD/CAVE	10 sessions with two modules: 4 psychoeducation and 6 exposure (60min)	PDSS;MI; BSQ;ACQ; PAI; the Avoidance Scale of Watson and Marks	VRET=vivo VR/IE=IET Both significantly mitigate agoraphobia
Castro, W. P.(2014)	VRET(VRET+CBT) versus CBT(vivo+CBT) and only drug treatment for efficacy	VRET(n=30/23/14) CBT(n=30/14/9) Drug(n=20/13)	7 scenes from Peñate (2008)	/	1 session psycho-education 2 sessions identify and manage phobic situation 8 session VRET/vivo (30-45min each)	CIDI;AI; ACQ;BSQ; BAI;LSAS; SUA;BAT	>50%↓ of assessments other than ACQ&BSQ for VRET CBT only has a 50% ↓ in BAI score in post-treatment
Pitti C.T.(2015)	The efficacy of paroxetine(PX) versus PX-CBT and PX-CBT-VRET	PX+CBT(n=27/20) PX+CBT+VRET(n=27/19) PX(n=32)	7 scenes	Nvidia Quadro FX3000O 2 video-projectors Glasses with polarized filters DTS 7.1 audio system	PX(22.60 mg/day) in average PX+CBT= 1 psychoeducation al+ 2 training+7 CBT sessions (35-45min) CBT+VRET= 4 sessions VRET(12-15min) in addition to CBT group	CIDI;AGPH;ACQ;BSQ; BAI;BDI-II; SUA;BAT	PX+CBT/CBT+VRET>PX The result of PX+CBT is better than VRET when measured immediately after CBT but in long term and BAT, VRET revealed a slightly greater efficacy
Freeman D. (2022)	Effectiveness of gameChange cognitive VR therapy	VRET(n=174) Without therapy(n=172)	6 interactive scenarios with five levels of difficulties for each	HTC Vive Pro Headset Dell G5 15 5590 laptop	3(minimum)-6 sessions over 6 weeks (30min)	O-AS;O-BAT;AMI.etc	↓agoraphobic avoidance

Lundin J.(2022)	Assess effectiveness of VR-CBT for PDA	n=12	7 reality-captured films	VE capture by Samsung VR 360 Gaming computer HTC Vive HMD	10-12 weekly session (60min)	MIA;PDSS-SR;PHQ9; WHODAS;WH OQOL; CSQ-8	large positive effect sizes for agoraphobia
Jung H.W.(2024)	Personalized VRET (adjust brightness& crowdedness) versus randomized VRET for eliciting greater anxiety	P- VRET(n=15/14) R- VRET(n=15/14)	3 scenes: movie theatre metro elevator	HMD Oculus Quest 2 AMD Ryzen 7 5800X 32GB RAM NVIDIA GeForce RTX 3080 Ti.	1 session VRET(~35min)	VAS;EEG; HR;PDSS; BSQ; STAI-1/2; CES-D;PSQI	PVR>RVR in eliciting anxiety

Sample(n=original sample size/minus dropouts); slash(/) represents the change in the sample size. <, >, = represent the comparative efficacy(less than, greater than, equal to) of the therapy. Tilde(~) represents around or approximately.

3. Qualitative Assessment

The bias of each paper is not rated in the paper. However, apparent concerns and crucial information not included in the diagram are introduced. Assessments are grouped based on the focus of the paper.

3.1. VRET VS CBT

Vincelli F. This is the first study that was conducted to evaluate the efficacy of VRET. ECT (experimental cognitive therapy) in this paper is defined as a new CBT with the use of VR, which is renamed VRET afterward [10]. In this paper, a new protocol is introduced first by the authors with a treatment schedule and VEPD (virtual environments for panic disorder). The second part of this paper is the experiment. The result indicates that both the CBT and VRET groups have a significant difference in the pre- and post-treatment, but there's no difference between the two. However, the generalizability of the experiment must be a concern because the experiment is gynocentric (with only female participants). The measurement time of the results was only before and after the treatment, which did not provide any evidence of long-term efficacy.

Choi Y.-H. compares the efficacy of ExCT (4 sessions VRET) with CBT (12 sessions) [3]. The concern with the experiment is evident as the VR environment, software, and hardware used are not provided. The validity is also problematic because the outcome measurements used for pre- and post-treatment are not applied to the 6-month follow-up. The researchers assert that CBT brought better efficacy in the long term, but the 6-month follow-up is only assessed from the change in the participants' medication and HES. Other confounding factors can cause the discontinuity of medication, and participants might decrease their doses because of other reasons besides agoraphobia. This study contains an experimental bias first in the total number of treatment periods. The ExCT group receives less treatment than CBT. Even though researchers claimed that the aim is to compare brief ExCT and CBT, the treatments are incomparable, and the result is definite because the result of past relevant research by Vincelli claims that VRET is greater than CBT but not substantially. Therefore, the researchers have a bias in the experiment design. Second, using a different assessment for the follow-up shouldn't make the researchers contend that CBT is better in the long term.

Botella C. offers the long-term efficacy of VRET by elongating the follow-up assessment to 12 months [1]. Researchers are careful with the experiment as they included a self-rated expectancy and satisfaction assessment and regard the side effects of VRET. However, the study did not mention the dropout rate of the participants. It, therefore, shows no clue that the VRET group has a greater adherence than IVE, even though the satisfaction for both groups was high.

For the first thing, studies with relevant topics often set the assessment into 3 stages: pre-treatment, post-treatment, and 6-month follow-up [11]. In this research, the last stage was shortened to a 3-month follow-up. The result could be different if an extra three months are given, and we can possibly see a correlation between developing VR and greater effectiveness in VRET. In Choi Y.-H. and Pitti

C.T. [3,12], the 6-month follow-up assessment shows a contradictory result, which could be explained by the fact that VR development was still not as advanced as nowadays in the early period. Moving 3 to 6 months in follow-up can demonstrate a trend since the three studies shared strong similarities. Nevertheless, this study presents largely unbiased data and offers feasible explanations for the higher general agoraphobia score in the VRET group and the slight increase in SUA for both groups.

Lorenzo M.G. assesses the separated efficacy of medication and CBT and VRET [6]. The researchers used a t-test that showed no significant difference to confirm that paroxetine and venlafaxine can be merged into a WL group. However, in the BAI assessment and self-perceived anxiety in the 6-month follow-up, the CBT+venlafaxine group is the only one along with WL that doesn't illustrate the efficacy of the treatment and has no improvement. According to previous measurements, the result of CBT+paroxetine and CBT+venlafaxine should show no significant difference if participants perform the same CBT. While this study hasn't delved into this problem statistically, the reason for this unexpected could be individual differences in responses to CBT. Another thing is that the CBT+VRET+venlafaxine group is the only group that received a score below the BAT test. This can provide further evidence for explaining distinctive individual differences in a limited sample size. Even if some measures are unintended, the efficacy of VRET+CBT is unmistakable.

Meyerbroeker K examines the efficacy of VRET plus CBT compared to IVE plus CBT [13]. The gender and the mean age of the participants are not mentioned. In addition, the effect of both treatments in the long term is not mentioned since the three assessments take place in pre-, intermediate, and post-treatment. The first concern with this study is that the dropout rate is high despite a relatively equal percentage of dropouts in the VRET, IVE, and the WL group. Participants dropped out for various reasons in all groups. Thus, it ruled out the possibility that the experiment didn't follow its protocol or contacted anything mistakenly. However, the dropout rate diminishes nearly half of its sample size and lowers the generalizability of the study. Despite there being no follow-up in this experiment, the assessment in the intermediate stage shows a consistent improvement of the participants from at least between the intermediate to post-treatment. This way of assessment also tries to separate the effect of CBT from IVE and VRET. The author then began to question the value of VRET since VRET has relatively the same efficacy as IVE but costs more price. This inference is reasonable because participants haven't shown additional adherence to VRET but have more affection for the interaction in vivo exposure.

Castro, W. P., The first concern with this study is that for an 80 initial sample size, the age range of the participants is between 24-60 [2]. This unequal distribution of age makes the study ungeneralizable for younger patients. However, the most significant issue is the dropout rate of the CBT group, being at an extremely high rate at 53.33% in between treatments. Compared to the rate for the other two groups, 23.33% and 35.3%, a 20% above difference, the experiment data for CBT is invalid and inconsistent with many previous experiments that share similar rates among groups. The team considered participants in the CBT group might have had negative experiences with past therapy, which led to this disparity. Assuming this is an accurate explanation, there might be a problem with the random distribution with a small sample size of the three groups. On the contrary, a mistaken or improper protocol might be followed that contributed to this error. Another mistake this paper make is that a missing decimal point between the dropout rate for drug group, the 35.3% became 353% in the flow chart.

Pitti C.T. attempts to isolate the effect of paroxetine, CBT, and VRET [12]. The result of this experiment shows the great efficacy of both CBT and VRET. In the CBT group, 50% of the participants started to decrease or discontinue their medication. In contrast, in the VRET group, the rate is 78.9%, but the outcome measurements show no significant difference. No bias exists in this finding.

3.2. VRIE VS IVE

VRIE and VRET or IET and IVE are different in that VR or non-VR interoceptive exposure also mimics the feeling of a panic attack condition by using techniques like audio to mock the breathing of the participants or through exercise to raise the heart rate [14]. This study compares the effectiveness of VRIE and IET through the same CBT sessions. The experiment results for the two groups are positive and improved even after the 6-month follow-up. However, the experiment failed to mention the dropout rate and hardware they had used. Moreover, the study only used 4 assessments to measure the result, which is less than other relevant papers, and the results are not completed. Missing data and a detailed statistical analysis process are not mentioned; thus, the conclusion of a consistent improvement for both groups can be questioned.

3.3. Extra CBT Session

Malbos E. investigates whether an additional 2 sessions of CBT to 8 sessions of VRBET affect overall efficacy [8]. The 2 extra CBT sessions are mainly related to psychoeducation and cognitive restructuring without any vivo exposure. The first concern is that two sessions of CBT are not enough to create any difference because in protocols such as the one written by Craske and Barlow, referred to in several relevant papers, CBT without vivo exposure should have three weekly sessions. Furthermore, vivo exposure to CBT might have a greater efficacy compared to psychoeducation. Even though the result of this experiment is unbiased, this study still possesses low validity because of its weakly designed procedure or aim and missing information such as the participants' mean age and dropout rate.

Malbos E. 2013, in comparison to Malbos's previous study, more participants are involved in this experiment following a more formal protocol, procedure, and result measurement and analysis [9]. The aim of this study is the same as the previous one, but the VRC group with 2 extra CBTs is promoted to apply their usage, which should increase the efficacy of the two classes according to individual endeavor. Thus, the result of the VRC should be slightly more positive than that of the previous studies. Moreover, a 3-month follow-up assessment is involved in this study. Although most relevant studies used a 6-month follow-up, an addition with a follow-up study did increase the experiment's validity. The result shows no bias but remains the same as the previous study. With this, we can claim that a brief CBT treatment doesn't affect the study, even with the promotion to participate in extra practice within 3 months.

3.4. Modification in Software/Hardware

Meyerbröcker K. 2011 compares the different efficacy of CBT and VRET and the use of HMD and CAVE in VRET [错误!未找到引用源。]. The study provides limited evidence on the efficacy of VRET because it is a quasi-experiment, and only two outcome measure assessments related to agoraphobia were applied. The study has a limited sample size of eleven participants, with no data on the mean age, gender, or dropout rate. Moreover, the CBT group only received a four-session treatment, which is less than the six-session treatment of the VRET group, and no explanation is offered, therefore showing an experimenter bias for this study. The second aim of the experiment (compare HMD and CAVE) is more detailed than the comparison between CBT and VRET. This study has a low validity and generalizability for the first module because of the bias and sample size.

Jung H.W plans to discover two hypotheses: 1) how personalized and randomized VR are different in eliciting anxiety [5], 2) personalized VRET is more effective because it elicits more anxiety. The second question was left unanswered despite the first hypothesis's detailed design description and data. There's no proof of a correlation between personalized VR and its better efficacy, which might indicate a researcher bias among the researchers. To test the second hypothesis, the experiment should be elongated for months to produce a result, and more research is required to test the assumption. Overall, the study should be evaluated as generally unbiased.

3.5. VRET VS No Therapy

This recent study has the largest sample size in this systematic review [4]. Unlike previous studies, male participants are >35% more than females, which is surprising because several studies enrolled up to 70% female participants [4]. With a greater number of participants, a problem with selective bias cannot be eliminated, which led to a nonuniform agoraphobia severity and participants' condition. Because this study also looked to test the efficacy of gameChange in treating various psychosis symptoms, it's impossible to consider every confounding variable, such as the different medications taken or individual disparity between participants. Moreover, changes from recruitment to assessment and the lockdown condition of several participants because of COVID-19 alters the result. Therefore, this study lacks internal validity regardless of the display of all assessments and statistical results. Still, it offers proof of the excellent efficacy of gameChange VRET because of its large sample size.

3.6. VRET

Lundin J. focuses on the efficacy of inexpensively constructed VEs for VRET [7]. 12 participants are involved in the study, and nobody drops out. In the experiment, the effect of VRET sessions and previous psychoeducational sessions are not separated. This can be improved by adding a control group to the result data. Moreover, between each treatment session, participants are encouraged to complete homework on their own time, which adds more randomization to the result because the time or endeavor that each participant spends on the extra hours can be different, and this could be a confounding variable if they participants in a vivo exposure or other treatment.

4. Discussion

In studies that compare the difference in the effectiveness of VRET and CBT, only in Choi Y-H. [3], VRET is equal to or shows less efficacy than CBT. For all other studies that tested for the same aim, 3 shows greater efficacy for VRET, and 3 indicates a similar result. Two studies which included the comparison between. VRIE and IET both found that the efficacy was equal. Two studies that hadn't tested for the direct effects of VRET but the difference in software or hardware showed that VRET is promising. Studies comparing the efficacy of no therapy or WL group observe a significant improvement with VRET participants in most scores. These studies provided a reliable account of the efficacy of VRET. However, the result can be problematic due to some factors.

On one hand, most studies have a small sample size, usually below 50 participants. For those with a larger sample size, such as Freeman D., confounding variables had a substantial effect on the result; as in other studies, the dropout rate is larger than in experiments with a smaller sample size [4]. The main concern for these studies is sampling biases. The majority of the experiments include 70% and above women participants. One experiment is gynocentric. Moreover, participants are mainly white. Including more men and participants from different races and cultures can help improve the generalizability of new relevant experiments.

The second concern is about the BAT assessment, which has a significant difference when it comes to its design and result measurements. As in some studies, researchers mentioned that the individual differences in BAT scores cannot reflect the efficacy of the treatment. Researchers are unsure which scene their participants are most afraid of. Therefore, the result can be different if participants are not exposed to those who are not frightened. In Peñate W.' only 46.20% of CBT participants agreed to stay for ten minutes compared to the 80% of the VRET group to cope for the same period [11]. In Castro, W.P.' four participants from the CBT group refused to receive the BAT assessment [2]. These might imply a better efficacy of VRET; however, personal differences do play a role in the result.

Considering these uncertainties and the similar efficacy of VRET compared to CBT, the problem of VRET can be seen. Similar effectiveness but a higher price suggests a limited market and economic value of applying VR to agoraphobic treatment.

5. Conclusion

This systematic review conducted on the efficacy of VRET for agoraphobia presents 15 experiments and evaluates the effectiveness of VRET in comparison to traditional treatment methods. The review shows that VRET is a promising therapy that can be used as a transitional tool before real exposure and is generally similar to IVE in terms of efficacy. Moreover, participants are primarily satisfied with the overall treatment after following the entire schedule. VRET allows better control for the exposure content, and personalized scenes with controllable crowdedness and environment can be addressed to different patients. However, some researchers argue that the implementation of VR in PDA treatment is worthless because of the difficulty of cybersickness and the economic value of VRET. Further research is essential to investigate the long-term effects of VRET and explore its economic value in combination with other treatment approaches.

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