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Published in:
Psychiatry Research

DOI:
[10.1016/j.psychres.2023.115477](https://doi.org/10.1016/j.psychres.2023.115477)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2023

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Riches, S., Nicholson, S. L., Fialho, C., Little, J., Ahmed, L., McIntosh, H., Kaleva, I., Sandford, T., Cockburn, R., Odoi, C., Azevedo, L., Vasile, R., Payne-Gill, J., Fisher, H. L., van Driel, C., Veling, W., Valmaggia, L., & Rumball, F. (2023). Integrating a virtual reality relaxation clinic within acute psychiatric services: A pilot study. *Psychiatry Research*, 329, Article 115477. <https://doi.org/10.1016/j.psychres.2023.115477>

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Integrating a virtual reality relaxation clinic within acute psychiatric services: A pilot study

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ARTICLE INFO

Keywords:

VR
Virtual environments
Immersive technology
Extended reality
XR
Digital mental health
Healthtech
Internet interventions
Cyberpsychology
Mental health
Wellbeing
Stress management
Psychosis
Personality disorders
Psychological interventions
Violence and aggression
Restrictive practices
Inpatient
Outpatient
Mixed methods [20]

ABSTRACT

People with acute psychiatric conditions experience heightened stress, which is associated with worsened symptoms and increased violence on psychiatric wards. Traditional stress management techniques can be challenging for patients. Virtual reality (VR) relaxation appears promising to reduce stress; however, research on VR for psychiatric wards is limited. This mixed-methods study investigated feasibility and acceptability of integrating a VR relaxation clinic within acute psychiatric services. The study evaluated a VR relaxation session for inpatients and outpatients with acute psychiatric conditions ($N = 42$) and therapists' ($N = 6$) experience facilitating VR sessions for patients. Self-report assessments of psychological wellbeing were completed by patients pre- and post-VR. Patients and therapists provided qualitative feedback. The number of violent incidents and restrictive practices on the wards in the 12 weeks before VR implementation was compared to the first 12 weeks of VR. Post-VR, there were statistically significant increases in patients' relaxation, happiness, and connectedness to nature, and decreases in stress, anxiety, and sadness. Qualitative findings indicate patients found sessions enjoyable, relaxing, and helpful. Therapists provided positive feedback but highlighted practical challenges. Violent incidents and restrictive practices halved during VR implementation. VR relaxation appears feasible and acceptable in acute services. Larger studies should evaluate potential impact on psychiatric wards.

1. Introduction

Acute psychiatric conditions are characterised by significant and distressing symptoms that require immediate treatment (National

Institute for Health and Care Research, 2022). Acute psychiatric crises are associated with psychosocial stress (Drake and Whitley, 2014), which has been defined as a relationship between an individual and their environment that they appraise as exceeding their resources or

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<https://doi.org/10.1016/j.psychres.2023.115477>

Received 18 May 2023; Received in revised form 6 September 2023; Accepted 9 September 2023

Available online 10 September 2023

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endangering their wellbeing (Lazarus and Folkman, 1984). Stress is associated with increased violent incidents on psychiatric wards, which is detrimental to patients and staff, and costly to health services (Jalil et al., 2017; Kramarz et al., 2023). Although commonly-used stress management interventions, e.g., mindfulness, meditation, distraction techniques, and breathing exercises, can reduce stress and improve mood (Kuyken et al., 2016; Potes et al., 2018; Shah et al., 2014; Strauss et al., 2014), acute psychiatric patients can find them cognitively challenging, due to difficulties with attention, memory, and imagination (Millan et al., 2012).

Novel approaches are needed to support stress management and emotion regulation in acute psychiatric settings. Virtual reality (VR) relaxation appears feasible and effective for stress management in the general population (Riches et al., 2021a) and psychiatric patients (Riches et al., 2023a; Veling et al., 2021). It involves using a head-mounted display (HMD) to access immersive, three-dimensional experiences of calming virtual environments designed to promote relaxation and reduce stress. Virtual natural environments, e.g., beaches, meadows, and oceans, are commonly used (Riches et al., 2023a), while the immersiveness of VR means less burden is placed on cognitive capacities (Bohil et al., 2011; Drigas et al., 2022).

VR-assisted treatments, including cognitive behavioural therapies, are feasible and acceptable for people with severe psychiatric conditions (Gainsford et al., 2020; Jahn et al., 2021; Monaghesh et al., 2022; Riches et al., 2021b; Rus-Calafell et al., 2018; Veling et al., 2014), and VR relaxation appears to have potential for inpatients in psychiatric services, including in acute settings (Mark et al., 2021; Rault et al., 2022; Riches et al., 2023a). However, studies are limited in number, design, and practical real-world applications; understanding of therapist facilitation of VR is hindered by lack of formalised clinical protocols or consultation with therapists who have delivered sessions, and little is known about the potential wider impact of VR on ward environments. The aims of this study were to evaluate, first, feasibility and acceptability of VR relaxation for inpatients and outpatients in acute psychiatric settings, including investigating therapist experience and real-world applications of VR, and second, impact of VR relaxation on violent incidents and restrictive practices on wards. Hypotheses were that VR relaxation would be feasible, acceptable, and have a positive impact on ward environments.

2. Methods

2.1. Procedure

This study was approved by the South London & Maudsley NHS Foundation Trust. A new VR relaxation clinic was created to support acute and crisis psychiatric services in South London. This clinic was attached to an existing inpatient psychology service, which provided psychological input to four acute psychiatric wards and worked closely with a crisis team and community psychiatric services. The VR clinic was promoted to these wards and services, and staff from these services were encouraged to refer patients to the clinic for VR relaxation sessions. Referrals from community staff to the clinic began in June 2021. Referrals from ward staff began in August 2021. Participation was voluntary and open to all patients deemed suitable for the intervention, as judged by clinicians involved in their care.

The VR relaxation intervention was a single session with patients in private rooms. Trained therapists from the VR clinic facilitated all sessions. Patients were told by therapists that VR relaxation sessions aimed to promote relaxation and reduce stress. Therapists began sessions by briefing patients about the intervention and how to use the VR equipment. Patients were seated, encouraged to be in a comfortable position, and wearing a wireless lightweight Oculus Go HMD. In VR, participants viewed calming natural environments in an immersive 360-degree audio-visual experience. Some environments included interactive, gamified elements. The experience began on a beach and participants

had the option to navigate through various virtual environments, including meditations, relaxation exercises, a coral reef, scuba diving with dolphins, a view of the sea from a mountain, a sunny meadow with cows, and a lake view with a Christian cross (Fig. 1). Table 1 lists all virtual environments. The software was programmed by VRelax (V1, <https://vrelax.com/en>). In VR, patients navigated by moving their body or head direction. A handheld controller was used to select on-screen icons, which acted as portals to other environments. Therapists told patients that they had the freedom to choose which environments they visited. Patients were encouraged to explore environments at their own pace, in any order, and for as long as they wished, although sessions were generally limited to an hour because of restrictions on room booking and therapist availability. Therapists provided guidance on VR navigation and regularly checked in with patients to ensure their wellbeing and engagement with the relaxing content.

Sessions were conducted according to a cognitive behavioural framework, as suggested in previous research (Riches et al., 2023a). Therapists used Socratic questions to elicit awareness of what patients found relaxing about the virtual environments and to enable patients to reflect on their relaxation and stress-reduction, e.g., “What did you find relaxing about that?” and “Could you say more about why you found that helpful?”. Post-VR, therapists asked patients how they felt, debriefed them, and invited patients to identify a behavioural activity



Fig. 1. Impression of virtual reality relaxation environments from VRelax app. Source: VRelax BV.

Table 1
Patient participants' demographics and information on virtual reality sessions.

Demographics	Total (N = 42) n (%)	Inpatient (N = 28) n (%)	Outpatient (N = 14) n (%)
Mean age (SD, range)	35.55 (13.52, 18–60)	35.79 (12.55, 18–60)	35.07 (15.78, 18–58)
Gender			
Female	13 (31.0%)	8 (28.6%)	5 (35.7%)
Male	29 (69.0%)	20 (71.4%)	9 (64.3%)
Ethnic Group			
Asian	4 (9.5%)	2 (7.1%)	2 (14.3%)
Black	15 (35.7%)	13 (46.4%)	2 (14.3%)
White	20 (47.6%)	11 (39.3%)	9 (64.3%)
Mixed/Multiple	2 (4.8%)	2 (7.1%)	0 (0%)
Not stated	1 (2.4%)	0 (0%)	1 (7.1%)
ICD-10 Diagnostic Block			
F10-F19 Mental and behavioural disorders due to psychoactive substance use	1 (2.4%)	1 (3.6%)	0 (0%)
F20-F29 Schizophrenia, schizotypal and delusional disorders	19 (45.2%)	15 (53.6%)	3 (21.4%)
F30-F39 Mood (affective disorders)	8 (19.0%)	5 (17.9%)	3 (21.4%)
F60-F69 Disorders of adult personality and behaviour	9 (21.4%)	1 (3.6%)	8 (57.1%)
F99 Unspecified mood disorder	4 (9.5%)	4 (14.3%)	0 (0%)
No ICD-10 diagnosis recorded	1 (2.4%)	1 (3.6%)	0 (0%)
Mean days since last an inpatient (SD, range) *	–	–	365.30 (542.61, 28–1611)
Virtual reality environments visited **			
Start position: Quiet beach	41 (100%)	28 (100%)	13 (100%)
Scuba diving with dolphins	38 (92.7%)	25 (89.3%)	13 (100%)
Coral reef with interactive air bubble game	35 (85.4%)	26 (92.9%)	9 (69.2%)
Quiet beach with rocks	28 (68.3%)	21 (75%)	7 (53.8%)
Beach with interactive relaxation exercises	29 (70.7%)	21 (75%)	8 (61.5%)
Sea view from cliff with interactive music element	28 (68.3%)	18 (64.3%)	10 (76.9%)
Session of Tibetan sound therapy	27 (65.9%)	21 (75%)	6 (46.2%)
Mountain scenery without animals	15 (36.6%)	11 (39.3%)	4 (30.8%)
Mountain scenery with cows	14 (34.1%)	10 (35.7%)	4 (30.8%)
Mean minutes spent using the virtual reality relaxation (SD, range) **	25.63 (11.01, 4–47)	26.43 (10.46, 4–46)	23.92 (12.37, 8–47)
Planned behavioural activities***			
Go to the beach	8	5	3
Go to the park	5	4	1
Practice paired muscle relaxation	5	3	2
Visit rivers or lakes	4	3	1
Explore a new location	4	3	1
Spend time in the garden	4	2	2
Go on holiday	4	4	0
Listen to nature sounds	4	3	1
Watch wildlife videos or programmes	3	1	2
Mindfully engage senses while amongst nature	3	2	1
Go swimming	3	0	3
Practice nature-based visualisation	3	3	0
Go for walks	3	1	2
Listen to music	2	1	1
Use mindfulness apps or videos	2	2	0
Practice meditation	2	1	1

Table 1 (continued)

Demographics	Total (N = 42) n (%)	Inpatient (N = 28) n (%)	Outpatient (N = 14) n (%)
Go to an aquarium	2	1	1
Create music	2	2	0
Receive a massage	1	1	0
Activate senses using scented candles and essential oils	1	0	1
Watch TV or films	1	1	0
Go to the countryside	1	1	0
Practice breathing exercises	1	1	0

Note. *Mean days since admission was calculated using the 10 out of 14 outpatients who had previously been inpatients; **One participant dropped out of the study before the virtual reality (VR) intervention meaning the percentage of participants who visited VR scenes and mean time spent in VR were calculated using the remaining participants in the whole sample (N = 41), inpatient sample (N = 28), and outpatient sample (N = 13). ***41 participants (28 inpatients, 13 outpatients) identified and planned a behavioural activity. Some participants identified and planned more than one behavioural activity, so percentages were not calculated.

that they could carry out within a week that would enable them to apply what they had learned about relaxation in VR to the real world.

To comply with COVID-19 infection control protocols of the time, HMDs were boxed and quarantined for five days between sessions. Post-session, HMDs were cleaned using antibacterial wipes. In sessions, therapists did not touch HMDs and verbally supported patients to independently unbox HMDs, wear them, and access the software.

2.2. Participants

Participants in this study were patients from acute and crisis psychiatric services who received a VR relaxation session and therapists who delivered VR relaxation sessions for these patients. All participants gave verbal consent.

Patient participants were inpatients and outpatients with acute psychiatric conditions. All were on the clinical caseload of the hospital's 'acute and crisis pathway'. At the time of the intervention, inpatient participants were staying on an acute psychiatric ward and receiving ongoing support from mental health professionals in the hospital. Outpatient participants were living at home and receiving regular support from community psychiatric services. Patient participants were excluded if it was judged that they were unable to engage with the intervention, e.g., due to challenging behaviour or reduced cognitive capacity; or if they had a history of epilepsy or seizures, given VR-associated risks (Riches et al., 2019).

Therapist participants were either assistant psychologists from the crisis team, who in their main roles provided some clinical input to the wards, or trainee clinical psychologists, who worked on the wards. All therapists were devoting a small proportion of their clinical time to the VR clinic around other clinical work. Therapists had received training on VR relaxation in May 2021 from a senior clinical psychologist with expertise in VR-based psychological interventions (SR), and then spent a week experiencing and familiarising themselves with the HMDs and software. Weekly one-hour clinical supervision sessions specific to the VR relaxation intervention were held remotely on Microsoft Teams for all VR therapists. Supervision sessions were facilitated by the same clinical psychologist who delivered the training. These sessions aimed to provide support and input on referrals, clinical issues, and real-world applications of VR relaxation.

2.3. Assessments and analysis

2.3.1. Patients

Data on number of referrals, uptake rate, reasons for non-participation, and session completion were recorded to investigate

feasibility. Demographic characteristics of participants, i.e., age, gender, ethnic group, ICD (International Statistical Classification of Diseases and Related Health Problems)–10 block, and days since last inpatient admission for outpatients, were recorded. ICD-10 was the diagnostic tool routinely used in clinical practice by the hospital.

Immediately pre-VR, six visual analogue scales (VAS), which assessed current self-reported levels of stress, relaxation, anxiety, sadness, happiness, and connectedness to nature on an 11-point Likert scale, from 0 (Not at all) to 10 (Very), were administered by therapists. Immediately post-VR, all pre-VR VAS were repeated by therapists, and two additional VAS on how helpful and immersive participants found the VR were administered using the same 11-point scale. Table 2 lists all VAS. All VAS were used subjectively, i.e., participants could interpret VAS content as they wished and define terms such as ‘stress’ and ‘happiness’ for themselves. Participants were not provided with definitions of the constructs being assessed unless they asked for clarification, in which case therapists provided prompts or explanation. This subjectivity was designed to maximise engagement with patients and to integrate VAS within the clinical approach of the session. Data on which virtual environments participants accessed, length of time in VR, and identification of a behavioural activity were recorded by therapists to investigate feasibility and acceptability.

Therapists collected qualitative feedback from patients by asking them about how the VR experience made them feel, likes and dislikes, recommended changes, applications to future relaxation practices, and any other feedback. See supplementary material S1 for all qualitative feedback questions. In session, VAS and qualitative questions had the dual function of providing data to evaluate the intervention and providing clinical questions that structured the session, e.g., therapists reflected with patients on VAS score changes and the impact of the VR.

Data was collected in session on smartphones or computers, using online surveys created in Qualtrics. All data was anonymised. There was no missing data. Quantitative analyses were conducted using SPSS v22. Given the normally distributed data, paired samples t-tests compared pre- and post-VR session VAS for the total sample, and inpatient and

outpatient subsamples, to investigate acceptability. Thematic analysis on qualitative feedback was conducted using NVivo11 to investigate feasibility and acceptability. The stages of thematic analysis were followed (Braun and Clarke, 2022). Themes were organised by researchers into categories of ‘Experience of VR Relaxation’ and ‘Applications of VR Relaxation’. This method corresponded to feedback questions and has been used in previous qualitative VR research (Riches et al., 2020; Riches et al., Under review-b). The number of patients endorsing each theme was recorded. Themes were included if they were endorsed by ≥ 2 participants, which was an arbitrary threshold decided upon by the research team. Qualitative data was recorded in the first and third person given varied methods of recording patient feedback by therapists.

2.3.2. Therapists

All supervision sessions were audio-recorded from June to September 2021 and transcribed using Microsoft Teams. Two independent researchers attended sessions and took process notes, which were integrated with cleaned and anonymised transcripts of supervision sessions. Transcripts and process notes were imported into NVivo11 software. Thematic analysis was conducted, using the same stages, to investigate feasibility and acceptability. Themes were organised by researchers into categories of ‘Impact on Patients’, ‘Experience of Delivering VR Relaxation’, ‘Challenges’, and ‘Recommendations’. The number of therapists endorsing each theme was not recorded given the small sample and the discussion-based format of supervision sessions. Qualitative analyses aimed to understand therapists’ experience of delivering VR relaxation through clinical reflections, challenges they encountered, and suggested improvements to enhance sessions. Once themes were identified by researchers, therapist participants and SR reviewed, refined, and validated them to maximise their clinical relevance.

2.3.3. Wards

Data on violent and aggressive incidents for all patients on the wards

Table 2
Pre- and post-virtual reality visual analogue scales of patient experience.

Visual analogue scale “Please mark on the line...	Sample	N	Before Mean (SD)	After Mean (SD)	Test (t)	df	p	Effect (d)
...how RELAXED you feel right now”	Total	40	5.20 (2.35)	7.83 (2.46)	6.32	39	<0.001	1.00
	Inpatient	27	5.68 (2.33)	8.36 (2.04)	6.03	26	<0.001	1.16
	Outpatient	13	4.20 (2.15)	6.73 (2.93)	2.76	12	.017	0.76
...how STRESSED you feel right now”	Total	40	4.10 (2.89)	2.15 (2.71)	-4.98	39	<0.001	-0.79
	Inpatient	27	3.97 (2.97)	1.99 (2.59)	-3.84	26	<0.001	-0.74
	Outpatient	13	4.37 (2.81)	2.48 (3.04)	-3.25	12	.007	-0.90
...how ANXIOUS you feel right now”	Total	40	4.58 (2.87)	2.71 (2.55)	-5.15	39	<0.001	-0.81
	Inpatient	27	4.50 (3.05)	2.59 (2.47)	-3.98	26	<0.001	-0.77
	Outpatient	13	4.74 (2.58)	2.96 (2.79)	-3.38	12	.006	-0.94
...how SAD you feel right now”	Total	40	3.14 (3.25)	1.83 (2.74)	-4.03	39	<0.001	-0.64
	Inpatient	27	3.06 (3.49)	1.86 (3.10)	-2.80	26	.009	-0.54
	Outpatient	13	3.31 (2.79)	1.76 (1.89)	-3.21	12	.008	-0.89
...how HAPPY you feel right now”	Total	40	4.69 (2.37)	6.49 (2.93)	5.41	39	<0.001	0.86
	Inpatient	27	4.93 (2.56)	7.00 (2.97)	5.22	26	<0.001	1.01
	Outpatient	13	4.18 (1.92)	5.43 (2.65)	2.06	12	.062	0.57
...how connected you feel to NATURE”	Total	40	3.35 (3.16)	6.93 (2.77)	7.12	39	<0.001	1.13
	Inpatient	27	3.75 (3.39)	7.22 (2.61)	5.60	26	<0.001	1.08
	Outpatient	13	2.53 (2.53)	6.34 (3.11)	4.27	12	.001	1.19
...how HELPFUL you found the virtual reality experience”	Total	40	-	8.27 (1.80)	-	-	-	-
	Inpatient	27	-	8.57 (1.72)	-	-	-	-
	Outpatient	13	-	7.65 (1.86)	-	-	-	-
...to what extent you FELT YOU WERE ACTUALLY IN THE RELAXING ENVIRONMENTS”	Total	40	-	6.76 (2.94)	-	-	-	-
	Inpatient	27	-	6.42 (3.29)	-	-	-	-
	Outpatient	13	-	7.47 (1.97)	-	-	-	-

Note. Visual analogue scales (VAS) were scored from 0 (Not at all) to 10 (Very). One participant had technical difficulties with the virtual reality (VR) headset and did not complete the VR relaxation intervention or post-VR assessments, so their pre-VR data was not included in the pre-/post-VR VAS analyses. Another participant completed the VR but declined to complete the post-VR VAS, so their pre- and post-VR VAS were not included in the analysis. Statistical tests therefore only included the remaining participants in the whole sample ($N = 40$), inpatient sample ($N = 27$), and outpatient sample ($N = 13$).

where VR was being implemented, and on restrictive practices carried out by ward staff during the intervention period, were extracted from databases for the four wards where VR relaxation was implemented. Violent incidents and restrictive practices, including seclusion and restraint, were identified by filtering data according to ward name, time, and incident type. Due to small samples and non-normally distributed continuous data, Mann Whitney U tests compared the number of violent incidents and restrictive practices in the 12-week period immediately before implementation of VR to the first 12-weeks of implementation. Percentage change was reported for violent incidents and restrictive practices.

3. Results

3.1. Referrals

There were seventy-eight referrals to the VR relaxation clinic (50 inpatients from the four wards and 28 outpatients from six outpatient services). Of the 50 inpatient referrals, 28 (56%) participated. Of the 28 outpatient referrals, 14 (50%) participated. Where patients declined participation, key reasons included lack of interest, being 'already relaxed', or because of paranoid ideas about VR. Other reasons for non-

participation included patients not attending sessions, not engaging when VR clinic staff attempted to book sessions, and patients being discharged from the ward. Fig. 2 reports referral pathways and all reasons for non-participation.

3.2. Impact on patients

Forty-two patients (28 inpatients, 14 outpatients) participated in the intervention. Table 1 reports their demographic characteristics. For the total sample, participants comprised 29 males and 13 females, with a mean age of 35.55 ($SD=13.52$, range 18–60). Nearly half the participants were of White ethnicity and over a third were of Black ethnicity. Nearly half of participants had a diagnosis within the diagnostic block 'F20–29 Schizophrenia, schizotypal and delusional disorders'. The next most common blocks were 'F60-F69 Disorders of adult personality and behaviour' and 'F30-F39 Mood (affective) disorders', collectively comprising nearly half of participants. Of the 14 outpatients, 10 were formerly psychiatric inpatients, with an average of one year since their most recent discharge from a psychiatric hospital.

Sessions were conducted from June to October 2021. All inpatient sessions were delivered in clinical rooms on the ward or in private rooms adjacent to the ward. Of the outpatient sessions, nine were delivered in

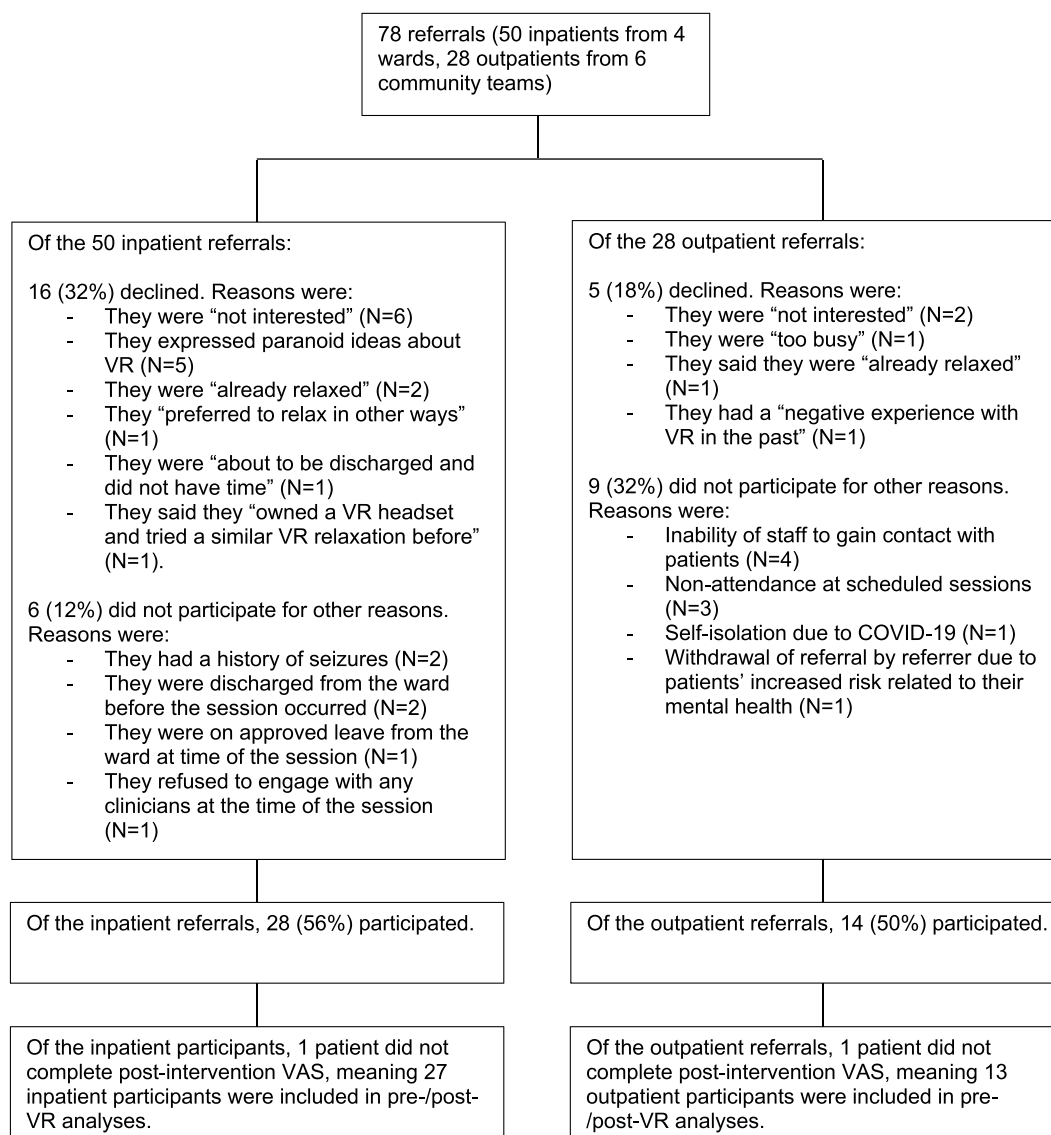


Fig. 2. Referral pathways to virtual reality relaxation clinic and reasons for non-participation and exclusion from the study.

clinics and five were delivered in patients' homes on scheduled visits for other psychiatric needs. The assistant psychologists were the therapists for thirty-four (80.95%) sessions. The trainee clinical psychologists were the therapists for eight (19.05%) sessions. Most sessions were co-facilitated by two of these therapists. All patients had one session, spending on average nearly half an hour in VR, with the longest period in VR lasting 47 min. All patients entered the VR on the Quiet beach and most tried a range of environments, in particular Scuba diving with dolphins ($N = 38$) and Coral reef with interactive bubble game ($N = 35$). **Table 1** reports session data.

Forty (95.24%) of the 42 participants completed all assessments. Drop-outs comprised one inpatient and one outpatient. One patient had technical difficulties while using the HMD and did not complete the intervention or post-VR VAS. Another patient completed pre-VR VAS, the VR intervention, and post-VR qualitative feedback, but declined to complete post-VR VAS. These two participants' VAS were excluded from pre-/post-VR VAS analyses. Therefore, VAS analyses included data from 40 participants.

Table 2 reports VAS scores and test results. For the whole sample ($N = 40$), post-VR there were statistically significant decreases in stress, anxiety (both large effects), and sadness (medium effect); and statistically significant increases in relaxation, happiness, and connectedness to nature (all large effects). For inpatients ($N = 27$), there were statistically significant decreases in stress, anxiety, and sadness (all medium effects); and statistically significant increases in relaxation, happiness, and connectedness to nature (all large effects). For outpatients ($N = 13$), there were statistically significant decreases in stress, anxiety, and sadness (all large effects); and statistically significant increases in relaxation and connectedness to nature (both large effects). For outpatients, change in happiness was not significant. All helpfulness scores were ≥ 7.65 . All immersion scores were ≥ 6.42 . One patient reported mild dizziness during VR. This lasted approximately one minute before they said they felt well and ready to continue. All 41 patients who completed the session were able to identify and plan at least one behavioural activity. They were mostly outdoor activities in natural surroundings. **Table 1** lists all behavioural activities.

Forty-one patients provided qualitative feedback. **Table 3** reports themes, explanations, and illustrative quotes. Under the 'Experience of the Intervention' category, eleven themes were identified. All participants found VR relaxation to be *Enjoyable Escapism* ($N = 41$), which they found engaging and helpful because it distracted them from their situation and symptoms. Two thirds of participants reported they *Felt More Relaxed and Less Stressed* ($N = 27$), with the sound and imagery enabling them to feel calm. Nearly half of participants found the VR *Immersive* ($N = 20$), in that they found these experiences of nature scenes believable and realistic. Over a third *Enjoyed Interactive Components* ($N = 16$) of the VR but reported they would have liked more environments to explore and greater interactivity to increase immersion. Nearly a third *Enjoyed the Novelty* ($N = 13$), as they liked doing something new and different. Nearly a quarter reported that VR enabled them to recall *Positive Memories* ($N = 10$), including places they had previously visited and enjoyed. Some participants reported they *Felt Happy* ($N = 7$) during the intervention, but there were *Triggering Effects of Specific Imagery* ($N = 4$), including the Christian cross, for a few participants. Some participants felt *Anxiety About Uncertainties* ($N = 3$) in the VR, e.g., not knowing what to expect in the ocean environment. Other participants mentioned that they found the VR *User Friendly* ($N = 2$), e.g., the HMDs were easy to use, and said that they *Felt Safe and in Control* ($N = 2$).

Under the 'Applications of VR Intervention' category, six themes were identified. Most participants reported that they *Wanted More Contact with Nature* ($N = 30$) after experiencing VR, as it reminded them of how much they enjoyed spending time outdoors. Half the participants *Felt Motivated to Use Other Coping Strategies* ($N = 21$), including practicing mindfulness exercises and watching relaxing videos. A fifth reported that VR could be *Helpful for Mental Health Problems* ($N = 8$), especially low mood and anxiety. Some participants reported VR could

Table 3

Thematic analysis of patients' experience of virtual reality relaxation.

Theme	Explanation	N (%)	Illustrative quotes
Experience of the intervention			
Enjoyable Escapism	Patients reported that the VR was an enjoyable and worthwhile experience. They found it to be engaging and helpful, and some were surprised by how much they benefitted from the intervention. Many reported they would like to do it again and some said they would like to buy their own VR headset. Participants reported enjoying the distraction and escapism of VR. The beach and mountain environments were reported to be particularly enjoyable.	41 (100)	"I'd like to buy one." (#1) "Even though she doesn't like trying new things she enjoyed this experience." (#4) "Can feel the impact of using the VR...it has helped." (#6) "Liked how it reminded me of sensory rooms." (#11) "It was worth exploring, it made me feel a more expansive version of myself." (#12) "Really enjoyed the meditation, the calming music and being in nature." (#13) "One of the best experiences of my life, really want to do it again." (#16) "Liked having a different experience - disrupts status quo of the ward. Good to have a distraction - get some 'fresh air' off the ward." (#17) "Nice escape from how I am feeling." (#20) "I enjoyed the distraction and escapism of being immersed into different realities." (#21) "Really enjoyed being at the beach, seeing the sunny day and hearing the sound of the waves." (#22) "Enjoyed being on the mountains and at the beach." (#24) "Very stimulating in terms of feeling in nature...very engaging." (#25) "I felt free, no annoying people around." (#27) "It made him feel 100 times better than before...liked everything about it, nothing could have been better." (#28) "Made service user feel good, he loved the realism of the environment and will be interested in doing it again." (#33) "Enjoyed everything, enjoyed using the remote to navigate the different environments." (#35) "Liked everything about the VR...really enjoyed the Tibetan sound therapy." (#36) "I loved everything...I am so glad you two came by...I can't believe it." (#39) "Reported finding watching the ripples of water on the surface of the sea from underwater scenes good." (#41)

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Table 3 (continued)

Theme	Explanation	N (%)	Illustrative quotes
Felt More Relaxed and Less Stressed	Patients reported finding the VR to be calming, relaxing, and valuable. They reported feeling less stressed and more peaceful during and after the intervention. Several reported that the sound and water aspects of the VR made the experience more relaxing.	27 (65.9)	<p><i>"He feels relaxed, this has given him a respite from his stress...he's quite relaxed...3D really relaxes you straight away". (#6)</i></p> <p><i>"Relaxing, the gongs were mesmerising and soothing, especially the vibrations." (#8)</i></p> <p><i>"The music was very calming and fitted the scenery." (#13)</i></p> <p><i>"The imagery of being underwater is very relaxing." (#14)</i></p> <p><i>"Very relaxed, less stressed." (#15)</i></p> <p><i>"Sound of sea was very relaxing and rhythmic." (#18)</i></p> <p><i>"Feeling calm after the VR, I have a feeling in my head that for some reason feels relaxing." (#21)</i></p> <p><i>"Felt very relaxed and peaceful." (#22)</i></p> <p><i>"Felt relaxed... did not hear any noises despite the hectic ward environment." (#24)</i></p> <p><i>"Very relaxed...very therapeutic." (#25)</i></p> <p><i>"I'm not even stressed out anymore...it's really relaxing." (#26)</i></p> <p><i>"Made client feel calm and relaxed, allowed him to breathe more easily and he found it comforting." (#30)</i></p> <p><i>"Feels a lot more relaxed and content." (#31)</i></p> <p><i>"Made service user feel very relaxed, particularly because he had a panic attack yesterday, he reported it being very therapeutic and soothing." (#35)</i></p> <p><i>"Felt good, it was relaxing, liked swimming with the dolphins and the fishes, the fishes were beautiful and the coral reef." (#37)</i></p> <p><i>"Made client feel good and refreshed and he wanted to stay there." (#38)</i></p> <p><i>"Swimming with dolphins is more relaxing...because you're actually immersed...moving is more immersive, it brings on more emotions." (#6)</i></p> <p><i>"You don't get distracted while you're in it, which makes you focus on the present." (#7)</i></p> <p><i>"I wasn't thinking about anything other than what I was exploring...it was immersive especially when the second senses kicked in." (#8)</i></p> <p><i>"Made me feel alive, like I was</i></p>
Immersive	Patients reported feeling immersed into the environments, to the extent that some participants reported they felt like they were actually there. Participants reported finding the VR more immersive and distracting than real life nature.	20 (48.8)	<p><i>"Swimming with dolphins is more relaxing...because you're actually immersed...moving is more immersive, it brings on more emotions." (#6)</i></p> <p><i>"You don't get distracted while you're in it, which makes you focus on the present." (#7)</i></p> <p><i>"I wasn't thinking about anything other than what I was exploring...it was immersive especially when the second senses kicked in." (#8)</i></p> <p><i>"Made me feel alive, like I was</i></p>

Table 3 (continued)

Theme	Explanation	N (%)	Illustrative quotes
Enjoyed Interactive Components	Patients reported that they enjoyed the more interactive environments, such as swimming with dolphins and muscle relaxation, as they felt most engaged with the intervention. Participants reported they would have liked more scenes to explore and further interactive aspects to make the experience more immersive.	16 (39.0)	<p><i>in the VR itself experiencing it." (#16)</i></p> <p><i>"Able to focus just on VR and put problems aside, which would be different to being at beach in real life." (#20)</i></p> <p><i>"Reported the VR to be immersive and said that if you really concentrated you would have felt like you were actually on the beach." (#24)</i></p> <p><i>"Brings nature and the environment to reality." (#25)</i></p> <p><i>"I'm so focused on it I'm not even taking notice of the noise outside and around...at one point I actually felt like I was in the ocean." (#26)</i></p> <p><i>"My senses heightened in terms of sound and I felt like I was exploring the different scenarios." (#27)</i></p> <p><i>"Service user felt he was actually in the environments." (#32)</i></p> <p><i>"Client felt like he was somewhere nice." (#33)</i></p> <p><i>"He was able to block out the sound in the background as he was focused in the relaxation therapy." (#38)</i></p> <p><i>"Made her feel like she was there in real life...did not feel like she was on the ward." (#39)</i></p> <p><i>"Liked paired muscle relaxation." (#3)</i></p> <p><i>"Liked the piano game." (#4)</i></p> <p><i>"Have more games...to be more immersive" (#5)</i></p> <p><i>"Swimming with dolphins is the best, most relaxing environment... VR works well with the sound. Moving is more immersive." (#6)</i></p> <p><i>"Enjoyed watching dolphins and the sea the most. It was super helpful having instructions for the paired muscle exercise." (#9)</i></p> <p><i>"The scenes and different music was helpful...I liked the water ones, the movement of the dolphins and looking at the water, being able to hear the noises was helpful." (#10)</i></p> <p><i>"Liked the meditation, the calming music and the interactive parts of it." (#13)</i></p> <p><i>"Favourite scenario is the air bubbles game. I want to finish on this scenario as it's the one I like best." (#14)</i></p> <p><i>"Interactive</i></p>

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Table 3 (continued)

Theme	Explanation	N (%)	Illustrative quotes
			<p>bubble popping was nice, it would be cool if you could play the gongs yourself in sound therapy." (#20) "More interactive sessions would be good, the nice sounds really help." (#21) "My favourite was the mindfulness, it allowed me to focus on something other than my depression." (#26) "More interactive activities would be better, especially sound and music-wise." (#27) "Enjoyed playing the bubble game, it was something different that she had not experienced." (#29) "One of the best parts was the dolphins, he would love to be able to swim with them." (#31) "Would like to really be there in the environments and didn't think anything else could make it feel more real." (#34) "Muscle relaxation was helpful, he relaxed after this." (#35) "Really enjoyed the Tibetan sound therapy, swimming with dolphins, and the paired-muscle relaxation." (#36)</p>
Enjoyed the Novelty	Patients reported having never experienced anything like the VR before and enjoyed trying something new and different. They found the experience refreshing and interesting and were impressed by the technology.	13 (31.7)	<p>"Surprised and curious because it was a new experience...would like to purchase one." (#2) "It was refreshing to see something different." (#5) "Thought the experience was very clever and interesting and good to try something new." (#18) "He experienced something he has never done before." (#28) "Likes media and technology and was interested to see how it worked." (#29) "It's unbelievable, it's amazing what technology can do nowadays." (#31) "He had an experience that he feels others don't get to do. It was a unique experience." (#32) "It provides people with a new way to explore environments they would not really get to do usually, appreciated this." (#33) "Was a new experience so thinking about how different it is in VR to be able to click and then be</p>

Table 3 (continued)

Theme	Explanation	N (%)	Illustrative quotes
Positive Memories	Patients reported that the intervention enabled them to recall pleasant memories. It reminded participants of childhood memories, exciting past experiences, and locations they had visited or used to live in.	10 (24.4)	<p>in different places." (#34) "Liked the fact it was a new experience." (#36) "It's beautiful, I have never experienced something like this." (#37) "Liked the new experience, made him feel satisfied." (#40) "Reminded me of snorkelling which is one of best experiences I've ever had." (#11) "Reminded her of the scuba diving she used to do, which made her miss it." (#14) "It reminded me of happy days and good memories of my childhood." (#16) "Brought back positive memories of growing up and visiting grandparents who all lived in seaside towns." (#18) "It made him feel like he was back in Australia where he lived near the beach, so brought up good memories." (#20) "It reminded him of Cornwall." (#28) "Brought back childhood memories like watching Finding Nemo and other positive childhood experiences." (#35) "Made client think of going back home to Jamaica and being on holiday." (#38)</p>
Felt Happy	Patients reported positive emotions and feelings of happiness during and after the VR intervention.	7 (17.1)	<p>"This made me feel happy." (#1) "Seeing the sea makes me feel good." (#5) "Very happy...just feel lovely now." (#15) "Felt happy at times." (#21) "She was in her element." (22) "I haven't felt as happy as I do now the whole time I've been here." (#26) "Felt amazing, absolutely amazing." (#31) "Feels much happier after the session." (#38)</p>
Triggering Effects of Specific Imagery	Patients reported feeling sadness due to memories the VR intervention brought up. A few also found certain symbols and environments to be triggering, including the Christian cross and the underwater scenes.	4 (9.8)	<p>"Didn't like the cross... said it could be misperceived by people with psychosis as Jesus Christ's cross." (#13) "She said that you can feel glad to be somewhere but also sad at the same time because she doesn't know whether she will go back to them again." (#14) "Felt triggered by being underwater in coral reef, felt too close to home with current negative connotations and</p>

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Table 3 (continued)

Theme	Explanation	N (%)	Illustrative quotes
Anxiety About Uncertainties	Patients reported feeling nervous in certain environments when they did not know what to expect, for example in the underwater environment.	3 (7.3)	associations with water." (#18) "Bit eerie in dolphin scene not being able to see much of your surroundings, felt like I could be drowning." (#20) "Didn't like the ocean one as didn't know what to expect." (#4) "First of all a bit more anxious as she's never done it before." (#14) "He also reported being anxious because there wasn't enough time to learn all about the environments." (#33)
User Friendly	Patients reported finding the headsets easy to use.	2 (4.9)	"It was very easy to use, there wasn't anything I would have liked to have been different." (#12) "Liked...how it is easy to use." (#13)
Felt Safe and In Control	Patients reported feeling in control during VR relaxation. They reported feeling safe during the intervention.	2 (4.9)	"I felt I was in control...I felt safe." (#12) "It made her feel...very safe." (#13)
Applications of VR intervention			
Wanted More Contact with Nature	Patients reported that the intervention reminded them of how much they liked being in nature. This made them want to go out in nature more, for example going to the beach or spending time in parks or gardens.	30 (73.2)	"The change of scene will encourage client to go out and explore different places in the environment." (#2) "Plans to carry on going to her garden often because she finds it relaxing and she likes the fresh air." (#3) "Seeing the sea made me think I would like to visit the beach at Newhaven. I might visit the river which is near my house as I like being near the sea." (#5) "Finds it very relaxing to go outside, listen to the wind, feed the ducks... this made him appreciate nature more." (#6) "Going to visit the sea, I used to swim a lot and would try to again." (#10) "Made me want to save up my money for holidays and explore new parks." (11) "It helps me relax to spend time in the garden... perhaps do a lap of the local park." (#12) "She used to go to a park with a lake and ducks, she might start going again." (#13) "She wants to go back to going to the mountains and beach and seaside." (#14) "Would like to be near the sea and mountains and go walking around lakes and rivers." (#19) "Reminded me I really

Table 3 (continued)

Theme	Explanation	N (%)	Illustrative quotes
Felt Motivated to Use Other Coping Strategies	Patients reported that they felt motivated to use other coping strategies to relax following the VR intervention. These included practicing muscle relaxation techniques, meditating, watching relaxing videos, listening to music, and listening to nature sounds.	21 (51.2)	like the beach environment and the beach is a few minutes away from where I go to university so I will make an effort to go more often." (#20) "I would like to go out into nature more, whilst in hospital I could use the park. I could also visit family in the countryside." (#21) "I like nature and do a lot of walking and looking at animals...I might do mindfulness in the park." (#26) "Doing it makes you want to look at the sky more in real life and explore different things in the world, like actually going outside and looking at trees more, look at things more and appreciate them more." (#27) "Goes to beach once every 4-5 years... motivated him to do this again, he will be going to the seaside." (#28) "Made him feel more connected to nature... made service user want to go scuba diving and swimming with dolphins, he would like to do this in the future." (#32) "Would like to get out into nature and gave an example of lying in the grass and feeling connected to nature, said he could go to the beach with friends and family as that would be nice." (#34) "On a holiday I would maybe go to the sea and would like to try scuba diving." (#37) "Made her want to be in the mountains and on her father's farm, he has trees and rivers on his land which it reminded the client of." (#39) "I would try to use thinking about the beach to help me relax." (#1) "Doing muscle relaxation techniques, tensing body and letting it go." (#3) "He would like to get the VR headset or maybe turn on TV with wildlife or sea, have some relaxing sound in the background." (#6) "Tap into my senses more using oils, incense, candles at home to relax and appreciate my senses more." (#8) "Could listen to relaxing

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Table 3 (continued)

Theme	Explanation	N (%)	Illustrative quotes
Helpful for Mental Health Problems	Patients suggested that VR relaxation could be implemented as a tool for when they experienced low mood or anxiety.	8 (19.5)	music." (#10) "Being more present...watch films and YouTube videos of nature... putting on rain sounds, or jungle sounds in background." (#11) "Doing the meditation reminded her to start doing Headspace meditations again." (#14) "Taking time out to de-stress lying down and doing visualisation." (#15) "Could access natural sounds online which could be helpful...even when feeling really distressed like in panic attack when I don't know how to help myself." (#20) "Enjoyed the distraction so I could start using film, TV, playing an instrument." (#21) "Utilise mindfulness and use mindfulness videos on YouTube as I really found that helpful." (#26) "Breathing exercise was helpful and I will do that more." (#27) "Would like to get pictures of the rocks and hang this up in his home, he reported this will help him to focus and help him to feel more tranquil." (#33) "If I was stressed, I would think of the coral reef and the dolphins, I appreciate this amazing memory." (#37) "The muscle relaxation, he will apply the breathing exercise to day-to-day life." (#38) "Changed her mood, helped her distract." (#4) "He said this will definitely help people... will definitely help people with social anxiety like him." (#6) "I wasn't thinking about my issues or problems... seems like a good tool to use when I'm getting into a negative mindset." (#8) "Made me realise even though I feel lost in myself I'm not underwater." (#11) "It has actually made my depression a lot easier, I'm not feeling so low and depressed since doing that." (#26) "Could be helpful when feeling distressed, e.g., in panic attack when don't know how to help myself" (#19) "Found

Table 3 (continued)

Theme	Explanation	N (%)	Illustrative quotes
Openness to New Experiences	Patients suggested that the intervention had inspired and motivated them to try new activities, because of how relaxed they felt.	7 (17.1)	it helped with feeling less anxious." (#29) "Client presentation dramatically changed, was silent initially but spoke with excitement and pleasure at the end." (#39) "It will help him get out and try to relax by doing different activities." (#2) "Made her more open to try new things." (#4) "Might go to London Aquarium." (#7) "I'd like to explore walking in hills and exercise." (#12) "Motivated him to visit somewhere outside London when discharged." (#24) "Made the client want to go get a massage after the relaxation exercise, due to how comfortable and relaxed he felt." (#30)
Helpful on Wards	Patients reported that the intervention would be useful to help patients feel calm on the wards and be a distraction from difficult experiences.	4 (9.8)	"Think it would be perfect to have for all of the ward patients because whatever stage somebody is at it could calm them down." (#11) "Liked having a different experience that disrupts status quo of the ward and good to have a distraction." (#18) "On the ward it is dull so the contrast between being in the VR and on the ward was dramatic. The longer you have it on, the longer you forget where you are." (#24) "There was distraction on the ward, but the client was focused on the scenes." (#32)
Intention to Reduce Dysfunctional and Unhealthy Coping Strategies	Patients reported that the VR experience helped them identify alternative activities or coping strategies that may be more beneficial to their mental health than alcohol or cannabis use.	2 (4.9)	"Encouraged him to get out and relax rather than smoke a joint, he thought about other options available to him to help him relax than cannabis and this made him more self-aware." (#24) "Motivated him to go to different places and environments rather than a pub, where there isn't anything interfering with anything." (#31)

Note. Data was recorded in the first and third person given varied methods of recording patient feedback between therapists. Some therapists used terms such as 'service user' or 'client' to refer to patients as these terms were routinely used in the hospital.

promote *Openness to New Experiences* (N = 7), as they felt inspired and motivated to try new activities. Some mentioned that VR would be *Helpful on Wards* (N = 4), to help people remain calm. Other participants mentioned an *Intention to Reduce Dysfunctional and Unhealthy Coping Strategies* (N = 2), e.g., going outdoors to relax rather than using

cannabis.

3.2. Therapist experience

There were eleven supervision sessions in total. Table 4 reports themes, explanations, and illustrative quotes. Under the ‘Impact on Patients’ category, seven themes were identified. Therapist participants reported that VR relaxation was *Enjoyable* for patients, as patients liked the intervention and being a part of something new and exciting. Therapist participants reported that VR relaxation was *Relaxing* for patients, resulting in noticeable changes in patients’ body language and general presentation. Participants reported that VR relaxation *Offered Respite*, as the immersion distracted patients from difficult ward experiences. Participants reported that VR relaxation *Reduced Stress and Anxiety*, in that patients appeared visibly less tense and anxious post-VR. Participants reported that patients showed *Increased Willingness to Engage* in psychology sessions. However, participants noted there were some *Triggering Effects of Specific Imagery*, e.g., the Christian cross evoked contrasting emotions in patients. Participants reported that patients identified *Real-World Applications* of the VR for their relaxation practices, e.g., inspiring visits to the park or beach.

Under the ‘Experience of Delivering VR Relaxation’ category, four themes were identified. Therapist participants sometimes felt a *Disconnect with Patients’ Experience*, as therapists were unable to view virtual environments in session. Therapist participants reported that VR relaxation was *Acceptable for High-Risk Patients*, as high-risk presentations were typical amongst the patient participants and no negative experiences were reported. Participants reported there was *Variation in Patients’ Technological Proficiency*, e.g., some required considerable instruction, while younger patients generally found it easier and more intuitive. Participants found the intervention *Enjoyable to Deliver*, as they liked experiencing the positive impact of VR relaxation.

Under the ‘Challenges’ category, six themes were identified. Therapist participants reported there were *Limited Resources* available to the clinic, including limited time, staff, and room availability. Therapist participants reported that there was an *Impact of COVID-19 Protocols*, which necessitated HMD quarantining, limited technological support provided by therapists to patients, and led to brief ward closures. Participants reported that another challenge was *Obtaining Referrals*, as community staff were busy and ward staff were unable to make referrals if there were no new admissions. Participants explained they often had *Limited Knowledge of Patients’ Background and Presentation*, which could make sessions challenging. Participants reported there were *Difficulties Setting Up Headsets*, as they could only give verbal instructions. A key challenge was the *Ward Environment*, e.g., noise disturbed sessions, high temperatures caused HMDs to steam up, and limited staffing could prevent sessions occurring.

Under the ‘Recommendations’ category, four themes were identified. Therapist participants reported that they benefitted from *Organised Referrals and Record Keeping*, e.g., using shared documents. Therapist participants reported that it was helpful to *Involve Community and Ward Staff in the Intervention*, to increase referrals and reduce patients’ challenging behaviour. Participants reported that it would be helpful to *Improve Set Up on Headsets*, to reduce patients’ potential frustration and increase immersion. Participants reported that it would be helpful to *Increase Therapist Time and Number of Therapists*, to increase provision and reduce risk.

3.3. Impact on wards

When comparing total number of incidents in the 12 weeks immediately before VR implementation to the first 12 weeks of VR, incidents decreased by 50.52%, from 97 to 49 incidents. There was a mean of 8.08 (*SD*=3.32) incidents per week in the 12 weeks before VR, which reduced to a mean of 4.08 (*SD*=2.54) incidents per week in the first 12 weeks of VR. This reduction was statistically significant, with a large effect ($U =$

Table 4

Thematic analysis of therapists’ experience of facilitating the virtual reality intervention.

Theme	Explanation	Illustrative quotes
Impact on Patients		
Enjoyable	Therapists reported that patients enjoyed the intervention and found it a novel experience. They reported that patients were curious about the intervention and enjoyed being part of something they perceived to be new and exciting.	“She did really enjoy it... straight away she was, like, ‘I really think everyone else on the ward should be able to have a go at this...it would be really helpful for helping people to kind of calm down and relax.’” “She did enjoy it...she thought it would be really helpful.” “People seem to be really enjoying it and really liking the intervention like we did one the other day... he said he was the happiest he’d been since he’d been on the ward.” “During the session she was just saying how much she was enjoying it.” “They seem to really enjoy the paired muscle relaxation one and the guided meditation.” “The service user was just saying how much he loved being in the ocean. He actually felt like that took him back to remembering when he was scuba diving in the past.” “He was like, please bring that next time you come. I’d love to do that again, he is really keen to do it again.”
Relaxing	Therapists reported that they could see a noticeable change in patients’ levels of relaxation. They observed changes in patients’ body language and general presentation.	“He did appear to literally physically relax while he was in there ... and I’ve seen that with a lot of people that we’ve done it with.” “After he took the headset off, he was visibly so relaxed. He just said that it really relaxed him and made him want to get a massage, you could see it in his...body language.” “I had one of the student nurses come into the session with me...and she actually said to the service user”. .look how relaxed you are after that...it’s really relaxed you being in there hasn’t it? So even she noticed the difference which was nice.”
Offered Respite	Therapists reported that the intervention offered respite to patients and immersed them in an experience that took them away from their current reality on the wards.	“She said that it was really good distraction. It kind of took the edge off.” “He did find that it took him away from the ward environment and when he was reflecting, he was talking about...being out in nature...I think while he was in it he felt like he was off the ward.” “He was just completely immersed in it.”
Reduced Stress and Anxiety	Therapists reported that patients were visibly less stressed and anxious following the intervention.	“I was amazed at how much it changed; she went from being so anxious to not at all.” “Before we started the session, I could see that this individual was particularly anxious, and his body was quite tense. He was shaking... he was visibly quite anxious

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Table 4 (continued)

Theme	Explanation	Illustrative quotes
Increased Willingness to Engage	Therapists found that following the intervention, patients were more open and willing to engage in psychology sessions.	<p>and as soon as he was into the environment, he literally... completely relaxed into it. He was just really, like, taking it in and he even said... 'I don't feel anxious at all anymore.'"</p> <p>"I've noticed people will initially be, like, 'Yeah, I'm quite stressed...' and then after they're like not stressed at all and that's the same with anxiety."</p> <p>"Most of the sessions she attended...she would always come in very angry very irritated...and it was interesting 'cause I offered her VR at the beginning... of the sessions... and it was incredible how her mindset completely changed, she went from being in such an angry state to actually being ready to engage with the rest of the psychology session." "I think it softens people, like people might be agitated or a little bit...guarded, irritable and when they put it on, after they're much more willing to engage... I think they do just really enjoy it and it kind of lifts their mood." "It's the first time we had a proper session with him, and it was such an ice breaker for him, he really enjoyed it and then...he was ready to talk, he was much more willing to engage."</p>
Triggering Effects of Specific Imagery	Therapists reported that some patients found certain symbols or environments to be triggering. They found that the Christian cross evoked different emotions in people.	<p>"When she was in the water, I think she just felt really uncomfortable...it felt too close to home, and it was actually triggering her." "She mentioned how that was the cross in which Jesus Christ had been crucified and then at the end of the session...she told me that the cross shouldn't really be there because that can be quite triggering for some patients."</p> <p>"One of the service users was particularly distracted by the cross...he felt like he needed to stand there for a little bit longer and click it a few times because he felt like he needed to get luck from the cross."</p> <p>"When she saw the cross, she said that it reminded her of a gravestone and for her one of the things that she finds really difficult is the death of a friend and that then made her think of that." "When she got to the cross, she didn't like it... she didn't give me any reason why."</p>
Real-World Applications	Therapists reported that the intervention had real-world applications of what patients had learned in VR about their relaxation. These applications included reminding	<p>"She said she's gonna use garden leave and just spend some more time looking at nature." "Before the intervention he was thinking that he couldn't wait to get out to smoke a joint; however,</p>

Table 4 (continued)

Theme	Explanation	Illustrative quotes
Experience of Delivering VR Relaxation	Therapists reported that they sometimes felt disconnected from patients' experience of the virtual environment. They suggested that it would be helpful to be able to access patients' VR screen.	<p>patients of activities, like spending time in nature, and motivating them to expand their horizons about things to do.</p> <p>after said that the intervention made him realize that there were other things he could do." "People often say that they want to go swimming or just go to the park, and it motivates some people to go on holiday." "It reminds people that there are other things to do...I've definitely had quite a few people say that they would go to the park now or go and try to find some lakes nearby them that they've not seen before... People are willing to try new things and are more aware that there are new things that they can go engage with." "There was one participant as well who mentioned how he wanted to try scuba diving." "I had a service user saying... even though he had physical disabilities, the intervention motivated him to call his friends up and suggest a trip to the beach because they usually do trips like that."</p>
Disconnect with Patients' Experience	Therapists reported that they sometimes felt disconnected from patients' experience of the virtual environment. They suggested that it would be helpful to be able to access patients' VR screen.	<p>"Not being able to see what they can see can make you feel a little bit disconnected in the session." "One of the difficulties is that...we cannot actually see what the service users are seeing which can make it a bit harder for us to prompt them and to guide them and to help them if they need our help." "Sometimes it might be distracting constantly asking them 'Where you now? What do you see? Tell me where you are' I think that's quite distracting so if we were able to see where they were then we wouldn't really need to ask those questions." "We didn't realise for a while she was finding it a bit difficult to navigate...the headset had oriented itself so that it was wrongly positioned for where she was."</p>
Acceptable for High-Risk Patients	Therapists reported that the intervention worked well for high-risk, acutely unwell patients as their enjoyment was high and there were no patient participants who reported negative experiences overall.	<p>"Nobody that I've done this intervention with so far has had a bad experience or has not managed and I think that we're working with some really high-risk service users." "So far all or most of them have really been enjoying the intervention."</p>
Variation in Patients' Technological Proficiency	Therapists reported large variation patients' technological proficiency. They reported that it was challenging to deliver the intervention when patients were not proficient with technology. Generally, younger patients were more comfortable using the	<p>"The fact that you can't put the headset on and just help them out is really, really frustrating." "It's quite a noticeable difference, when I've done it with people in their 20s...they're very intuitive about knowing what to click to get where." "Perhaps there are some</p>

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Table 4 (continued)

Theme	Explanation	Illustrative quotes
	VR and keen to explore all aspects of the virtual environment.	<i>people for whom with this kind of intervention you do have to spend quite a lot of time just talking it through with them beforehand ...you know, just introducing them to a controller and how you hold it."</i>
Enjoyable to Deliver	Therapists reported that delivering the intervention was generally enjoyable. They reported that it was nice to watch the positive impact the intervention had on patients and that they liked delivering such a novel intervention.	<i>"It had an impact on her presentation, so that was quite nice to see and really, really made my session easier." "I think it's really nice to watch the physical change in people and watch how they can come in and be quite stressed, or a bit tense, and then at the end of the session they seem more relaxed." "I find it really enjoyable 'cause you can literally see that the service users are having a good time and that we're giving them a break from their time on the ward." "There is definitely something enjoyable about delivering something so new, so novel, so different to what people are used to." "I like the fact that we're giving service users the opportunity to experience something different and novel that they've not experienced before...it makes me want to offer it even more."</i>
Challenges		
Limited Resources	Therapists reported that they had limited time assigned to running the clinic. As a result of this, last minute cancellations meant no sessions could be delivered by a particular clinician in a week. There were difficulties organising clinician time and room availability, particularly in the community.	<i>"One of the most difficult things, especially in the community, is that only having half a day means that you can only book one person a week and then if they cancel, you can't get any data for anybody that week. Because you have to quarantine the headset, you can't book more than one in a day. And then that slot is gone." "Often, they didn't have any rooms...when I mentioned it in the meetings they would often say 'actually we don't have capacity' or that some of the rooms would be used for other meetings. So, it was kind of difficult to obtain a room."</i>
Impact of COVID-19-Protocols	Therapists reported various challenges associated with COVID-19 protocols: headsets needed to be quarantined, patients needed to put on the headsets and set up the intervention with little support, and COVID-19 outbreaks on wards led to ward closures.	<i>"We couldn't book more than one person a day in our community team because you've got to quarantine the headset." "Service users struggled with adjusting the head straps as well...so that's difficult because you can't help them." "Another difficulty we had was with explaining how to set up the VR intervention." "This past week, we've not been able to go into one of the wards to get participants due to a COVID outbreak, so that's kind of obstructed our data collection."</i>

Table 4 (continued)

Theme	Explanation	Illustrative quotes
Obtaining Referrals	Therapists reported that community staff were busy and did not refer patients or prioritise the clinic, even when they expressed an interest in the intervention. They reported that ward staff were not able to provide referrals if there were no new admissions and the patients on the ward had done the intervention, declined it, or were not deemed suitable. They reported that it was generally easier to obtain referrals on the wards as staff were available to assess suitability of all patients and there were also patients who were present on the ward.	<i>"When you mention it in a meeting, they're quite enthusiastic about it, but because they have so much going on, they often kind of just forget it." "When we were emailing care coordinators to get new referrals most of them did not reply. Some expressed they were new in their role and therefore didn't know the patients, so they couldn't make a referral. Others did reply, but...this was a minority." "We went on the wards, but the staff were not able to refer new people as we had already offered the intervention to everyone suitable." "It definitely has been easier to get them on the wards... the difference with the wards is you go in and everybody's there. And if people [service users] are willing to do it you can go and... try lots of different people all at one time and the nursing staff have capacity to just look at the board and assess every single person on the ward. And that's easier than in the community, people having to mentally go through a list in their head and assess whether they're suitable." "The quick turnaround or change of patients [on the wards] means that staff don't always know them as well, so they're not always able to refer them, or at least refer them as confidently."</i>
Limited Knowledge of Patients' Background and Presentation	Therapists reported that although referral information always included assurances that the patient was appropriate for the session and clinical notes were always consulted, they sometimes felt they did not know as much about patients' backgrounds as they would have liked. Of particular concern to participants was the potential for patients' presentation to vary and be unpredictable.	<i>"We're contacting people that we don't necessarily know much about the history of." "You don't know what their behaviour is going to be like, and we've not seen their baseline presentation. Yes, they've been referred, and we've been told that they're appropriate. And yes, we obviously looked on clinical records to get their background, but we wouldn't be able to notice any small changes in behaviours. And sometimes that can feel a little bit daunting." "In a way you're kind of going in blind so you don't know what to expect... this is a really big challenge, just not knowing what their presentation will be like at that time." "When people are quite unwell, they can be quite unpredictable in general, even when you know them."</i>
Difficulties Setting Up Headsets	Therapists reported that patients had difficulties adjusting the headset straps, going through the menu screens to access the app, and calibrating the	<i>"Talking someone through something when you can't see it and they're not always very descriptive about what they can see is challenging and... adjusting the head straps as</i>

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Table 4 (continued)

Theme	Explanation	Illustrative quotes
	controller. Due to COVID-19 protocols, participants were only able to support patients on how to set up the intervention through verbal guidance. This meant setting up the headsets was often challenging and time-consuming.	<i>well. Obviously sometimes it's a little bit blurry unless it fits right onto the head, and I did notice that people were struggling to get that right while they're in the headset. "We spent about half an hour trying to set up the intervention." "It's not that simple. When you put the headset on, you don't click on that app straight away, you've got to go through a few different channels to get to it. Also, we realised that some of the headsets have slightly different setups...so we're explaining it the same way every time, and actually they might be seeing something slightly different, and that obviously complicates it as well." "When the controller is not working there is a need to calibrate it again and this is just one of the practicalities that service users struggle with."</i>
Ward Environment	Therapists reported that the heat on the ward made patients sweat and the headset lenses steam up. Noise and interruptions on the ward were sometimes distracting for them and for the patients during the intervention. They reported that limited staff on the wards may impact their ability to deliver sessions due to the need for two clinicians to deliver it at a time. They reported that the quick turnover of patients could make it difficult for staff to confidently make referrals. They reported that patients' inappropriate behaviour during sessions could make sessions difficult to deliver.	<i>"The headsets were warming up on their faces and got quite sweaty...The temperature on the wards at times led to the lenses steaming up and then... [patients have had to] take the headsets off, wipe the lenses, put them back on, which might recalibrate them." "The environment on the wards is quite chaotic, it's very noisy. Sometimes people are screaming, sometimes people are coming through the room where we are doing the intervention, so there can be a lot of disruptions...And sometimes the noise may not even be bothering the service user who's using the headset because they're so immersed. However, it can be... distracting for us when delivering the intervention." "If there isn't...two of us, we need to ask a member of staff to deliver the intervention with us. This can be a bit... tricky, because staff are usually busy when we ask them to help us deliver the intervention." "He was just making inappropriate remarks about how being around two females made him feel. Despite trying to get him back on track on numerous occasions...he always found a way to go back to that, so it made the session really difficult to carry on."</i>
Recommendations		
Organised Referrals and Record Keeping	Therapists identified that using a shared referrals list and a spreadsheet for patient information were helpful. Sending targeted emails to individual staff	<i>"It's been quite helpful to have a shared Excel sheet where we write down all the referrals that we get, whether they come from the community or from the wards,</i>

Table 4 (continued)

Theme	Explanation	Illustrative quotes
	members was more likely to receive responses and reminder emails brought staff members' attention back to the project. They reported that verbal communication with staff was an effective way of obtaining referrals.	<i>and another one where we write the participant information for all the service users we delivered the intervention to." "I found it very helpful to send emails to care coordinators individually...instead of just sending a big group email and not getting any answers." "That's why the email reminder is helpful because it kind of brings their attention back to the project." "I would say the easiest way is to actually ask people in person 'Do you have any referrals?'...They feel obliged to kind of give you a name right there."</i>
Involve Community and Ward Staff in the Intervention	Therapists reported that when other staff were involved in sessions, they saw the benefits of VR as a tool for patients' treatment. This could increase staff members' willingness to support with promoting the VR and understanding of the intervention so they could make more targeted referrals. Staff involvement also served to minimise risks and challenging behaviour, especially on the wards, where staff members could provide additional information about patients' presentation on the day of the session. They identified that involving staff would enable them to help implement the real-world application of the intervention by assisting patients in an activity they found relaxing following the intervention. They reported that staff involvement also had the potential for staff members to carry out VR sessions independently in future.	<i>"It was quite nice that...as a staff member...she could see the benefits and thought it could be helpful." "Another reason to involve staff that know the service user is that they know their baseline presentation. They know when they change in presentation, and it might just help with any escalation of risk or managing risk." "It might also help reduce the inappropriateness of certain comments." "Having staff in the sessions and co-facilitating the sessions will be a good way to promote the VR relaxation clinic on and across the wards." "If staff were able to either have a go themselves or help with the delivery of the intervention... that would give them a better understanding of what they're referring people for." "One of the benefits of having a staff member in the room is they're gonna see what that person finds relaxing or distressing... and they can then take that forward within their care. So, it might be helpful for the real-world application aspects of the intervention." "If staff have sat in on the intervention they see it, they understand it. There might be capacity for them to then run sessions in the future...without us being there. And then more sessions can be delivered."</i>
Improve Set Up on Headsets	Therapists reported that if patients could access the intervention straight away without having to set it up, this could prevent patients from becoming distressed or frustrated, give them more time in the intervention, and increase their immersion.	<i>"It would really improve the intervention if the service users didn't have to set up the intervention because it can be quite distressing, and it takes time away from the intervention." "Sometimes if it is getting quite complicated with setting it up, people have become a little bit frustrated which initially takes away from the relaxing element of the intervention...if they could just put it on and go, that</i>

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Table 4 (continued)

Theme	Explanation	Illustrative quotes
Increase Facilitation Time and Number of Therapists	Therapists reported that increased time dedicated to the VR clinic would increase the number of referrals they could see in a day. They also reported that it would be helpful to involve more therapists for the VR clinic as they preferred delivering the intervention in pairs, particularly on the wards, to manage disruption and risk.	<i>would just eradicate all of those issues.” “If you were just to go into the environment... you would feel more immersed and more like you’re actually there...going through all of the computer screens just reminds you that it’s virtual reality.”</i> <i>“It would definitely help to have more staff and more time. It would just make it a lot more accessible for people.” “One of the things we have found really helpful is making sure that we do the intervention in pairs because of the disruption and because of not knowing the people when we go on the wards...It’s helped to have somebody else there with us to manage that.”</i>

Note. Therapist participants were not given participant numbers for the analysis due to the clinical discussion-based format of the supervision sessions. Some therapists used terms such as ‘service user’ or ‘client’ to refer to patients as these terms were routinely used in the hospital.

25.50, $p = 0.007$, $r = 0.55$). When comparing restrictive practices in the 12 weeks before VR to the first 12 weeks of VR, incidents decreased by 52.94%, from 34 to 16 incidents. There was a mean of 2.83 ($SD=2.21$) incidents per week in the 12 weeks before VR, which reduced to a mean of 1.33 ($SD=0.78$) incidents per week in the first 12 weeks of VR. This reduction was statistically significant, with a medium effect ($U = 34.50$, $p = 0.023$, $r = 0.46$).

4. Discussion

This study investigated integration of a VR relaxation clinic within acute psychiatric services. Hypotheses that the VR intervention would be feasible, acceptable, and have a positive impact on wards were supported. Qualitative feedback indicated that VR relaxation was a transformatively positive experience for many patients; there was high session completion, considerable time spent in VR, positive short-term benefits to mood, stress, and anxiety; and VR relaxation appeared to support patients with positive behavioural activation and accessing other sources of wellbeing support and stress management. Immersion was high despite delivery in busy, noisy, and challenging clinical settings; patients found the intervention enjoyable, helpful, and relaxing; and reported that VR should be implemented on psychiatric wards to calm and distract patients from distress. Findings of this study are consistent with research on feasibility and helpfulness of VR relaxation for psychiatric patients (Riches et al., 2023a; Veling et al., 2021), while patients’ experience of connectedness to nature and respite from the wards are consistent with research indicating the importance of contact with the natural world to enhance wellbeing and recovery (Jimenez et al., 2021; Tillmann et al., 2018). In restrictive environments, where natural stimuli may be inaccessible, these findings highlight the potential of VR to artificially simulate therapeutic feelings of connectedness to nature.

Despite these positive outcomes, various issues hindered implementation. A considerable number of patients declined VR relaxation, highlighting the importance of patient choice and the existence of potential obstacles to engagement. While therapists enjoyed delivering the intervention and emphasised its benefits, various clinical, technological, and practical issues highlighted the importance of their training and supervision needs, e.g., barriers to the therapeutic relationship, given

that the therapist is in the real world and the patient is in a virtual environment; clinical skills in managing patient worries or anxieties in, or about, VR; integrating operation of VR technology with their clinical approach; supporting patients operating VR technology and adapting to their needs and proficiency; adhering to hygiene protocols; creating optimal referral pathways; and managing the limited involvement of other clinical staff, provision of therapists, time, challenging clinical settings, and space for sessions.

The reductions in violent incidents and restrictive practices are a striking finding, with potential economic implications. This finding suggests VR relaxation could be more widely used as a targeted wellbeing, stress-reduction, and de-escalation intervention to improve the therapeutic culture of psychiatric wards. Patient feedback that the VR was enjoyable, engaging, and novel suggests it may alleviate patient boredom, which is known to exacerbate violence on wards (Fletcher et al., 2021). Despite the limited implementation of VR in this study, it is possible that the interpersonal aspects of inpatient violence (Thibaut et al., 2019) meant that a trickle-down effect of making individual patients calmer may have systemically influenced ward dynamics and interpersonal relations, thereby creating a calmer and more therapeutic ward environment.

Strengths of the study include clinical implementation of a VR clinic in challenging psychiatric settings; the relatively large sample size compared to previous VR studies on psychiatric wards; the diverse sample across various clinical services; adoption of hygiene protocols, and the mixed methods and mixed samples design, which is limited in research on VR-based therapeutic interventions. The findings, particularly the qualitative analyses, provide a template for how therapists might deliver VR relaxation in psychiatric settings, while identifying obstacles that they may face.

Limitations include lack of a control group; use of unstandardised self-report assessments that lack validity and reliability; lack of specific thresholds to measure feasibility; subjective definitions of VAS constructs like “stress”, which hinder objective measurement; the single-session design, which may limit therapeutic effects; the limited scope of interview questions; limited availability of therapists; lack of follow-up on whether patients carried out behavioural activities; and exclusion of patients with the most challenging behaviour, which limits generalisability and prevented access to patients who may have benefitted from VR sessions. The study did not formally assess the virtual environments, which could be a limitation given that some patients identified triggering imagery.

Several methodological limitations make it challenging to discern whether the positive findings were attributable to VR sessions. It is unclear whether outcomes were due to the VR experience, the cognitive behavioural approach, contact with supportive therapists, or other unmeasured variables. Briefing information from therapists to patients about aims to promote relaxation and reduce stress may have resulted in placebo effects for VAS ratings. In relation to the impact on wards, the study design makes it difficult to determine whether reductions in violence and restrictive practices were due to VR or other factors, especially given limited implementation of VR. Reductions may relate to numerous uncontrolled confounders, e.g., staff and patient turnover, varied length of inpatient stays, inconsistent reporting of violent incidents and restrictive practices, COVID-19-related ward changes, patients’ awareness of being evaluated, and their engagement with medication and other therapies. As an initial pilot study, results should be interpreted cautiously and replication within case-control or randomised-controlled designs is necessary to assess the true impact of VR relaxation on ward environments.

The multiple roles of the therapists in the study may amount to a conflict of interest and will have impacted on the reporting of the findings. Therapists delivered sessions, collected patient data in sessions, provided their own qualitative data from their supervision sessions, and contributed to data analysis and the reporting of the findings. However, there were also strengths to this approach. Their integration

with all aspects of the study increased emphasis on their clinical insights. This reflexivity particularly strengthens the qualitative findings. A study aim was to convey therapists' subjective experience of delivering the VR sessions and this was central to the way the findings were reported. However, to reduce the effect of bias, many of the research team, including those who led on the analysis and reporting of the findings, were not study therapists and were independent of the facilitation of VR sessions.

Future research should explore longer-term impact of VR relaxation, including whether patients carry out behavioural activities, multiple session interventions, and longitudinal analyses to assess if benefits are sustained. Studies should investigate potential mechanisms and mediators through which VR relaxation may impact upon wellbeing and ward environments. Future implementation of VR relaxation for patients could explore facilitation by a wider range of therapists, including non-psychologist ward staff. Implementation research should develop a formalised protocol or manual for therapists to deliver VR relaxation that builds on the template developed in this study. Studies could evaluate formalised clinical protocols and further consultation with therapists and other clinicians could investigate impact of VR on psychiatric wards, including interpersonal dynamics of patients.

There is great potential for VR relaxation in other clinical services, e.g. community services, forensic units, or with other populations with emotion regulation and imagery difficulties, such as those with neurodevelopmental conditions (Drigas et al., 2022). However, there is a need to increase focus on the clinical experience. Future studies should consult with patients and clinicians about the design of VR software, interventions, and research methodologies. This consultation could focus on assessment of virtual environments to increase awareness of stimuli that may cause distress; development of more diverse, interactive environments, including those that can be tailored to patients' interests and preferences; and awareness of clinical issues that may affect implementation for patients and clinicians, e.g., investigate whether specific patient groups are excluded, identify barriers to engagement, and improve understanding of therapist experience.

Self-administered VR, without a facilitator, as a self-help intervention to promote autonomy and self-care, could be introduced in settings with limited staffing or in primary care as a preventative tool to support emotion regulation and protect from psychiatric crises. Future research could compare effects of self-administered VR to VR with therapist input, either with or without cognitive behavioural components. This could be used to investigate the effectiveness and feasibility of self-delivered VR relaxation, as opposed to VR relaxation involving therapists and more theoretical, psychological frameworks.

Future studies might also investigate delivering VR relaxation as a staff support intervention for clinicians, especially given they experience high levels of stress, anxiety, and burn-out (Nijland et al., 2021; Riches et al., Under review-a; Riches and Smith, 2022; Riches et al., 2023b), and studies indicate that psychiatric staff may benefit from interventions that are offered to patients (Williams et al., 2022).

In conclusion, this study indicated that VR relaxation was feasible and acceptable to patient participants, and VR relaxation appeared to be associated with reduced violent incidents and restrictive practices on the wards. This suggests VR relaxation might be a way of reducing stress and increasing relaxation for patients with acute psychiatric conditions. There is a need to increase resources and investment in VR relaxation so it can be more robustly tested and made more widely available to patients in psychiatric settings.

Ethics approval and consent to participate

This study was approved by the South London and Maudsley NHS Foundation Trust. All participants provided verbal consent to participate.

Availability of data and material

Ethical approval did not permit sharing of participants' data.

Funding

This study was supported by an Innovation Grant from the Health Innovation Network, the Academic Health Science Network for South London, awarded to Simon Riches and Freya Rumball. Helen L. Fisher was part supported by the Economic and Social Research Council (ESRC) Centre for Society and Mental Health at King's College London [ES/S012567/1]. Authors would like to express their gratitude to the National Institute for Health Research (NIHR) Biomedical Research Centre for Mental Health at South London and Maudsley NHS Foundation Trust and King's College London. The views expressed are those of the author (s) and not necessarily those of the NHS, the NIHR, Department of Health, the ESRC, or King's College London.

Authorship contribution statement

Simon Riches, Freya Rumball, Wim Veling, Catheleine van Driel, James Payne-Gill, Lucia Valmaggia, and Helen L. Fisher conceived the concept and the design of the study. Carolina Fialho, Jordan Little, Lava Ahmed, Harley McIntosh, Ina Kaleva, Tom Sandford, Rebecca Cockburn, and Clarissa Odoi conducted the data collection under the supervision of Simon Riches. Simon Riches, Sarah L. Nicholson, Carolina Fialho, James Payne-Gill, Jordan Little, Lava Ahmed, Harley McIntosh, and Ina Kaleva conducted the analysis. Simon Riches and Sarah L. Nicholson led on writing the manuscript. All authors contributed to and approved the final manuscript.

Declaration of Competing Interest

Wim Veling is cofounder of VRelax BV, the company that has developed the VR application in collaboration with University Medical Center Groningen, and holds shares in VRelax BV. To address this competing interest, Wim Veling had an advisory role in study design and was not involved in data collection or data analysis. Some of the co-authors were also therapist participants in the study, which will have impacted on the reporting of the findings. There are no other conflicts of interest.

Acknowledgments

The authors thank the participants for their involvement in this study and the Health Innovation Network for supporting this project.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.psychres.2023.115477](https://doi.org/10.1016/j.psychres.2023.115477).

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