



The Efficacy of Virtual Reality Exposure Therapy in Treating PTSD among LGBTQ Individuals in Selected Support Groups in Kenya

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Abstract

Virtual reality exposure therapy (VRET) is a digitally assisted psychotherapy that has potential evidence to suggest that VRET may be effective to reduce posttraumatic stress disorder (PTSD) symptoms. Meanwhile, empirical studies have indicated that LGBTQ+ individuals are at higher risk of developing PTSD, with the prevalence estimates of up to 48%, which is much higher than the general population. This current study therefore sought to investigate whether VRET will be efficacious to treat PTSD among LGBTQ+ individuals. This study is an intervention research using quasi-experimental research design to collect data from 60 LGBTQ+ individuals in selected support groups in Kenya. The samples of 60 LGBTQ+ individuals were screened positive for PTSD symptoms, using the post-traumatic stress disorder checklist (PCL-5). The recruited participants were assigned into two research groups namely, experimental (N = 30), and control (N = 30) groups. Participants at experimental group were treated with VRET, whereas, participants at control group did not go through VRET protocols. Participants were assessed at baseline, midline and a 3-month follow-up assessment at end line. The results from independent sample t test showed that VRET was effective in the treatment of PTSD ($p = 0.042$). The partial Eta Square effect size of ($\eta^2 = 0.080$; $p = 0.042$) at endline is an indication that VRET has a medium effect size. The study concluded that VRET is a potentially effective psychotherapeutic approach for the treatment of PTSD and it can be used to help the LGBTQ+ individuals to mitigate the severity of PTSD among the SGM population in Kenya.

Subject Areas

Physiology

Keywords

Efficacy, Virtual Reality Exposure Therapy (VRET), LGBTQ+, Posttraumatic Stress Disorder (PTSD), Sexual and Gender Minority (SGM)

1. Introduction to the Study

Data from epidemiology indicates that individuals who identify as lesbian, gay, bisexual, transgender or queer (LGBTQ) usually experience traumatic occurrence such as violence, victimization, discrimination, stigmatization and sexual violences at higher rates than the general population [1]. In addition, scholars have argued that the individuals who identified with LGBTQ+ have been exposed to one form of sexual assault or the other, in which 54% of gay and 85% of lesbians have reportedly endured some degree of sexual assault [2]. Sequel to the travails of this population, studies have indicated that members of the LGBTQ+ are more vulnerable to experiencing traumatic events, mental and potential physical health conditions due to their sexual identity in their lifetime [2] [3]. Additionally, studies have indicated that LGBTQ individuals are twice more likely to exhibit mental health in their lifetime as opposed to heterosexual counterparts. Specifically, this population is 2.5 times more likely to present with depression, anxiety, substance abuse and PTSD symptoms compared to heterosexual individuals [3]. Conversely, professionals seem to have neglected the needs of traumatized LGBTQ+ members, this led to the meagre attention and ineffective treatment approaches that will mitigate the severity of traumatic stress confronting members of LGBTQ communities [4].

Regarding appropriate psychotherapy and treatment plans for treatment of PTSD among LGBTQ+, Scholars in psychotherapies offer evidence-based recommendations for the treatment of PTSD [5]. Among the recommendations are individual trauma-focused psychotherapies, Cognitive processing therapy (CPT), and Eye Movement Desensitization and Reprocessing (EMDR). These were reported to be the most effective treatment for PTSD. Further, pharmacotherapy is another potential option to treat individuals with PTSD [6] [7]. However, there was empirical evidence showing superiority of psychotherapeutic and combined treatments of psychotherapy and pharmacotherapy to treatment of PTSD with pharmacotherapy alone. An example of such studies was a meta-analysis including randomized clinical trials that shows that long-time benefits of psychotherapeutic and combined treatments were superior to pharmacological treatment of PTSD [7].

One of the major disadvantages of conventional trauma-focused therapies such as mentioned above is the inability of the individuals treated with those approaches to recall the underlying traumatic events and their effects. The development of digital and modern technology to be incorporated into psychotherapies has made it possible to overcome the shortcomings of conventional trau-

ma-focused psychotherapies. Meanwhile, virtual reality exposure therapy (VRET) is a digitally assisted psychotherapy that has potential evidence to suggest that VRET may be effective to reduce posttraumatic stress disorder (PTSD) symptoms [8]. Another empirical study showed that LGBTQ+ individuals are at higher risk of developing PTSD, with the prevalence estimates of up to 48%, which is much higher than the general population [6].

Virtual Reality Exposure Therapy (VRET) has been argued to be an alternative of PTSD therapy, which engages patients to be integrated fully into digital environment [9]. VRET is a digitally assisted psychotherapy that has potential evidence to suggest that VRET may be effective to reduce posttraumatic stress disorder (PTSD) symptoms [8]. This approach is one of the tools that has been used for exposure, and it has achieved tremendously positive results to treat various conditions such as anxiety disorders, phobias treatment, panic disorder and PTSD [10]. Likewise, the results of a systematic review and meta-analysis of efficacy of VRET for PTSD symptoms showed that the approach had a moderate effect size compared to control group, and that effects of VRET were largely significant in reducing the symptoms of PTSD [11].

Findings from a systematic review of 14 articles on intervention studies among military personnel with PTSD using VRET showed clinically significant reduction in PTSD scores [12]. Besides testing the effectiveness of VRET among the military personnel with PTSD, the approach was also used among patients with PTSD due to motor vehicle accidents. Results from a randomized controlled study to examine the efficacy of VRET among patients with PTSD due to motor vehicle accidents found that scores in the VRET group were lower than those in the control group, meaning that VRET was found to be effective to significantly reduce the PTSD symptoms [13]. VRET has also been used in combination with other approaches to reduce the severity of PTSD. For instance, a recent empirical study on efficacy of using VRET with other extra intervention such as medicine, and EMDR to treat patients diagnosed with PTSD revealed that combination of VRET and EMDR influence the outcome of symptoms reduction significantly [14]. In addition, VRET as an approach was not only effective to treat PTSD patients, it has also been found to be effective to treat other mental health conditions such as anxiety, eating disorders and phobia. For example, results from a randomized clinical trial to investigate the effectiveness of VRET in patients with acrophobia, which is known also as fear of flying. An empirical intervention research found that VRET with a inactive placebo is a powerful intervention in the treatment of acrophobia [15]. Further, another recent study found that VRET was an effective treatment approach for emotional disorders, where it was recommended that, VRET could be an effective treatment intervention for depressive disorders, anxiety disorders and PTSD [16].

Conversely, there seem to be limited studies on effectiveness of VRET in the treatment of PTSD among the LGBTQ+ individuals. Therefore, the purpose of

this present study was to investigate the efficacy of VRET in PTSD among LGBTQ+ individuals from a selected support groups in Kenya.

2. Methods

2.1. Participants and Procedure

This study was designed to be intervention research because it was designed to examine the effects of an intervention on an outcome of interest. The study adopted a quasi-experimental design as an empirical interventional study to estimate and establish a cause-and-effect relationship between an independent and dependent variable without random assignment. In other words, research subjects are assigned to groups based on non-random criteria. The study population was sampled, and 60 research subjects were chosen using a nonprobability sampling technique and specifically, a purposive sample technique. This technique is suitable when seeking specific characteristics and qualities. Therefore, this study purposively selected 60 individuals who identified as members of lesbian, gay, bisexual, transgender or queer and other non-cisgender identities and sexualities (LGBTQ+) community. The researcher applied purposive sampling to also select Jinsiangu SGM support group in Nairobi County, Kenya for the experimental group, and LEHA SGM support group in Kiambu County, Kenya was the control group. Hence, experimental group (N = 30) and control group (N = 30). The two support groups had similar demographic, socioeconomic, sexual and gender expression and identity characteristics.

Table 1 shows how the recruited participants, and the sociodemographic characteristics were assigned into the research groups. There were two groups in this study namely the experimental group and control group. Participants' sociodemographic characteristics were proportionately distributed across the two research groups. Chi-square test showed that the difference in the distribution of participants' sociodemographic characteristics was insignificant ($P_s > 0.05$). However, Chi-square test indicates that the difference in the distribution of gender across the research groups is significant ($p = 0.047$). This means that all the sociodemographic characteristics of the participants besides gender were proportional, so the difference in the distribution was inconsequential. This was presented in **Table 1** where the cross-tabulation of sociodemographic characteristics and the research groups were presented.

2.2. Measure

The researcher used both researcher-generated questionnaire and standardized psychological assessment tool namely Posttraumatic Stress Disorder Checklist for DSM-V (PCL-5), to collect data from the participants. The Posttraumatic Stress Disorder Checklist for DSM-V (PCL-5) has been established to have outstanding psychometric properties that comprises internal consistency; α ranging from 0.83 to 0.98, test-retest reliability that ranges from 0.66 to 0.96, convergent validity; associations with other PTSD evaluations ranging from 0.62 to 0.93, discriminant

Table 1. Cross-tabulation of sociodemographic characteristics and research groups.

Variables	Total (%)	Research Groups		Chi-Square Test		
		Experimental (VRET)	Control (TAU)	X ²	df	Sig.
Participant's age						
18 - 23 years	32 (53.3)	18 (30.0)	14 (23.3)			
24 - 29 years	26 (43.3)	12 (20.0)	14 (23.3)	2.654	2	0.265
30 - 35 years	2 (3.3)	0 (0.0)	2 (3.3)			
Participant's gender						
Female	35 (58.3)	15 (25.0)	20 (33.3)			
Male	14 (23.3)	11 (18.3)	3 (5.0)	6.104	2	0.047
Others	11 (18.3)	4 (6.7)	7 (11.7)			
Participant's current employment status						
Employed	24 (40.0)	12 (20.0)	12 (20.0)			
Non-Employed	36 (60.0)	18 (30.0)	18 (30.0)	0.000	1	1.000
Participant's marital status						
Married	1 (1.8)	0 (0.0)	1 (1.8)			
Single	41 (71.9)	22 (38.6)	19 (33.3)	1.803	2	0.406
Others	15 (26.3)	6 (10.5)	9 (15.8)			
Participant's sexual orientation						
Lesbian	23 (38.3)	9 (15.0)	14 (23.3)			
Gay	8 (18.3)	8 (13.3)	3 (5.0)			
Bisexual	6 (10.0)	1 (1.7)	5 (8.3)			
Transgender	5 (8.3)	3 (5.0)	2 (3.3)	6.919	5	0.227
Queer	13 (21.7)	8 (13.3)	5 (8.3)			
Others	2 (3.3)	1 (1.7)	1 (1.7)			

validity associations with measures of connected constructs below 0.87, and diagnostic efficacies oscillating between 0.58 to 0.83 [17]. A cut-off score of 31 and above on the PCL-5 was adopted indicated a provisional diagnosis of PTSD.

The recruited participants (N = 60) were assigned into the research groups: the experimental (N = 30) and the control groups (N = 30) respectively. The participants at experimental group were treated using Virtual Reality Exposure Therapy (VRET) (N = 30, 50%) and participants at control group was not treated with VRET but treatment as usual (TAU) (N = 30, 50%). The recruited participants were assessed before the treatment (pre-test), after the treatment (post-test) and a-3-month follow-up assessment (end line).

2.3. Ethical Issues

The screening and recruitment exercise commenced immediately after the researcher obtained ethical clearance from Daystar University Ethics and Research Board, a letter from the School of Applied Human and Social Sciences (SHSS) and a permit from National Commission for Science, Technology, and Innovation (NACOSTI) to embark on the study and data collection. The LGBTQ individuals who participated in the study were informed of what the research entailed, the risk, freedom to discontinue or withdraw whenever they deemed fit, and that participation was voluntary with no repercussion. Only the participants who consented to participate and who met certain inclusion criteria were included in the study.

3. Results

The objective of this study was to estimate the effectiveness of Virtual Reality Exposure Therapy in treatment of PTSD among the LGBTQ+ individuals.

Table 2 shows the frequency of PTSD among the participants. As indicated, the result from this study shows that 86.7% of the participants scored high in the scale measuring PTSD. This implies that 86.7% of the participants were presented with PTSD symptoms, whereas the rest of the participants (13.3%) presented with no symptoms of PTSD.

Table 3 shows the frequency of PTSD within the experimental group treated with Virtual Reality Exposure Therapy (VRET) was at 93.3% compared to control group at 80.0%. Chi-square test shows that the difference in the distribution of PTSD across research groups was not significant ($p = 0.129$). This suggests that though PTSD was not equally distributed to experimental and control groups, the difference in the distribution was immaterial.

Table 4 indicates the distribution of PTSD and participant's sociodemographic characteristics at intervention phase of the study. Concerning the

Table 2. Frequency of PTSD among the participants.

Variables	Frequency	Percent
0 - 32 = No PTSD symptoms	8	13.3
≥33 = PTSD	52	86.7
Total	60	100.0

Table 3. Distribution of PTSD across the research groups.

Variables	Total (%)	PLC_5 Scores		Chi-Square Test		
		0 - 32 No PTSD	33+ PTSD	X ²	df	Sig.
Research Groups						
Experimental groups	30 (100)	2 (6.7)	25 (93.3)	2.308	1	0.129
Control groups	30 (100)	6 (20.0)	21 (80.0)			

Table 4. Distribution of PTSD and participant's sociodemographic characteristics at intervention phase of the study.

Variables	Total (%)	PTSD		Chi-Square Test		
		0 - 32 No PTSD	33+ PTSD	X ²	df	Sig.
Participant's age						
18 - 23 years	32 (53.3)	4 (6.7)	28 (46.7)	13.735	2	0.001
24 - 29 years	26 (43.3)	2 (3.3)	24 (40.0)			
30 - 35 years	2 (3.3)	2 (3.3)	0 (0.0)			
Participant's gender						
Female	35 (58.3)	3 (5.0)	32 (53.3)	1.705	2	0.426
Male	14 (23.3)	3 (5.0)	11 (18.3)			
Others	11 (18.3)	2 (3.3)	9 (15.0)			
Participant's current employment status						
Employed	24 (40.0)	2 (3.3)	22 (36.7)	.865	1	0.352
Non-employed	36 (60.0)	6 (10.0)	30 (50.0)			
Participant's marital status						
Married	1 (1.8)	0 (0.0)	1 (1.8)	1.212	2	0.545
Single	41 (71.9)	4 (7.0)	37 (64.9)			
Others	15 (26.3)	3 (5.3)	12 (21.1)			
Participant's sexual orientation						
Lesbian	23 (38.3)	2 (3.3)	21 (35.0)	6.974	5	0.223
Gay	8 (18.3)	1 (1.7)	10 (16.7)			
Bisexual	6 (10.0)	0 (0.0)	6 (10.0)			
Transgender	5 (8.3)	2 (3.3)	3 (5.0)			
Queer	13 (21.7)	2 (3.3)	11 (18.3)			
Others	2 (3.3)	1 (1.7)	1 (1.7)			

distribution of PTSD and the participant's sociodemographic characteristics. The analysis shows, for example the participant's age, the frequency of PTSD was higher among participants aged 18 - 23 years at 46.7% as opposed to participants aged 24 - 29 years at 40%, and none of the participant aged 30 - 35 years had symptoms of PTSD. Chi-square test indicated that the difference in the distribution of participant's age and PTSD was significant ($p = 0.001$). This implies that participant's age plays possible controlling variable in this study being the only variable significantly distributed. Chi-square tests shows that distribution of PTSD and every other sociodemographic characteristic was insignificantly distributed ($P_s > 0.05$). This means that the difference in the distribution of PTSD and other sociodemographic characteristics besides participant's age was incon-

sequential.

Principal Component Analysis (PCA) test analyzes dimension reduction of PTSD symptoms from baseline to end line as indicated on **Table 5**. The mean PTSD at baseline in experimental group that was treated with VRET was $54.73 \pm$ (SD: 13.416). This was reduced to $22.44 \pm$ (SD: 19.698) at midline and slightly reduced further to $19.33 \pm$ (SD: 17.065) at end line. The Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity indicated that the factorial reduction from baseline to end line among the participants treated with VRET was significant ($p = 0.017$). Similarly, within the control group that was treated with treatment as usual, the mean PTSD at baseline was $46.67 \pm$ (SD: 14.206). This was slightly reduced to $33.00 \pm$ (SD: 15.692) at midline, and further reduced to $28.04 \pm$ (SD: 12.381) at end line. The Bartlett's test of sphericity indicated that the factorial reduction from baseline to end line among the participants treated with treatment at usual in control group was significant ($p = 0.042$). The implication of the PCA test was that there was a significant reduction in PTSD symptoms among the participants treated with VRET and, significant reduction in control group (**Table 5**). However, the mean difference between the groups will be tested using the independent sample t-test.

Table 6 presents the independent sample t test to assess the effectiveness of VRET in the treatment of PTSD among the LGBTQ+ community. The independent sample t test in statistics is a test to compare two sample means from unequal or unrelated groups. This means that there are different research subjects providing scores for each group. Like in this study, a group of LGBTQ+

Table 5. Principal Component Analysis of PTSD symptoms from baseline to end line.

Research Groups		Baseline	Midline	End line	Bartlett's	Sig.
VRET (Experimental)	Mean	54.73	22.44	19.33		
	Std. deviation	13.416	19.698	17.065	10.182	0.017
	Number	30	27	27		
TAU (Control group)	Mean	46.67	33.00	28.04		
	Std. deviation	14.206	15.692	12.381	8.181	0.042
	Number	30	27	27		

Table 6. Independent Sample T Test to assess effectiveness of VRET to treat PTSD.

Variables	Levene's test Equality of variance		T -Test for Equality of Means							
	F	Sig.	T	Df	Sig.		Mean difference	Std. Error difference	95% CI of difference	
					One sided	Two sided			Lower	upper
PTSD at Baseline	0.103	0.749	2.261	58	0.014	0.028	0.8.067	3.567	0.926	15.208
PTSD at Midline	0.363	0.550	-2.126	50	0.019	0.038	-10.556	4.965	-20.528	-0.583
PTSD at End line	1.415	0.240	-2.091	50	0.021	0.042	-8.70667	4.163	-17.069	-0.344

received treatment using VRET, while the other control group did not. The purpose of this test was to determine if the samples are different from the outcome mean. Consequently, independent sample t Test assesses the effectiveness of VRET to treat PTSD in this study. The test compares the means of two unequal groups to determine whether the two-population means are different. As shown on **Table 6**, the mean difference between VRET and TAU at midline was -10.556 ; (95% CI: $-20.528 - -0.583$). The independent sample t-test indicates that the mean difference at midline was significant at two-sided p-value ($p = 0.038$). Likewise, it is observed that the mean difference between VRET and TAU at end line, which was -8.707 (95% CI: $-17.069 - -0.344$) is noted to be significant at two-sided p-value ($p = 0.042$). The implication of this result was that there was a significant mean difference at midline as well as a 3-month follow-up assessment at end line, which was found to be significant. This is interpreted that the VRET as a therapeutic approach to treat PTSD among the LGBTQ+ individuals was effective.

Independent Pairwise Comparisons using Partial Eta Square to test the effect sizes of the intervention for PTSD from baseline to end line among SGM individuals who participated in the study as presented on **Table 7**. This measures the effects of independent total variance in a dependent variable and its interactions that are partialled out. As shown on **Table 7**, there was a medium effect size ($\eta^2 = 0.083$; $p = 0.038$) at midline, and medium effect size ($\eta^2 = 0.080$; $p = 0.042$) at end line.

4. Discussion

The empirical studies have indicated that LGBTQ+ individuals are at higher risk of developing PTSD, with the prevalence estimates of up to 48%, which is much higher than the general population [6]. This study found that VRET is efficacious in reducing symptoms of PTSD at midline ($p = 0.038$) as well as the follow-up

Table 7. Pairwise comparison-partial eta square to test the effect size.

Dependent Variable	Parameter	β	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared	Observed Power ^b
						Lower Bound	Upper Bound		
PTSD Scores at Baseline	Intercept	47.960	2.786	17.216	<.001	42.364	53.556	0.856	1.000
	[Exp]	6.670	3.866	1.725	0.091	-1.096	14.435	0.056	0.394
	[Control]	0 ^a	.	.	.	.	.	.	.
PTSD scores at midline	Intercept	33.000	3.578	9.224	<.001	25.814	40.186	0.630	1.000
	[Exp]	-10.556	4.965	-2.126	0.038	-20.528	-0.583	0.083	0.550
	[Control]	0 ^a	.	.	.	.	.	.	.
PTSD scores at endline	Intercept	28.040	3.000	9.346	<.001	22.014	34.066	0.636	1.000
	[Exp]	-8.707	4.164	-2.091	0.042	-17.069	-0.344	0.080	0.536
	[Control]	0 ^a	.	.	.	.	.	.	.

assessment at end line ($p = 0.042$). The result from this study aligns with some of the empirical studies on the effectiveness of VRET for PTSD [18] [19] [20]. For example, the approach has been shown to effectively treat PTSD in many studies where VRET successfully reduces symptoms of PTSD by 27% [18] [19]. Another study Lewis *et al.* similarly experience lower percentage of symptoms reduction at 19% using VRET [21]. This approach to intervention has been argued to be an effective psychotherapy to treat PTSD. The distinction from others was the integration of patients into digital environment [9]. There is empirical evidence that VRET has achieved remarkably positive results to treat PTSD [10]. This present study found that at end line, VRET was found to have a moderate effect size using Partial Eta Square. Likewise, Deng *et al.* reported the results of a systematic review and meta-analysis of efficacy of VRET for PTSD symptoms that the approach showed a moderate effect size compared to control group, and that effects of VRET were largely significant in reducing the symptoms of PTSD [11]. Most significantly, results from a systematic review and meta-analysis indicated that there was a long-range effect of VRET on PTSD symptoms at 3-month follow-up and 6-month follow-up [11].

However, another systematic review of clinical trial of VRET in the treatment of most phobia and trauma related conditions reported that the results demonstrated a positive outcome of VRET for most phobias. The findings suggest that for some specific phobias' treatment, VRET does not reach the in vivo exposure level of immersion and presence. The researcher in the same study suggested that further research is needed using VRET with higher sample size, that this might be reason why probably many of the results using VRET have inconclusive results [20]. A similar conclusion was made based on the results of VRET as an efficacious treatment for combat-related PTSD, the researchers suggest that VRET alone does not result in optimal treatment outcome across domains associated with PTSD [22].

5. Conclusion

Since, most individuals who identify as lesbian, gay, bisexual, transgender or queer, or other minoritized identities such as intersex, asexual, pansexual, or nonbinary usually have unique experiences such as traumatic treatment, assault from law enforcement agencies, discrimination, harassment, emotional, physical, sexual, and psychological abuses. These ugly experiences predisposed LGBTQ+ individuals to develop PTSD. There seem to be very limited studies on the best approach to treat sexual identity and orientation-based trauma. The quasi-experimental intervention study like this present study shows that VRET was efficacious to significantly reduce the severity of PTSD among this population. Therefore, there is empirical evidence that VRET is effective to treat PTSD among LGBTQ+ individuals. Clinical psychologists working among this population who might be presenting with PTSD symptoms, VRET is a potential and effective intervention that could be used to help this population.

Authors' Contributions

Profs Abraham Waithima and Alice Munene are the supervisors to PhD dissertation of the principal researcher: Carolyne Mbaneka, at Daystar University, Nairobi-Kenya. All authors approved the final article as submitted.

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Conflicts of Interest

The authors declare no conflicts of interest.

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