Virtual Reality as a Mental Health Education Tool for Healthcare Professionals

Stephanie Stubbs

Registration Number: 100153064/2

Thesis submitted in partial fulfilment of the degree of

Doctorate in Clinical Psychology

Faculty of Medicine and Health Sciences

University of East Anglia

Primary Supervisor: Dr Adrian Leddy

Secondary Supervisor: Dr Jordan Tsigarides

March 2026

Word count: 23737

This copy of the thesis has been supplied on condition that anyone who consults it is understood to recognise that its copyright rests with the author and that use of any information derived there from must be in accordance with current UK Copyright Law. In addition, any quotation or extract must include full attribution.

Thesis Portfolio Abstract

Background: Immersive virtual reality (IVR) delivered via head-mounted displays (HMDs) is an emerging education tool increasingly used in healthcare training. However, comparatively limited evidence exists regarding its application within mental health education. This thesis aimed to evaluate the emerging evidence base for IVR as a mental health education tool for healthcare professionals (HCPs) and students.

Method: A systematic review and meta-analysis examined the utility, acceptability, effectiveness, and limitations of IVR as a mental health education tool across studies (N = 15). Given study heterogeneity, findings were synthesised narratively, with exploratory meta-analyses conducted for adverse effects and selected effectiveness outcomes. An empirical pre-post study (N = 70) examined a VR simulated psychosis (VRSP) intervention on healthcare students' stigma-related outcomes (attitudes, empathy, social distance, and continuum beliefs) and adverse effects.

Results: Three primary categories of IVR simulation emerged in the systematic review: (1) diagnostic interview and consultation skills; (2) patient-perspective; and (3) risk assessment and management. Meta-analyses examining empathy, stigma, and attitudinal outcomes were not statistically significant; however, pooled estimates were small and directionally favoured IVR over comparators. In the empirical study, significant reductions were observed in stigmatising attitudes and desire for social distance, alongside significant increases in empathy and continuum beliefs. Across both components, adverse effects were generally low.

Discussion: This portfolio highlights IVR as a safe and acceptable approach to mental health training, warranting consideration within healthcare curricula. However, methodological limitations and mixed findings indicate that further adequately powered controlled research is required before firm conclusions regarding comparative effectiveness can be drawn.

Access Condition and Agreement

Each deposit in UEA Digital Repository is protected by copyright and other intellectual property rights, and duplication or sale of all or part of any of the Data Collections is not permitted, except that material may be duplicated by you for your research use or for educational purposes in electronic or print form. You must obtain permission from the copyright holder, usually the author, for any other use. Exceptions only apply where a deposit may be explicitly provided under a stated licence, such as a Creative Commons licence or Open Government licence.

Electronic or print copies may not be offered, whether for sale or otherwise to anyone, unless explicitly stated under a Creative Commons or Open Government license. Unauthorised reproduction, editing or reformatting for resale purposes is explicitly prohibited (except where approved by the copyright holder themselves) and UEA reserves the right to take immediate ‘take down’ action on behalf of the copyright and/or rights holder if this Access condition of the UEA Digital Repository is breached. Any material in this database has been supplied on the understanding that it is copyright material and that no quotation from the material may be published without proper acknowledgement.

Contents

LIST OF TABLES **4**

LIST OF FIGURES **5**

ACKNOWLEDGEMENTS **6**

DECLARATION **7**

CHAPTER ONE INTRODUCTION TO THE THESIS PORTFOLIO **8**

Introduction 9
Thesis Aims and Overview 14

CHAPTER TWO SYSTEMATIC REVIEW AND META-ANALYSIS **16**

Abstract 18
Introduction 19
Methods 21
Results 24
Discussion 45
References 52

CHAPTER THREE EMPIRICAL RESEARCH STUDY **62**

Abstract 64
Introduction 65
Method 68
Results 74
Discussion 79
References 83

CHAPTER FOUR DISCUSSION AND CRITICAL EVALUATION **93**

Discussion and Critical Evaluation 94
Critical Review 96
Clinical Implications 100
Directions for Future Research 103
Conclusion 104

REFERENCES **106**

APPENDICES **132**

Appendix A Glossary of Key Extended Reality Terms 132
Appendix B Systematic Review Journal Guidelines 133
Appendix C Mixed Methods Appraisal Tool (MMAT) 134
Appendix D Empirical Research Study Journal Guidelines 135
Appendix E Ethical Approval 136
Appendix F Electronic Patient Information Sheet 138
Appendix G Initial Screening Questionnaire 141
Appendix H Consent Form 142
Appendix I Empirical Study Measures 143
Appendix J Psychosis Factsheet 153
Appendix K Debrief Form 154
Appendix L Permission to use the JSE-HPS 157

List of Tables

CHAPTER TWO: SYSTEMATIC REVIEW AND META-ANALYSIS

Table 1. Quality Appraisal as Assessed using the MMAT

Table 2. Characteristics of Included Studies

Table 3. Random-Effects Meta-Analyses for Empathy, Stigma, and Attitudes

CHAPTER THREE: EMPIRICAL RESEARCH STUDY

Table 4. Demographic Characteristics

Table 5. Changes in AQ-27 Subscale Scores from Pre- to Post-Intervention

List of Figures

CHAPTER TWO: SYSTEMATIC REVIEW AND META-ANALYSIS

Figure 1. PRISMA Flowchart

Figure 2. Forest Plot of Mean SSQ Scores Following IVR Exposure

Figure 3. Forest Plot of Empathy, Stigma, and Attitude Post-Scores for IVR versus Comparator Conditions

CHAPTER THREE: EMPIRICAL RESEARCH STUDY

Figure 4. Study Procedure Flowchart

Figure 5. Example of Two VRSP Scenes

Figure 6. Changes in Stigma-Related Outcomes Following the VRSP Intervention

Figure 7. Cybersickness Mean Scores Bar Chart

Acknowledgements

I would like to start by formally thanking my thesis supervisors, Dr Adrian Leddy and Dr Jordan Tsigarides, for their continued support and encouragement throughout the entire process. Their impeccable knowledge in the field made this process considerably more interesting and enjoyable, and I am very grateful to have worked alongside them.

I would also like to extend a special thank you to Phillip Roberts for his statistical support, and to Dr Olivia Hannah for leading the development and feasibility study of the virtual reality programme I utilised in my empirical study. Subsequently, I would like to thank all the participants who took time out of their days to participate in my study. I appreciate how busy healthcare courses are and am touched by how well received the study was. I wish you all the best for the rest of your degrees and subsequent careers.

To lifelong friends, and friends who have become lifelong since starting the Doctorate, I am so lucky to have you by my side. Thank you for the endless support and laughter, with a special thanks to Amelia who has been on this psychology journey with me since I was 19. We have come a long way, and nothing has felt more appropriate than completing this course with you by my side. Finally, I would like to thank my family. Thank you for all the games and breaks amongst the busyness, especially George who has been the most supportive husband, and Julie, who was proofreading my university work long before becoming my mother-in-law. However, the biggest thank you must go to my parents for providing me with more opportunities than I can count and for supporting me throughout the whole journey and with my ‘homework’.

Declaration

This portfolio draws from material written for the ClinPsyD Thesis Proposal, which was submitted as a summative assignment in 2024. This material has been adapted and used to guide the work throughout this thesis.

CHAPTER ONE

Introduction to the Thesis Portfolio

Introduction

This chapter aims to introduce immersive virtual reality (IVR) delivered via head-mounted displays (HMDs), outlining its technological development, before examining its application within healthcare education. It then considers the emerging use of IVR in mental health education, as well as the gaps within the literature. The chapter concludes by outlining the aims and structure of the thesis portfolio, which comprises of a systematic review and meta-analysis followed by an empirical research study.

Virtual Reality

Over the past decade, extended reality (XR) technologies have advanced rapidly, expanding beyond traditional screen-based interfaces to create increasingly interactive digital experiences (Lee, 2025). XR serves as an umbrella term, which encompasses augmented reality (AR), virtual reality (VR), and mixed reality (MR), each differing with how digital content is displayed in comparison to the real world. While AR overlays virtual elements onto the physical world, enabling users to perceive both simultaneously, VR aims to fully transport users into a computer-generated or 360° recorded video environment (Lee, 2025; Slater & Sanchez-Vives, 2016). Alternatively, MR combines both technologies, enabling users to interact and manipulate virtual stimuli as though they coexist within the physical world (Bekele & Champion, 2019; Lee, 2025).

Although technology has advanced the development of XR in recent years, the concept of simulating reality predates the digital era, including visually immersive art and theatre. This was enhanced in the 1830s by the understanding of stereopsis, the perceptual phenomenon whereby slightly different two-dimensional images presented to each eye are cognitively perceived as a singular three-dimensional image (King, 2013; Wheatstone, 1938). Stereopsis was initially understood using drawings and later photography, and it continues to

underpin VR today (King, 2013; Moscoso et al., 2022; Wheatstone, 1938). However, it was not until the digital age and the advancements in technology, through which simulating reality became more 'virtual' by using computers and HMDs.

Despite the widespread use of the term 'virtual reality', the vast and ever-changing development of VR has led to inconsistency within the literature around how to define it. In healthcare research, Abbas et al. (2023) synthesised the different definitions and defined VR as "a three-dimensional computer-generated simulated environment, which attempts to replicate real world or imaginary environments and interactions, thereby supporting work, education, recreation, and health" (p.7). However, this fails to recognise VR healthcare environments captured using 360° video recordings (Restout et al., 2023) or how VR systems can vary in their degree of 'immersion', which is the technological ability to immerse users within a virtual world and isolate them from reality (Savickaite et al., 2022).

Consequently, VR systems are commonly categorised as non-immersive, semi-immersive, and fully immersive (Rose et al., 2018). Non-immersive systems typically involve smaller screens, such as computers, while semi-immersive systems utilise larger or panoramic screens. Fully IVR is primarily delivered through HMDs, combined with headphones for sound and controllers or gloves for haptics (sense of touch and motion) to create a multi-sensory 360° experience. This level of immersion and sensory integration can elicit a sense of 'presence', which is the extent an environment, person, object, or other stimulus appears to exist in the same world as the user (Felton & Jackson, 2021; Savickaite et al., 2022).

Although early HMDs were developed in the 1960s (Abes et al., 2025; Slater & Sanchez-Vives, 2016), there has been a rapid growth in its application since the release of low-cost, consumer available versions, such as the Google Cardboard in 2015 and Oculus

Rift in 2016, making them more accessible to a wider audience. Accessibility further increased with the release of newer wireless devices, such as HTC VIVE Focus in 2018 and Oculus Quest in 2019. These do not need to be connected to high-graphics computers and can 'room-scale' (calibrate to any sized room) to track the position of the HMD and user (Schjerlund et al., 2018; Wohlgenannt et al., 2020).

This new generation of VR is often referred to as the modern era of VR, and as such IVR HMDs are increasingly being used in research and educational settings (Jensen & Konradsen, 2018). Whilst there are other VR devices, such as the Cave Audio Visual Experience (CAVE) system, where virtual worlds are projected into a multi-screened room (Cruz-Neira et al., 1992), their level of immersion and presence can vary. CAVE systems have also been considered less immersive than HMDs, as the user can see the room in which the virtual environment is being projected. Moreover, they are less accessible due to the required space and cost (Mestre, 2017; Slater & Sanchez-Vives, 2016). For clarity and consistency, IVR within this thesis refers specifically to VR delivered through HMDs (see Appendix A for a glossary of key XR terms).

IVR Healthcare Education

Alongside academic teaching, healthcare education frequently relies on workplace-based learning. While these approaches provide valuable experiential opportunities, they can be resource-intensive, logistically complex, high-risk, and at times daunting for trainees (Kamphuis et al., 2014). Educational technology therefore offers a complementary approach for delivering a safe and cost-effective alternative. This has particular promise for its ability to replicate real-world clinical situations in a controlled manner (Kamphuis et al., 2014; Pottle, 2019). Consequently, there has been a paradigm shift to integrate digital strategies into healthcare curricula (Gerup et al., 2020).

IVR allows users to continue to learn through experience, drawing on experiential, constructivist, and situated learning theories (Kolb, 1984; Marougkas et al., 2023; Lave & Wenger, 1991; Piaget, 1970; Vygotsky, 1978). It has been proposed to be particularly beneficial for healthcare training due to its capacity to replicate a variety of clinical scenarios, with increased quality and adherence to training protocols (Pottle, 2019). Additionally, VR allows for autonomous repeated learning, enabling users to make mistakes without serious consequences to themselves or patients. This can create psychologically safe and enjoyable learning (Kamphuis et al., 2014; Pottle, 2019). Moreover, being able to provide mass training with minimal resources is especially important given the global and national shortages of healthcare workers (HM Government, 2024; Kyaw et al., 2019; World Health Organization, 2026).

Recent reviews have explored the application and effectiveness of IVR in healthcare education and recommend the adoption of IVR into healthcare training programmes (Kyaw et al., 2019; Philip & Savundranayagam, 2025). Applications within healthcare range in their level of interactivity, broadly falling into passive IVR experiences, in which learners observe a scenario without controlling it, and active IVR, where users can interact and make decisions (Philip & Savundranayagam, 2025). Passive IVR was shown to be particularly effective for enhancing understanding of specific health conditions and providing ‘day in the life’ perspectives of someone living with the condition (Philip & Savundranayagam, 2025). This led to reported improvements in knowledge, empathy, and communication skills, and was considered especially beneficial for novice learners, such as students. Alternatively, active IVR was found to be most effective when practicing clinical skills or for knowledge assessment training, with the aim to improve confidence and proficiency, without harming patients. This was especially seen for surgical training, but also across other health professions, such as nursing.

Both passive and active IVR were considered cost-effective training solutions, with advantages over traditional methods, such as lectures, online learning modules, role-play, or cadavers/mannequins (Philip & Savundranayagam, 2025). Kyaw et al. (2019) also found in their review greater improvements in users' knowledge and clinical skills following IVR compared with traditional approaches or other forms of digital learning. However, the evidence base for both reviews were limited and heterogeneous, and they varied in methodological rigour, making it difficult to draw definitive conclusions regarding effectiveness.

IVR Mental Health Education

A technological revolution has also occurred within mental health fields; however, the predominant focus has been on therapeutic application for patients. VR has been applied across a range of patient interventions, most commonly in the treatment of anxiety disorders and phobias (Cieślik et al., 2020). In contrast, comparatively limited attention has been directed towards the use of IVR as a mental health educational tool for healthcare professionals (HCPs) and students. Consequently, there is a risk of falling behind other professions, such as surgeons and nurses, where IVR has been more extensively adopted into education (Lie et al., 2023; Philip & Savundranayagam, 2025).

IVR holds distinct potential within mental health education due to its capacity to simulate psychological experiences and conditions through presence and embodiment, that are difficult to replicate through traditional training methods. It also offers advantages for high-risk or emotionally complex scenarios, enabling repeated practice without risk to service users, while providing standardised, scalable training, assessment, and examination opportunities. Furthermore, IVR can enable learners to embody virtual patients with mental health conditions, facilitating insight into patients' perspectives.

IVR may be especially valuable for mental health presentations, such as psychosis, which are characterised by complex cognitive symptoms. Psychosis is a syndrome with three main symptoms: hallucinations (sensory experiences in the absence of external stimuli), delusions (strong beliefs not shared by others), and disordered thinking and speaking (NHS, 2023). Within western healthcare systems, the presence of such symptoms may contribute to a diagnosis of a psychotic disorder, such as schizophrenia. Whilst there are some insights into the aetiology and pathology of psychotic symptoms, its precise causes remain incompletely understood (Gaebel & Zielasek, 2015). This can lead to individuals developing personal attributions regarding symptom onset, which can contribute to stigma and hinder help-seeking behaviour (Colman et al., 2020; Weiner et al., 1988). IVR may therefore offer a potential mechanism for addressing psychosis-related stigma by enabling users to experience simulated hallucination and delusions within a controlled, multisensory environment, aiding learning in ways that traditional educational methods cannot replicate.

Despite these theoretical advantages, the use of IVR within mental health education remains in its infancy. To date, the acceptability, utility, and effectiveness have not yet been comprehensively synthesised. Additionally, a greater understanding of the limitations within this context are required, such as the risk of adverse effects, including cybersickness symptoms (e.g. nausea, disorientation). Accordingly, further systematic evaluation and research is required to build the evidence base and inform the development and implementation of IVR mental health education training for HCPs and students.

Thesis Aims and Overview

There is a recognition that future research should address the disparities in developing and evaluating IVR training programs in underrepresented professions (Philip & Savundranayagam, 2025). This thesis therefore aims to systematically evaluate and extend

the emerging evidence base regarding the use of IVR as a mental health education tool for HCPs and students.

Chapter Two presents a systematic review and meta-analysis examining the utility, acceptability, effectiveness, and limitations of IVR as a mental health education tool. This is then followed by the empirical research study presented in Chapter Three, which specifically explores how sensitive a VR simulated psychosis (VRSP) HMD intervention is at influencing psychosis-related stigma outcomes, including stigmatising attitudes, empathy, desire for social distance, and continuum beliefs. This builds upon a feasibility study, which assessed the VRSP intervention, demonstrating it to be a feasible and acceptable intervention for healthcare students, with the potential to increase empathy and decrease stigmatising attitudes (Hannah et al., 2025). The final chapter integrates the findings from both components, considering strengths and limitations, clinical implications, and directions for future research, before concluding the thesis portfolio.

CHAPTER TWO

Systematic Review and Meta-Analysis

Written based on guidance for submission to

International Review of Psychiatry, Taylor & Francis (Appendix B)

Head-Mounted Virtual Reality as a Mental Health Educational Tool for Healthcare Professionals: A Systematic Review and Meta-Analysis

Stephanie Stubbs[1], Amelia Smith[1], Jordan Tsigarides[1], Adrian Leddy[1]

[1]Norwich Medical School, University of East Anglia, Norwich, UK.

Word Count: 9203

Abstract Word Count: 200

Author Note

Stephanie Stubbs https://orcid.org/0009-0004-3591-3229

Amelia Smith https://orcid.org/0009-0002-5031-8634

Jordan Tsigarides https://orcid.org/0000-0001-9893-8002

Adrian Leddy https://orcid.org/0000-0002-7803-9437

Correspondence: Adrian Leddy, Norwich Medical School, University of East Anglia, Norwich, UK. Email: a.leddy@uea.ac.uk

Abstract

Immersive virtual reality (IVR) is increasingly used in healthcare, with recent initiatives exploring its use in mental health education. This systematic review (PROSPERO; CRD42024619188) investigated IVR delivered via head-mounted displays, as training tools for healthcare professionals and students, looking at its utility, acceptability, effectiveness, and limitations within mental health. MEDLINE, PsychInfo, EMBASE, PubMed, and CINAHL databases were searched. A total of 15 quantitative and mixed-method studies published between 2015-2025 were included. Findings were synthesised narratively given study heterogeneity. Where data permitted, exploratory meta-analyses were conducted for adverse effects and effectiveness outcomes. Three types of simulations were identified: (1) diagnostic interview and consultations skills; (2) patient-perspective; and (3) risk assessment and management. Across studies, adverse effects following IVR exposure were generally low. Effectiveness meta-analyses indicated non-significant effects for empathy, stigma, and attitudes; however, pooled estimates were small and directionally favoured IVR over comparators. Interpretation is limited by the small number of studies, modest sample sizes, and heterogeneity. However, IVR appears feasible and acceptable, showing promise as a psychoeducational training tool. Future research should prioritise adequately powered trials, addressing implementation barriers related to technological limitations to inform future delivery of IVR within mental health training.

Keywords: Virtual Reality, Mental Health, Education

Introduction

Harnessing digital innovation and reforming education and training of healthcare professionals (HCPs) is a central part of the UK Government (2025) 10-year NHS plan, with education expansion having a strong emphasis on mental health needs (NHS England, 2023). These priorities are reflected in national initiatives supporting the development and evaluation of emerging technologies for mental health, including 'Innovate UK's Mindset extended reality (XR) for digital mental health programme', which aims to grow the UK's immersive digital mental health sector (UK Research and Innovation, 2026). Developing mental health education across the workforce is especially important as mental health conditions are commonly encountered across general NHS care pathways, not just specialist mental health services.

Virtual Reality (VR) is one form of XR technology that has gained increasing attention within healthcare education. A systematic review exploring terminology defined VR as "a three-dimensional computer-generated simulated environment, which attempts to replicate real world or imaginary environments and interactions, thereby supporting work, education, recreation, and health" (Abbas et al., 2023, p.7). VR can be fully immersive, such as through the use of head-mounted displays (HMDs), or non-immersive, using devices such as computer screens. In the modern era of VR, marked by the release of consumer-oriented devices, such as the Oculus Rift in 2016, VR HMDs have become more accessible and affordable for the public, and are increasingly being used in research and educational settings (Jensen & Konradsen, 2018). Due to this increased popularity, this systematic review focuses specifically on immersive VR (IVR) delivered through HMDs.

Within education, IVR allows learners to interact with realistic scenarios in a safe environment, with the potential to connect theoretical constructs with clinical applications

through active learning (Marougkas et al., 2023). Advances in technology, increased digital literacy, and reduced cost, have contributed to the growing incorporation of IVR across medical fields, offering cost effective, standardised, and repeatable on-demand training (Pottle, 2019). VR has also demonstrated to be an effective method for medical training across several meta-analyses, with moderate-to-large effects sizes when compared to traditional educational approaches (Hongthong et al., 2025; Kim & Kim, 2023; Zhao et al., 2020).

In parallel, VR has increasingly been applied within clinical psychology and psychiatry for therapeutic interventions. Systematic reviews and meta-analyses indicate promising effects for VR interventions in the treatment of anxiety disorders (Horigome et al., 2020; Schröder et al., 2023), eating disorders (Clus et al., 2018), neurodevelopmental spectrum conditions (Karami et al., 2021; Tan et al., 2022), post-traumatic stress disorder (Kothgassner et al., 2019; Wenrui et al., 2019) and psychosis (Riches et al., 2021). However, despite this expanding clinical evidence base, considerably less attention has been paid to the use of IVR as a mental health educational tool for HCPs.

IVR may hold particular promise for mental health education given its novel ability to enable experiential learning of complex mental health scenarios through controlled, repeatable simulations. A scoping review found augmented reality (AR) and VR are starting to be used to improve knowledge, attitudes, empathy, and stigma related to people with mental health conditions, with studies mostly conducted on undergraduate students but also professionals and carers (Tay et al., 2023). However, despite this increased application, to the authors' knowledge, no systematic review has been undertaken to examine the use of IVR as a mental health education tool for HCPs and students. This systematic review therefore aimed to address the gap by exploring: (1) how IVR is being used; (2) the safety and acceptability of

IVR training; (3) its effectiveness; and (4) the limitations of IVR, within the context of mental health education.

Methods

This systematic review was registered on the International Prospective Register of Systematic Reviews (PROSPERO; CRD42024619188; 20/12/2024) and followed the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines (Page et al., 2021).

Search Strategy

The primary researcher (SS) completed the systematic literature search on the 28th of November 2025 using PubMed, MEDLINE, PsycINFO, Embase, and CINAHL. Peer-reviewed studies published in English from 2015 onwards were included to ensure relevance to the modern era of IVR HMDs. All fields were searched, including titles, abstracts and keywords, using the following search terms [“virtual reality” OR VR OR “augmented reality” OR “VR environment” OR “VR simulation” OR “VR character” or AR OR “mixed reality" OR MR OR "extended reality" OR XR or "head-mounted" OR "head-mounted displays" OR HMD OR "face-mounted" OR "helmet mounted" OR "head-worn" OR headset OR "smart glasses"] AND [mental OR "mental health" OR "mental illness" OR "mental disorder" OR "psychiatric illness*" OR psychology OR anxiet* OR phobia* OR "eating disorder*" OR depress* OR psychosis OR schizo*] AND ["healthcare students" OR "healthcare professional*" OR staff OR profession*] AND [education OR "education tool" training OR teaching].

Disorder-specific search terms were included as supplementary keywords to improve search sensitivity. They represent common psychiatric conditions and were not intended as an exhaustive list of mental health disorders. Broad search terms, including “mental disorder”,

were used to capture studies relating to other psychiatric conditions not explicitly specified. Manual searches of reference lists were also conducted to minimise the risk of omitting relevant studies.

Inclusion and Exclusion Criteria

The Population, Intervention, Comparison, Outcomes (PICO) framework was used to structure the review and eligibility criteria. Studies were included if they evaluated IVR training delivered via a HMD for healthcare students or professionals, focused on education about mental health disorders, and reported outcomes related to effectiveness, safety, acceptability, and/or limitations. Studies with or without a comparator were eligible. Purely qualitative studies were excluded because the primary aim was to quantitatively synthesise the evidence. Restricting the inclusion criteria increased methodological consistency and enabled comparisons across studies. Studies were also excluded if they were not available in full text or not published in English due to insufficient methodological detail and limited translation resources.

Study Selection

SS performed initial screening through title and abstract review. 20% of studies were randomly selected for independent screening by AS to minimise bias and increase consistency. The inter-rater reliability for the initial screening was considered ‘substantial’, ($AC_1 = 0.74$; Gwets, 2008). Full texts of eligible studies were then reviewed using the same screening process and there was considered an ‘almost perfect’ agreement ($AC_1 = 0.84$; Gwets 2008). Discrepancies were resolved through discussions with the wider research team.

Data Extraction

The following data from eligible studies were extracted by SS: (1) study details (e.g. author, publication year, country, sample size and characteristics), (2) type of IVR

intervention including content, duration, and HMD type, (3) comparator group content and delivery, (4) outcome measures used, (5) pre- and post-outcome data and IVR adverse effects data, and (6) reported limitations with the IVR intervention (e.g. high latency). Where possible, means and standard deviations were extracted. Study authors were contacted if further clarification or data was required.

Quality Appraisal

The quality of the eligible studies was assessed by SS using The Mixed Methods Appraisal Tool (MMAT; Hong et al., 2018; Appendix C). AS assessed 27% of the studies (*n* = 4), with an 80.6% agreement rate. Discrepancies were resolved through discussions with the wider research team. As recommended, all studies were included in the review and the protocol was to conduct sensitivity analyses as required (Hong et al., 2018). The MMAT is a widely used quality appraisal tool and has been used in reviews like the current one (Lampropoulos & Kinshuk, 2024; Rincon et al., 2023). The MMAT has particular value when there are heterogenous designs across studies (Hong et al., 2019).

Analysis

A narrative synthesis (Popay et al., 2006) was the primary approach because the number of included studies was limited and there was substantial heterogeneity in study design, interventions, outcome measures, and reporting, which restricted the feasibility of robust meta-analyses. Outcomes were organised by construct to support comparability across studies. The most frequently reported educational outcomes (empathy, stigma, knowledge, and attitudes) were synthesised in detail; less frequently reported outcomes were summarised descriptively. Mean adverse-effect scores were converted to percentages of the possible scale range (accounting for non-zero lower bounds) to allow comparison between studies.

Where quantitative pooling was considered feasible, RStudio (version 2025.09.2+418) was first used to harmonise measures so that effect estimates had a consistent direction. For IVR adverse effects, an exploratory single-arm random-effects meta-analysis pooled post-intervention mean scores for studies using the same instrument, as many studies lacked a comparable control group. For effectiveness outcomes with at least three sufficiently comparable studies (e.g. same construct, measure, and post-intervention timepoint), exploratory random-effects meta-analyses were conducted using standardised mean differences (Hedges' *g*) based on post-intervention scores to account for between-study and baseline heterogeneity. Statistical heterogeneity was summarised using the I^2 statistic and interpreted cautiously given the small number of studies.

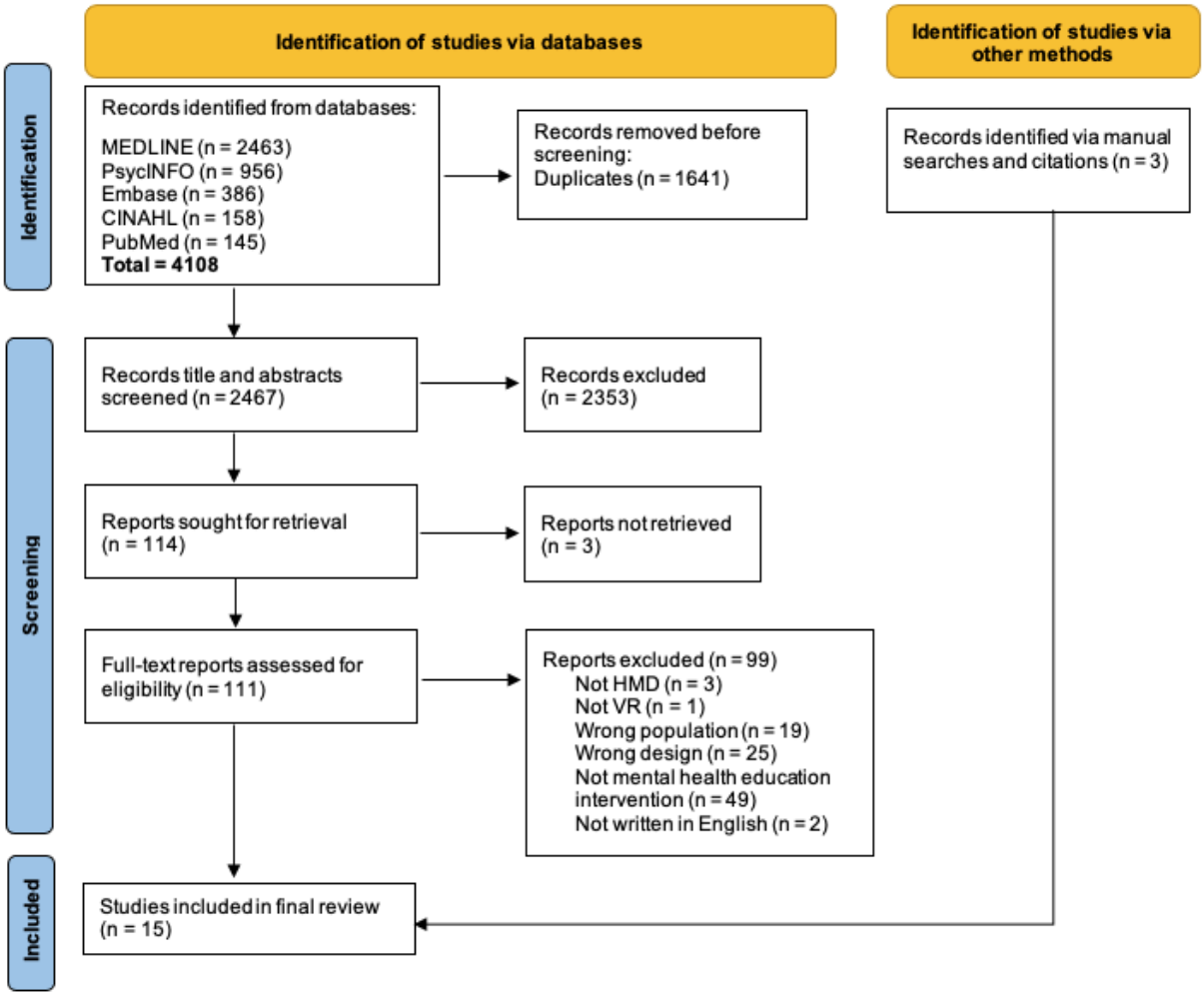
Sensitivity analyses using change scores with assumed pre–post correlations ($r = 0.3$–0.7) were conducted, as post-scores can be more conservative whilst change scores are more likely to produce significant results (Fu & Holmer, 2016). Between-study variance (τ^2) was estimated using restricted maximum likelihood, and 95% confidence intervals were calculated using normal approximation, noting the exploratory nature of the analyses.

Results

A total of 2467 records were screened following the removal of duplicates, and 15 studies were included in the final review (Figure 1). Studies were commonly excluded if they did not use a mental health educational IVR intervention regarding a mental health condition or if the intervention's main aim was to improve HCPs own mental health (e.g. reduce anxiety/burnout). Two authors were contacted for clarification regarding adverse effects (Pina-Thomas et al., 2025; Ng et al., 2025). Ng et al. (2025) responded, and their data was included in the meta-analysis.

Figure 1

PRISMA Flowchart



Quality Assessment

Of the studies assessed as RCTs using the MMAT (n = 8), most met the criteria for having complete outcome data (n = 6) and participants adhering to the assigned intervention (n = 7). Lack of assessor blinding was a common methodological limitation (n = 7), and studies often did not clarify their randomisation processes (n = 5), making this difficult to assess. All non-randomised quantitative studies (n = 3) were assessed as having administered the intervention as intended, with appropriate measures and participants representative of the

target population, as well as most having complete outcome data (n = 2). In all three studies it was not clear whether confounders were accounted for in the design and analysis.

All mixed-method studies (n = 4) had a good rationale for using their design, integrated the different components effectively, and addressed inconsistencies. However, the quality of quantitative components was lower than the qualitative aspects for reasons such as, not using validated or reliable measures, and confounders not accounted for in the design and analysis. Table 1 highlights the overall mix of methodological quality of the studies included in this review, with many also lacking statistical power due to limited sample sizes and being feasibility or pilot studies. These findings informed the interpretations and conclusions made in this review.

Table 1

Quality Appraisal as Assessed using the MMAT

Study	Qualitative					RCT					Non-Randomised					Descriptive					Mixed Methods				
	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5
Bahadur et al., 2024											Y	Y	Y	CT	Y										
Graf et al.,2024	Y	Y	Y	Y	Y											Y	N	N	CT	Y	Y	Y	Y	Y	N
Gutierrez-Maldonado et al., 2015						CT	CT	Y	N	Y															
Heys et al.,2022	Y	Y	Y	Y	Y						Y	CT	Y	N	Y						Y	Y	Y	Y	N
Hiley et al.,2024						CT	CT	CT	N	CT															
Laker et al.,2025	Y	Y	Y	Y	Y						Y	N	N	N	Y						Y	Y	Y	Y	N
Lan et al.,2023											Y	Y	Y	N	Y										
Lem et al., 2022	Y	CT	Y	Y	Y	Y	Y	Y	N	Y											Y	Y	Y	Y	N
Lin et al., 2024						Y	Y	Y	N	Y															
Marques et al., 2022						CT	Y	Y	N	Y															
Ng et al., 2025											Y	Y	N	CT	Y										
Phiri et al., 2024						CT	CT	N	N	Y															
Pina-Thomas et al., 2025						Y	Y	Y	Y	Y															
Tay et al., 2025						Y	Y	Y	N	Y															
Zare-Bidaki et al., 2022						CT	Y	Y	N	Y															

Note. N = No, Y = Yes, CT = Can't Tell

Study Characteristics and Utility

Table 2 summarises the characteristics of the 15 included studies published between 2015 to 2025 across 11 countries. Sample sizes ranged from 5 to 180, with medical and nursing populations being the most commonly recruited. A variety of different HMDs were used across the studies with Meta being the most common brand (n = 3). Six studies did not specify the HMD used.

A diverse range of IVR interventions were used and can be categorised into three types of simulations: diagnostic interview and consultation skills (n = 4), patient-perspective (n = 8), and risk assessment and management (n = 3). The most common type of intervention was embodied psychosis patient-perspective simulations (n = 5). 10 studies had a comparison group, which varied from a comparator IVR intervention (e.g. IVR simulation without psychosis hallucinatory experiences), non-immersive intervention (e.g. 2D computer version), and real-life interventions (e.g. visit patient on a ward). Across the studies, the outcomes measured could be categorised into four domains: (1) educational effectiveness and skills (e.g. diagnostic understanding, knowledge acquisition, communication skills); (2) attitudinal (e.g. empathy, attitudes, stigma, and social distance); (3) acceptability and user experience (e.g. usability, presence); and (4) safety and tolerability (e.g. adverse effects).

Table 2

Characteristics of Included Studies

Authors (Country)	Study Design	Sample Size	Mean Age	Healthcare Population	IVR Intervention	Comparison Group	Outcome Measures	HMD	IVR Duration (min)
Diagnostic Interview and Consultation Skills Simulation									
Graf et al. 2024 (Germany)	Mixed Methods (feasibility)	5	24.2	Medical students	Mental health diagnostic interview simulation	None	Believability (RDM) Semi-structured interview (RDM) Hints/error log simulation data	Meta Quest Pro	33.7
Gutiérrez-Maldonado et al. 2015 (Spain)	Quasi-experimental	52	N/R	Students	Immersive differential diagnosis interview simulation	Non-immersive differential diagnosis interview computer simulation	Diagnostic interview skills test (RDM) Usability (SUMI)	Oculus Rift DK1	N/R
Hiley et al. 2024 (UK)	2-stage pilot feasibility and evaluation	123	24.3	HCPs and students	Perinatal mental health consultation simulation	Augmented reality (AR) of the same perinatal mental health consultation simulation	Cognitive learning (PMHAFS) Affective learning (RDM) Student Satisfaction and Self-Confidence in Learning Scale	Meta-Quest 2 (VR) Microsoft HoloLens 2 (AR)	15

							Career aspirations (RDM) Presence (IPQ) Usability (SUS) Adverse effects (VRSQ subscale scores only)		
Lan et al. 2023 (Taiwan)	Instrument development and cross-sectional validation	36	N/R	Psychologists and psychology students	Virtual intake OSCE based on depression diagnosis	None	OSCE performance score (RDM) Written station score (RDM)	HTC Vive	20
Authors (Country)	**Study Design**	**Sample Size**	**Mean Age**	**Healthcare Population**	**IVR Intervention**	**Comparison Group**	**Outcome Measures**	**HMD**	**IVR Duration (min)**
Patient-Perspective Simulations									
Heys et al. 2022 (UK)	Mixed methods (pilot)	10	N/R	Midwives	Birth trauma and PTSD simulation (third-person perspective of patient)	None	Knowledge (RDM) Attitudes (RDM)	VR Google Cardboard	7
Laker et al. 2025 (UK)	Mixed methods (preliminary)	21	N/R	Nursing students	Mental health ward simulation (third-person perspective of patient)	None	Qualitative interview (RDM) Anxiety and confidence scale (RDM)	N/R	5

Lem et al. 2022 (Japan)	RCT (pilot)	16	N/R	Medical students	Embodied depression simulation (multiple perspectives: third-person, counsellor, and patient)	Non-immersive 2D 'Black Dog' depression video (third-person perspective)	Depression Stigma (DSS) Social Distance (ASD) Knowledge (RDM) Feasibility and usability (adapted from WBLT) Adverse effects (usability scale)	N/R	5
Lin et al. 2024 (Taiwan)	RCT (pilot)	59	N/R	Medical students	Embodied depression simulation (e.g. inattention, ruminating thoughts, first-person perspective)	IVR embodied simulation of student without depression symptoms (first-person perspective)	Attitudes (IAT) Empathy (JSE) Presence Questionnaire (3.0) Body ownership and agency and Inclusions of others (RDM) Adverse effects (VRSQ)	HTC VIVE Cosmos	15-20
Marques et al. 2022 (Portugal)	Quasi-experimental	102	21.75	Students	Embodied psychosis simulation cognitive task	Non-immersive 2D version of the psychosis embodiment	Empathy (QCAE and	Oculus Quest 1	7

					(delusions and auditory and visual hallucinations, first-person perspective)	simulation cognitive task (first-person perspective)	Empathic Feelings for People Suffering from Schizophrenia) Attitudes Toward People with Schizophrenia Knowledge (MAKS) Psychophysiological data		
Pina-Thomas et al. 2025 (USA)	Quasi-experimental	25	25.64	Students	Embodied psychosis simulation (auditory hallucinations, first-person perspective)	Non-immersive psychosis embodiment using earbuds/mp3 player (first-person perspective)	Empathy (KCES-R) Adverse effects (VRSQ)	N/R	10
Tay et al. 2025 (Singapore)	RCT	180	VR 33.40, Control 33.56	HCPs	Embodied psychosis simulation (audio and visual hallucinations, first-person perspective)	IVR embodied simulation without psychosis-symptom experiences (first-person perspective)	Attitudes towards people with Schizophrenia Scale Social Distance Scale (SDS) Personal Stigma Scale Interpersonal Reactivity Index Empathy Subscale	Google Cardboard equivalent	7

							Usability (RDM) Adverse effects susceptibility (VIMSSQ)		
Zare-Bidaki et al. 2022 (Iran)	Quasi-experimental	144	VR 19.90, Control 20.38	Medical students	Embodied psychosis simulation (auditory hallucinations and delusions, first-person perspective)	Psychiatric ward visit under supervision (routine education)	Stigma (MIS) Empathy (JSE) Knowledge (RDM) Adverse effects (RDM)	N/R	4.5
Authors (Country)	**Study Design**	**Sample Size**	**Mean Age**	**Healthcare Population**	**IVR Intervention**	**Comparison Group**	**Outcome Measures**	**HMD**	**IVR Duration (min)**
Risk Assessment and Management Simulation									
Bahadur et al. 2024 (Canada)	Quasi-experimental	22	N/R	Psychiatry residents and physicians, nursing and pharmacy students	Suicide risk assessment simulation	None	User Engagement Scale – Short Form Adverse effects (SSQ)	Meta Quest 2	N/R
Ng et al. 2025 (Canada)	Non-randomised quant	101	N/R	HCPs and students	Opioid overdose response simulation (high-level physical movement)	IVR Suicide risk assessment simulation (low-level physical movement)	Adverse effects (SSQ)	N/R	N/R
Phiri et al. 2024 (UK)	RCT (feasibility)	56	VR 40.8,	HCPs	Standard reducing restrictive practice training	Standard reducing restrictive practice training	General Self-Efficacy Scale	N/R	20

	Control 40.7	followed by VR reducing restrictive practice training	Anxiety (GAD-7) Burnout (BAT-12) Everyday Discrimination Scale Compassionate Engagement and Action Scale Usability (SUS)

Note. N/R = not reported. RDM = researcher-developed measure. ASD = Attitudinal Social Distance Scale. BAT-12 = Burnout Assessment Tool 12. GAD-7 = Generalised Anxiety Disorder 7. IAT = Implicit Association Test. DSS = Depression Stigma Scale. IPQ = iGroup Presence Questionnaire. JSE = Jefferson Scale of Empathy. MAKS = Mental health knowledge scale. MIS = mental illness stigma by world psychiatric association. OSCE = Objective Structured Clinical Examination. PMHAFS = Perinatal Mental Health Familiarity and Awareness Scale. QCAE = Questionnaire of Cognitive and Affective Empathy. SUMI = Software Usability Measurement Inventory. SUS = System Usability Scale. WBLT = Web-Based Learning Tool. VIMSSQ =Visually Induced Motion Sickness Susceptibility Questionnaire.

Usability and Acceptability

Nine studies explored the usability and acceptability of IVR training, with an overall positive response across the studies (Bahadur et al., 2024; Graf et al., 2024; Gutiérrez-Maldonado et al., 2015; Hiley et al., 2024; Laker et al., 2025; Lem et al., 2022; Lin et al., 2024; Phiri et al., 2024; Tay et al., 2025). Two studies without comparator groups descriptively reported participant acceptability, with Laker et al. (2025) documenting all participants to agree their mental health ward simulation was a valuable learning experience. Similarly, Bahadur et al. (2024) found 95.4% of participants were satisfied with the IVR training on suicide risk assessment, with 68.2% agreeing it enhanced their learning experience.

When exploring two IVR interventions, Tay et al. (2025, p.10) found the embodied psychosis simulation had significantly higher user satisfaction and was described as ‘insightful’ and ‘engaging’, in comparison to one without simulated psychosis symptoms (e.g. audio/visual hallucinations). Similarly, medical students in Graf et al. (2024) study reported their immersive diagnostic interview simulation provided a calmer, more realistic environment than actors or classmates used in their regular training (Graf et al., 2024). However, when comparing an immersive diagnostic interview simulation with a non-immersive computer screen alternative, Gutiérrez-Maldonado et al. (2015) did not find a significant difference in usability scores.

Two studies used the System Usability Scale (SUS), where a score below 50 is not acceptable and a score more than 80 is considered excellent (Hiley et al., 2024; Phiri et al., 2024). Phiri et al. (2024) reported an average SUS score of 71.79, when assessing the user acceptability of an IVR programme aimed to reduce restrictive practices in psychiatric care (e.g. restraints, seclusion). Similarly, in a pilot experiment exploring perinatal mental health

consultation skills, Hiley et al. (2024) reported a SUS score of 78.75 for IVR, which was slightly higher than the AR comparator score of 73.75. In their follow-up experiment, the SUS scores increased to over 80 for both VR and AR, with 77.2% of participants preferring VR or AR over traditional methods.

Presence, which is the extent that something appears to exist in the same world as the observer (Felton & Jackson, 2022), was explored in three studies (Hiley et al., 2024; Laker et al., 2025; Lin et al., 2024). Hiley et al. (2024) found the VR perinatal mental health consultation simulation to have a significantly improved 'sense of involvement' compared to the AR comparator. However, general, spatial, and realism domains of presence did not significantly differ. Similarly, Lin et al. (2024) did not find a significant difference in overall presence scores when comparing two IVR embodiment simulations, one of a student with depression symptoms and one without.

Within a qualitative evaluation of a mental health ward simulation, Laker et al. (2025, p.6) identified a theme around 'strong presence effects/high levels of empathy' with participants reporting the simulation as being highly immersive and emotive. However, as this simulation was from a third-person perspective, participants reported feeling frustrated they were unable to interact with the patient, leading to another theme, 'strong emotional response but restricted agency', and a participant stopping the simulation early. Lem et al. (2022) explored multiple perspectives in their study exploring depression. The IVR group exploring three different perspectives scored significantly higher when rating their understanding of depression stigma compared to a 2D psychoeducational video of depression. Additionally, one participant specifically reported that the change from third- to first-person perspective led to a better understanding of depression stigma.

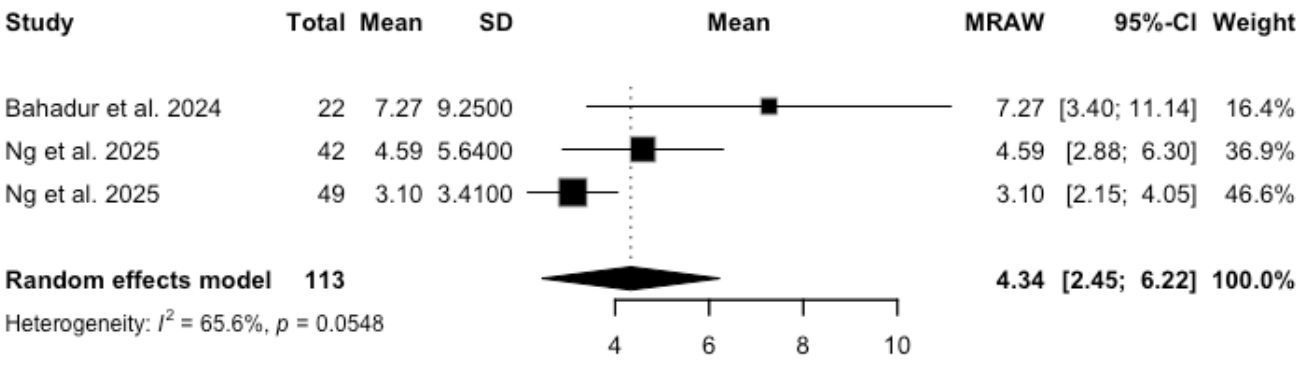
Safety and Tolerability

Six studies assessed physical adverse effects following IVR exposure (Table 2; Bahadur et al., 2024; Hiley et al., 2024; Ng et al., 2025; Pina-Thomas et al., 2025; Tay et al., 2025; Zare-Bidaki et al., 2022). As Tay et al. (2025) used the Visually Induced Motion Sickness Susceptibility Questionnaire (VIMSSQ), which measures susceptibility rather than post-exposure symptoms, it was considered separately.

All six studies reported generally low or mild adverse effects following IVR exposure, with two studies documenting this qualitatively (Pina-Thomas et al., 2025; Zare-Bidaki et al., 2022). Mean adverse-effect scores, when expressed as percentages of the available scale range, varied from 1% to 15%, with mean scores falling within negligible/minimal adverse-effects thresholds. This pattern was observed in both of Ng et al. (2025) conditions, which compared a high-movement immersive risk assessment task to a low-movement comparator. This was depicted in the exploratory single-arm meta-analysis of total simulator sickness questionnaire (SSQ) scores (k = 3, *n* = 113), which demonstrated low adverse-effect severity following IVR exposure (pooled mean = 4.33, 95% CI 2.45-6.22), with moderate heterogeneity (Q(2) = 5.81, $p = 0.055$, $I^2 = 65.6\%$, Figure 2).

Figure 2

Forest Plot of Mean SSQ Scores Following IVR Exposure



Adverse-effect subscale scores were reported in three studies and similarly demonstrated low severity, with mean values ranging from 4% to 16% of the available scale range. Oculomotor scores were higher than nausea or disorientation subscales in two studies (Bahadur et al., 2024; Hiley et al., 2024), and despite Ng et al. (2025) finding low-movement IVR to be associated with significantly lower nausea symptoms, no between-condition differences were observed for oculomotor symptoms.

Across the studies, only a small number of participants experienced moderate symptoms, which dissipated shortly after IVR exposure. No withdrawals or severe adverse events were attributed to physical symptoms following IVR use. However, despite not being formally assessed, Laker et al. (2025) documented the aforementioned participant who withdrew due to psychological distress.

Effectiveness

Knowledge

Five studies evaluated the impact of IVR on increasing mental health knowledge outcomes (Heys et al., 2022; Hiley et al., 2022; Lem et al., 2022; Marques et al., 2022; Zare-Bidaki et al., 2022). Four studies reported improvement in knowledge, with two pilot studies documenting this qualitatively. Heys et al. (2022) reported a positive shift in knowledge gaps, with participants demonstrating increased understanding of traumatic birth and strategies to improve women's birthing experiences following the IVR intervention. Similarly, Lem et al. (2022) found participants in an embodied depression simulation demonstrated greater knowledge acquisition regarding depression stigma compared to those who viewed a non-immersive psychoeducational video.

Three studies with sample sizes exceeding 100 participants quantitatively examined mental health knowledge outcomes (Hiley et al., 2025; Marques et al., 2022; Zare-Bidaki et al., 2022). Two studies reported significant improvements in mental health knowledge following IVR interventions with large effect sizes (d = 1.01-3.42, Hiley et al., 2025; η_p^2 = 0.70, Zare-Bidaki et al., 2022). Hiley et al. (2025) specifically found VR and AR perinatal mental health consultation simulations to significantly improve different domains of cognitive learning among primary care professionals, medical students, and mental health students, including improved understanding of perinatal mental health conditions, assessments and care. Zare-Bidaki et al. (2022) also found an embodied psychosis simulation produced significantly greater knowledge gains in medical students than an in-person psychiatric ward visit, with a large effect size (η_p^2 = 0.22). In contrast, Marques et al. (2022) did not find an embodied psychosis simulation cognitive task to significantly increase knowledge or to significantly differ from a non-immersive 2D comparator.

Empathy

Five studies evaluated the impact of IVR on empathy towards people with mental health conditions (Lin et al., 2024; Marques et al., 2022; Pina-Thomas et al., 2025; Tay et al., 2025; Zare-Bidaki et al., 2022). All the studies employed patient-perspective simulations with comparator conditions. Across studies, total empathy scores increased in IVR conditions; however, statistically significant increases were only observed in two studies, with small and large effect sizes respectively (Pina-Thomas et al., 2025, Zare-Bidaki et al., 2022). Notably, Zare-Bidaki et al. (2022) found the IVR intervention produced significantly higher empathy scores than an in-person ward visit, with a medium effect size (η_p^2 = 0.09). The remaining four studies compared IVR to immersive or non-immersive comparators and did not observe

significant differences in total empathy scores (Lin et al., 2024; Marques et al., 2022; Pina-Thomas et al., 2025; Tay et al., 2025).

Marques et al. (2022) further examined affective and cognitive empathy, defined respectively as the capacity to experience another's emotional state and the ability to understand another's emotional state. Participants completed a cognitive task while experiencing simulated psychosis symptoms (delusions and hallucinations), with one group using IVR and the other a non-immersive 2D version. Neither intervention demonstrated significant changes in affective empathy. However, a between-group comparison revealed a significant difference in cognitive empathy scores ($d = 0.39$), driven by a significant decrease in the non-immersive group's cognitive empathy ($d = -0.31$).

Stigma

Four studies examined the impact of IVR on mental health stigma, all of which included comparator conditions (Lem et al., 2022; Phiri et al., 2024; Tay et al., 2025; Zare-Bidaki et al., 2022). Across studies, stigma scores generally decreased following IVR exposure; however, statistically significant reductions were only reported in two studies with small to medium effects ($\eta_p^2 = 0.04$, Tay et al., 2025; $\eta_p^2 = 0.08$, Zare-Bidaki et al., 2022). Both studies explored embodied psychosis simulations and Tay et al. (2025) findings included a one-month follow-up. Whilst overall reductions in stigma did not reach statistical significance in Lem et al. (2022) study, a moderate effect size was observed ($d = 0.44$). At item level, a significant reduction was observed for the stereotype regarding the unpredictability of individuals with mental illness ($d = 1.53$). Across studies, no significant differences in total stigma scores were observed between IVR interventions and comparator conditions.

Phiri et al. (2024) examined stigma using the Everyday Discrimination Scale. Although pre-post changes did not reach statistical significance across the nine-items, participants in the IVR-based reducing restrictive practice training demonstrated reductions on seven items, compared with the training-as-usual group which reduced on three items. Significant between-group differences were observed for two individual items; however, baseline differences and limited statistical power suggest these findings should be interpreted with caution.

Desire for social distance from people with mental health conditions was assessed in two studies (Lem et al., 2022; Tay et al., 2025). Both studies reported reductions in desire for social distance following IVR exposure; however, a statistically significant decrease was only observed in Tay et al. (2025) study, which evaluated an embodied psychosis simulation. This finding was sustained after a one-month follow-up. Lem et al. (2022) reported a significant improvement in the IVR group on a single item assessing willingness to form friendships with individuals with mental illness following an embodied depression intervention, whereas no significant changes were observed in the control group. Despite these within-group effects, neither study demonstrated a statistically significant between-group difference in overall social distance outcomes.

Attitudes

Four studies explored attitudes towards people with mental illness, all employing patient-perspective IVR simulations (Heys et al., 2022; Lin et al., 2024; Marques et al., 2022; Tay et al., 2025). Three studies reported improvements in attitudes following IVR exposure (Heys et al., 2022; Marques et al., 2022; Tay et al., 2025). Heys et al. (2022) qualitatively described a ‘positive shift’ in attitudes following the immersive birth trauma intervention. Quantitatively, Marques et al. (2022) and Tay et al. (2025) reported significant improvement

in attitudes following embodied psychosis simulations, with small to moderate effects (d = 0.48; η_p^2 = 0.04, respectively). Lin et al. (2024) observed a small, non-significant improvement in attitudes following an embodied depression simulation (d = 0.10)

No significant between-group differences were identified across the studies. However, Marques et al. (2022) reported a greater within-group improvement in attitudes in the immersive embodied psychosis simulation task (d = 0.48) compared with the non-immersive 2D comparator (d = 0.29).

Meta-Analyses for Stigma, Empathy, and Attitudes

Random-effects meta-analyses highlighted no significant differences between IVR-based mental health interventions and comparator conditions for stigma, empathy, and attitudes (Table 3). Whilst not significant, the direction of the meta-analyses moved in the desired direction favouring IVR over comparator conditions for increasing empathy and positive attitudes, whilst decreasing stigma, with the largest effect seen in attitudes.

Table 3

Random-Effects Meta-Analyses for Empathy, Stigma, and Attitudes

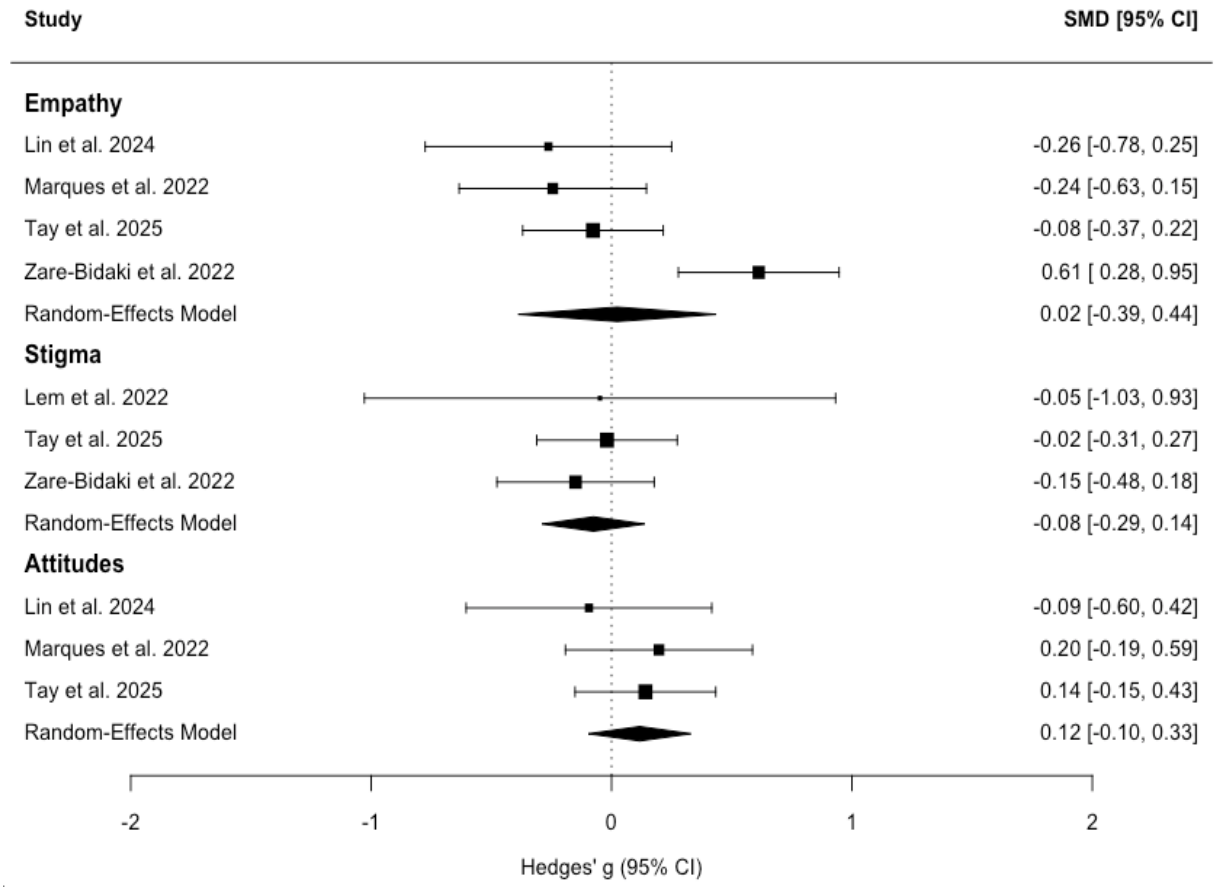
Outcome	k	n	Hedges' *g*	SE	95% CI	*p*	Q (*p*)	I^2 (%)
Empathy	4	485	0.02	.21	[-0.39, 0.44]	.91	15.20 (.002)	80
Stigma	3	340	-0.08	.11	[-0.29, 0.14]	.49	0.35 (.48)	0
Attitudes	3	341	0.12	.11	[-0.10, 0.33]	.28	0.84 (.66)	0

Note. Estimates are based on random-effect model. n = total sample size across studies.

Figure 3 demonstrates the differences between studies included in the meta-analyses. Sensitivity analyses using change scores with assumed correlations (r = 0.3-0.7) produced analogous results.

Figure 3

Forest Plot of Empathy, Stigma, and Attitude Post-Scores for IVR Versus Comparator Conditions



Secondary Effectiveness Outcomes

The effects of IVR psychoeducation on anxiety, burnout, self-efficacy, and confidence were less frequently examined and yielded mixed results (Hiley et al., 2024; Phiri et al., 2024). Hiley et al. (2024) reported VR and AR perinatal mental health consultation simulations significantly improved confidence and reduced anxiety in primary care

professionals (confidence: $d = 0.79$, anxiety: $d = 0.92$) and medical students (confidence: $d = 2.54$, anxiety: $d = 1.29$), as well as significantly improving confidence in mental health and psychology students ($d = 2.32$). In contrast, Phiri et al. (2024) found that IVR training designed to reduce restrictive practice did not produce significant improvements in anxiety ($d = 0.13$), burnout ($d = 0.26$), or self-efficacy ($d = 0.08$), and did not significantly differ from treatment-as-usual reducing restrictive practice training.

IVR Limitations

Eight studies reported limitations relating specifically to their IVR interventions, with limited agency, reduced realism, and conversational constraints most commonly referenced (Graf et al., 2024; Hiley et al., 2024; Laker et al., 2025; Lan et al., 2023; Lem et al., 2022; Lin et al., 2024; Phiri et al., 2024; Zare-Bidaki et al., 2022).

Across patient-perspective simulations, participants frequently adopted a passive observer role, with limited or no capacity to influence the unfolding scenario. Although Zare-Bidaki et al. (2022) identified limited agency as a design constraint, only Laker et al. (2025) reported how this lack of control contributed to participant distress. In contrast, Heys et al. (2022) reported that participants valued the psychosocial impact of the IVR, which they believed could not be achieved through traditional approaches.

Reduced realism was highlighted in three studies that utilised avatars instead of actors. Challenges included replicating nuanced body movements and facial expressions (Lan et al., 2023; Graf et al., 2024), as well as participant concerns that the simulation was ‘exaggerated’ and not representative of real-world experiences (Lem et al., 2022, p. 7). Despite these concerns, Graf et al. (2024) reported participants generally perceived their diagnostic interview simulation as believable and functionally convincing.

Conversational and speech-related limitations were reported in three of the four diagnostic interview and consultation skills simulations, where interactions were restricted to predefined scripts or response options (Graf et al., 2024; Hiley et al., 2024; Lan et al., 2023). Authors recognised that such constraints limited the spontaneity and complexity of clinical dialogue.

Additional technological limitations were scarcely reported but included high latency/delay in movement (Lem et al., 2022), equipment overheating (Lin et al., 2024), and participant attrition due to internet-related issues (Graf et al., 2024). General implementation-related considerations were also noted, including start-up costs, software licensing fees, and accessibility challenges for individuals with visual or auditory impairments (Hiley et al., 2024). However, several studies highlighted the potential cost-effectiveness and scalability of VR-based interventions, particularly through reduced travel, accommodation, and training time, as well as increased opportunities for flexible and repeatable training (Hiley et al., 2024; Phiri et al., 2024).

Discussion

This systematic review and meta-analysis examined the utility, acceptability, effectiveness, and limitations of IVR mental health education tools for HCPs and students. Overall, IVR demonstrated high acceptability, tolerability and safety across a range of mental health educational contexts. Evidence for effectiveness across educational outcomes was more variable; however, findings suggest IVR may offer promising benefits. Whilst exploratory meta-analyses did not yield statistically significant pooled effects, IVR was consistently favoured over comparator conditions across the stigma, empathy, and attitude effectiveness meta-analyses, indicating potential benefits within the emerging evidence base.

Utility and Acceptability

The findings highlight the growing utility of IVR as a mental health education tool. However, most studies were conducted in high-income economies and relied on convenience samples. Whilst this reflects wider patterns in mental health research (Acuña-Rodríguez et al., 2025), it limits the generalisability of findings, especially in low- to middle-income countries where mental health and educational contexts may differ.

Acceptability was a consistent strength across studies, with high levels of user satisfaction, and participants describing IVR as engaging and valuable for learning. IVR interventions generally elicited a strong sense of presence, with a higher sense of involvement compared to an AR comparator (Hiley et al., 2024). Presence has been highlighted as an important component for making VR appear more realistic and therefore more accepted by learners (Fabris et al., 2019; Plotzky et al., 2021). Interestingly, the absence of difference in presence between IVR embodied simulations with and without simulated depression symptoms (Lin et al., 2024), may suggest how virtually embodying someone with mental health symptoms can still feel realistic. However, qualitative feedback from another study reported the simulation to feel exaggerated and not representative of real-life experiences (Lem et al., 2022), therefore highlighting the importance of careful content design.

Presence alone may not be sufficient to optimise learning outcomes, as in a highly immersive but passive third-person scenario (e.g. ward environment), limited user agency was associated with emotional discomfort and disengagement (Laker et al., 2025). Additionally, qualitative findings suggest first-person patient-perspective simulations may offer greater benefits for understanding mental health stigma (Lem et al., 2022), and therefore should be considered for future IVR mental health education interventions. This aligns with experiential learning theory, which emphasises learning through active engagement and

reflection (Kolb, 1984), as well as research associating third-person VR perspectives with reduced sense of presence, agency, and embodiment (Hoppe et al., 2022). However, further research is required to systematically compare perspectives and agency in mental health education contexts.

Adverse Effects

IVR was generally well tolerated with low levels of reported physical and psychological adverse effects, consistent with findings from other healthcare education reviews (Erbaş et al., 2024). Although some participants experienced moderate symptoms, no serious adverse events or withdrawals were reported due to physical side effects and only one withdrawal was reported as a consequence of psychological distress. Findings indicate a potentially higher risk of oculomotor symptoms in IVR mental health training, with nausea symptoms more likely in high-movement programmes. However, these findings should be interpreted with caution given the limited number of studies documenting symptom-specific outcomes. Likewise, further analyses were restricted by the intermittent reporting of adverse effects or factors known to influence them, such as duration of exposure (Saredakis et al., 2020). Future research should prioritise standardised reporting of adverse effects to enable more robust conclusions. Additionally, providing alternative delivery formats for mental health training, such as desktop-based versions, may be considered to improve accessibility for individuals prone to motion sickness (Ng et al., 2025).

Effectiveness

The effectiveness of IVR varied across outcomes and studies. In most of the IVR conditions, improvements were seen in knowledge, empathy, stigma, and attitudes; however, these improvements were not always statistically significant and were not consistently greater than comparator conditions. Notably, when IVR conditions failed to improve outcomes, this

was often also reflected in the comparator conditions, suggesting outcomes may be influenced by other factors, such as the quality or content of the educational intervention, rather than the delivery modality.

Despite the meta-analyses not being significant, small Hedge's effects favouring IVR over comparator conditions were found for empathy (g = .02), stigma (g = -.08), and attitudes (g = .12). The larger effect seen for attitude outcomes may reflect how more explicit cognitive judgements are easier to alter after one intervention compared to stigma and empathy, which may be more implicit. Implicit biases can remain even when explicit attitudes alter (Tao, 2024), which is something that has been observed in other mental health education programmes (Praharaj et al., 2021), and therefore may require more extended interventions.

Heterogeneity across studies, including comparator conditions and outcome measures, may contribute to the variability in effectiveness. Many of the studies also developed their own measures, which was especially observed in knowledge outcomes. Therefore, whilst the effectiveness results are promising given the limited evidence base, further research is required using standardised measures to draw firmer conclusions. Research should also aim to have multiple comparators within a singular study to make more concise conclusions around the benefits of IVR over non-immersive and in-person comparators.

Limitations of IVR

Across the included studies, few limitations relating to IVR interventions were identified, however when referenced they often focused on technological restrictions, alongside implementation and accessibility challenges. Limited user agency was identified in patient-perspective simulations studies, where participants adopted passive observer roles. Active learning has been shown to enhance healthcare students' knowledge acquisition,

understanding, and application of learned material (Harris & Bacon, 2019). This has been demonstrated in simulation-based healthcare education, where active participants outperformed observers in learning (Delisle et al., 2019). Future research should therefore investigate different levels of interactivity in their designs to promote active learning and explore the impact on knowledge acquisition. Additionally, this might diminish psychological distress that may arise from limited user agency.

Technological advancements, additional research, and considerations around the type of HMD and content design, may help address several of the reported IVR limitations. For example, the reduced realism and conversational constraints seen within diagnostic and consultation skills simulations and those using avatars. However, increasing realism in VR can be challenging as it must be balanced with the 'uncanny valley' phenomenon (Mori, 1970), where animated figures which appear too realistic can elicit discomfort or avoidance. This consideration is particularly salient in mental health education, where interventions aim to foster positive attitudes, empathy, and understanding towards individuals with mental health conditions. Future research should compare the use of 360° videos filmed in the real world with actors compared to computer-generated environments using avatars within mental health education contexts to explore the impact on realism and learning outcomes.

Strengths and Limitations of the Review

To the authors' knowledge, this is the first systematic review and meta-analysis exploring IVR as a mental health education tool for HCPs and students. Such reviews are important given the rapid increase of IVR in healthcare programmes and mental health contexts. The review strived for transparency, accuracy, and reduced bias by pre-registering on PROSPERO, following PRISMA guidelines, and utilising a second rater. To maximise the chance of included studies, a variety of VR terminology was used, on top of additional

manual searches. The findings highlight the variety and promise of IVR training within mental health context, alongside identifying how they are generally well accepted and tolerated by learners.

Several limitations should be considered when interpreting the findings of this review. First, the evidence base remains relatively novel, with approximately half of the included studies comprising of pilot, feasibility, or preliminary designs, and limited sample sizes. Second, the heterogeneity across studies, including variation in content, outcome measures, HMD, and comparator conditions, restricts direct comparability and limits the strength of quantitative synthesis. Third, IVR studies often rely on self-report measures, and blinding of participants and researchers are often not feasible due to the nature of the intervention. These factors increase susceptibility to bias, including expectancy and social desirability bias. Lastly, few studies included follow-up assessments, limiting conclusions regarding the long-term effectiveness of IVR in mental health education. Future research should aim to prioritise adequality powered study designs, standardised outcome measures, transparent reporting of IVR design, content, and HMD, systematic monitoring of adverse effects, and longer-term follow-ups to assess sustained educational impact.

Conclusion

Overall, IVR represents a promising and increasingly acceptable and safe approach to mental health education for HCPs and students, offering novel opportunities for experiential learning that extends beyond traditional approaches. While the current evidence base remains undeveloped and heterogeneous, findings from this review suggest IVR may provide an encouraging alternative approach within mental health contexts, especially for areas such as stigma, empathy, and attitudes, which can be more difficult to convey through traditional approaches. Advancing research should focus on refining how and when IVR is used,

through carefully designed and theory-informed interventions, in order to assess the full educational potential of IVR in mental health education contexts.

Declaration of Interest Statement

The authors report there are no competing interests to declare.

Funding

This research did not receive any specific grant from funding agencies.

References

Abbas, J. R., O'Connor, A., Ganapathy, E., Isba, R., Payton, A., McGrath, B., Tolley, N., & Bruce, I. A. (2023). What is virtual reality? A healthcare-focused systematic review of definitions. *Health Policy and Technology*, *12*(2), Article 100741. https://doi.org/10.1016/j.hlpt.2023.100741

Acuña-Rodríguez, M., Quintero, K. F. M., Bolaño-Romero, M. P., & Lozada-Martinez, I. D. (2025). Gaps and opportunities in global mental health research: Disparities across geographic regions and income levels. *Psychiatry Investigation, 22*(11), 1227-1229. https://doi.org/10.30773/pi.2025.0235

Bahadur, A. G., Hargreaves, F., Antinucci, R., Sockalingam, S., & Abdool, P. S. (2024). Virtual reality simulation for suicide risk assessment training: Prevalence of adverse effects. *Academic Psychiatry*, *48*(1), 57-60. https://doi.org/10.1007/s40596-023-01799-1

Clus, D., Larsen, M. E., Lemey, C., & Berrouiguet, S. (2018). The use of virtual reality in patients with eating disorders: Systematic review. *Journal of Medical Internet research*, *20*(4). https://doi.org/10.2196/jmir.7898

Delisle, M., Ward, M. A. R., Pradarelli, J. C., Panda, N., Howard, J. D., & Hannenberg, A. A. (2019). Comparing the learning effectiveness of healthcare simulation in the observer versus active role: Systematic review and meta-analysis. *Simulation in Healthcare, 14*(5), 318-332. https://doi.org/10.1097/SIH.0000000000000377

Erbaş, A., Akyüz, E., & Ergöl, S. (2024). The effects of virtual reality used in healthcare education on cybersickness and sense of presence: A systematic review. *PRESENCE: Virtual and Augmented Reality*, *33*, 161–178. https://doi.org/10.1162/pres_a_00414

Fabris, C. P., Rathner, J. A., Fong, A. Y., & Sevigny, C. P. (2019). Virtual reality in higher education. *International Journal of Innovation in Science and Mathematics Education, 27*(8), 69-80. https://doi.org/10.30722/IJISME.27.08.006

Felton, W. M., & Jackson, R. E. (2022). Presence: A review. *International Journal of Human-Computer Interaction, 38*(1), 1-18. https://doi.org/10.1080/10447318.2021.1921368

Fu, R., & Holmer, H. K. (2016). Change score or follow-up score? Choice of mean difference estimates could impact meta-analysis conclusions. *Journal of Clinical Epidemiology*, *76*, 108-117. https://doi.org/10.1016/j.jclinepi.2016.01.034

Graf, L., Sykownik, P., Gradl-Dietsch, G., & Masuch, M. (2024). Towards believable and educational conversations with virtual patients. *Frontiers in Virtual Reality*, *5.* https://doi.org/10.3389/frvir.2024.1377210

Gutiérrez-Maldonado, J., Ferrer-García, M., Plasanjuanelo, J., Andrés-Pueyo, A., & Talarn-Caparrós, A. (2015). Virtual reality to train diagnostic skills in eating disorders. Comparison of two low cost systems. *Studies in Health Technology and Informatics, 219*, 75-81. https://doi.org/10.3233/978-1-61499-595-1-75

Gwets, k. L. (2008). Computing inter-rater reliability and its variance in the presence of high agreement. *British Journal of Mathematical and Statistical Psychology, 61,* 29-48. https://doi.org/10.1348%2F000711006X126600

Harris, N., & Bacon, C. E. W. (2019). Developing cognitive skills through active learning: A systematic review of health care professions. *Athletic Training Education Journal*, 135-148. https://doi.org/10.4085/1402135

Heys, S., Downe, S., McKeown, M., & Thomson, G. (2022). The design, delivery and evaluation of 'Human Perspectives VR': An immersive educational programme designed to raise awareness of contributory factors for a traumatic childbirth experience and PTSD. *PLoS ONE 17*(11). https://doi.org/10.1371/journal.pone.0276263

Hiley, K., Bi-Mohammad, Z., Taylor, L., Burgess-Dawson, R., Patterson, D., Puttick-Whiteman, D., Gay, G., Hiscoe, J., Munsch, C., Richardson, S., Knowles-Lee, M., Beecham, C., Ralph, N., Chatterjee, A., Mathew, R., & Mushtaq, F. (2025). Extended reality–enhanced mental health consultation training: Quantitative evaluation study. *JMIR medical education*, *11*. https://doi.org/10.2196/64619

Hong, Q. N., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M. P., Griffiths, F., Nicolau, B., O'Cathain, A., Rousseau, M. C., Vedel, I., & Pluye, P. (2018). The Mixed Methods Appraisal Tool (MMAT) version 2018 for information professionals and researchers. *Education for Information*, *34*, 1-7. https://doi.org/10.3233/EFI-180221

Hong, Q. N., Pluye, P., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M. P., Griffiths, F., Nicolau, B., O'Cathain, A., Rousseau, M. C., & Vedel, I. (2019). Improving the content validity of the mixed methods appraisal tool: A modified e-Delphi study. *Journal of Clinical Epidemiology*, *111*, 49-59. https://doi.org/10.1016/j.jclinepi.2019.03.008

Hongthong, B., Jantakoon, T., & Trisupakitti, S. (2025). The effectiveness of virtual reality in medical education: A meta-analysis of knowledge, skills, and motivation outcomes. *Higher Education Studies, 15*(4), 101-118. https://doi.org/10.5539/hes.v15n4p101

Hoppe, M., Baumann, A., Tamunjoh, P. C., Machulla, T. K., Woźniak, P. W., & Schmidt, A. (2022). There is no first- or third-person view in virtual reality: Understanding the perspective continuum. *ACM Digital Library, 360,* 1-13. https://doi.org/10.1145/3491102.3517447

Horigome, T., Kurokawa, S., Sawada, K., Kudo, S., Shiga, K., Mimura, M., & Kishimoto, T. (2020). Virtual reality exposure therapy for social anxiety disorder: A systematic review and meta-analysis. *Psychological Medicine, 50*, 2487–2497. https://doi.org/10.1017/S0033291720003785

Jensen, L., & Konradsen, F. (2018). A review of the use of virtual reality head-mounted displays in education and training. *Education and Information Technology, 23*, 1515-1529. https://doi.org/10.1007/s10639-017-9676-0

Karami, B., Koushki, R., Arabgol, F., Rahmani, M., & Vahabie, A. H. (2021). Effectiveness of virtual/augmented reality–based therapeutic interventions on individuals with autism spectrum disorder: A comprehensive meta-analysis. *Frontiers in Psychiatry*, *12*. https://doi.org/10.3389/fpsyt.2021.665326

Kim, H. & Kim, E. (2023). Effects of medical education program using virtual reality: A systematic review and meta-analysis. *International Journal of Environmental Research and Public Health, 20*(5), 3895. https://doi.org/10.3390/ijerph20053895

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice-Hall.

Kothgassner, O. D., Goreis, A., Kafka, J. X., Van Eickels, R. L., Plener, P. L., & Felnhofer, A. (2019). Virtual reality exposure therapy for posttraumatic stress disorder (PTSD): A meta-analysis. *European Journal of Psychotraumatology*, *10*(1), https://doi-org.uea.idm.oclc.org/10.1080/20008198.2019.1654782

Kutcher, S., Wei, Y., & Coniglio, C. (2016). Mental health literacy: Past, present, and future. *Canadian Journal of Psychiatry, 61*(3), 154-158. https://doi.org/10.1177/0706743715616609

Laker, C., Knight-Davidson, P., & McVicar, A. (2025). The use of 360-degree video to reduce anxiety and increase confidence in mental health nursing students: A mixed methods preliminary study. *Nursing Reports*, *15*(5), 157. https://doi.org/10.3390/nursrep15050157

Lampropoulos, G., & Kinshuk. (2024). Virtual reality and gamification in education: A systematic review. *Educational Technology Research and Development*, *72*(3), 1691-1785. https://doi.org/10.1007/s11423-024-10351-3

Lan, Y. L., Chen, W. L., Wang, Y. F., & Chang, Y. (2023). Development and preliminary testing of a virtual reality measurement for assessing intake assessment skills. *International Journal of Psychology*, *58*(3), 237-246. https://doi.org/10.1002/ijop.12898

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*(1), 159. https://doi.org/10.2307/2529310

Lem, W. G., Kohyama-Koganeya, A., Saito, T., & Oyama, H. (2022). Effect of a virtual reality contact-based educational intervention on the public stigma of depression: Randomized controlled pilot study. *JMIR Formative Research*, *6*(5). https://doi.org/10.2196/28072

Lin, H. L., Wang, Y. C., Huang, M. L., Yu, N. W., Tang, I., Hsu, Y. C., & Huang, Y. S. (2024). Can virtual reality technology be used for empathy education in medical students: A randomized case-control study. *BMC Medical Education*, *24*(1), 1254. https://doi.org/10.1186/s12909-024-06009-6

Marougkas, A., Troussas, C., Krouska, A., & Sgouropoulou, C. (2023). Virtual reality in education: A review of learning theories, approaches and methodologies for the last decade. *Electronics*, *12*(13), 2832. https://doi.org/10.3390/electronics12132832

Marques, A. J., Veloso, P. G., Araújo, M., de Almeida, R. S., Correia, A., Pereira, J., Queiros, C., Pimenta, R., Pereira, A. S., & Silva, C. F. (2022). Impact of a virtual reality-based simulation on empathy and attitudes toward schizophrenia. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.814984

Mori, M. (1970). The uncanny valley. *Energy*, *7*(4), 33–35.

Ng, A., Inagaki, M., Antinucci, R., Sockalingam, S., & Abdool, P. S. (2025). Determining the severity and prevalence of cybersickness in virtual reality simulations in psychiatry. *Advances in Simulation*, *10*(1), 32. https://doi.org/10.1186/s41077-025-00358-y

NHS England. (2023, June). *NHS long term workforce plan.* https://www.england.nhs.uk/long-read/nhs-long-term-workforce-plan-2/#references

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow C D., Shamseer, L., Tezlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ,* 372. https://doi.org/10.1136/bmj.n71

Phiri, P., Pemberton, L., Liu, Y., Yang, X., Salmon, J., Boulter, I., Sajid, S., Clarke, J., McMillan, A., Shi, J. Q., & Delanerolle, G. (2024). Tree: Reducing the use of restrictive practices on psychiatric wards through virtual reality immersive technology training. *World Journal of Psychiatry*, *14*(10), 1521-1537. https://doi.org/10.5498/wjp.v14.i10.1521

Pina-Thomas, D., Zohn, J. H., & Phillips, L. (2025). A Comparison of virtual reality and traditional audio-recorded hearing voices simulations: Their impact on empathy in health care students. *Nursing Education Perspective*, *46*(2), 116-118. https://doi.org/10.1097/01.nep.0000000000001271

Plotzky, C., Lindwedel, U., Bejan, A., König, P., & Kunze. (2021). Virtual reality in healthcare skills training: The effects of presence on acceptance and increase of knowledge. *i-com Journal of Interactive Media, 20*(1), 73-83. https://doi-org.uea.idm.oclc.org/10.1515/icom-2021-0008

Popay, J., Roberts, H., Snowden, A., Petticrew, M., Arai, L., Rodgers, M., Britten, N., Roen, K., & Duffy, S. (2006). Guidance on the conduct of narrative synthesis in systematic reviews: A product from the ESRC methods programme. *Lancaster University.* https://doi.org/10.13140/2.1.1018.4643

Pottle, J. (2019). Virtual reality and the transformation of medical education. *Future Healthcare Journal*, *6*(3), 181-185. https://doi.org/10.7861/fhj.2019-0036

Praharaj, S. K., Salagre, S., & Sharma, P. S. V. N. (2021). Stigma, empathy and attitude (SEA) educational module for medical students to improve the knowledge and attitude towards persons with mental illness. *Asian Journal of Psychiatry, 65*. https://doi.org/10.1016/j.ajp.2021.102834

Riches, S., Pisani, S., Bird, L., Rus-Calafell, M., Garety, P., & Valmaggia, L. (2021). Virtual reality-based assessment and treatment of social functioning impairments in psychosis: A systematic review. *International Review of Psychiatry*, *33*(3), 337–362. https://doi.org/10.1080/09540261.2021.1918648

Rincon, E., Rodriguez-Guidonet, I., Andrade-Pino, P., & Monfort-Vinuesa, C. (2023). Mixed reality in undergraduate mental health education: A systematic review. *Electronics*, *12*(4), 1019. https://doi.org/10.3390/electronics12041019

Saredakis, D., Szpack, A., Birckhead, B., Keage, H. A., Rizzo, A., & Loetscher, T. (2020). Factors associated with virtual reality sickness in head-mounted displays: A systematic review and meta-analysis. *Frontiers in Human Neuroscience, 14*. https://doi.org/10.3389/fnhum.2020.00096

Schröder, D., Wrona, K. J., Mueller, F., Heinemann, S., Fischer, F., & Dockweiler, C. (2023). Impact of virtual reality applications in the treatment of anxiety disorders: A systematic review and meta-analysis of randomized-controlled trials. *Journal of Behavior Therapy and Experimental Psychiatry*, *81*, 101893. https://doi-org.uea.idm.oclc.org/10.1016/j.jbtep.2023.101893

Tan, B. L., Shi, J., Yang, S., Loh, H., Ng, D., Choo, C., & Medalia, A. (2022). The use of virtual reality and augmented reality in psychosocial rehabilitation for adults with neurodevelopmental disorders: A systematic review. *Frontiers in Psychiatry*, *13*, 1055204. https://doi.org/10.3389/fpsyt.2022.1055204

Tao, Q. (2024). Review paper: Implicit and explicit attitude in psychology. *Journal of Education, Humanities, and Social Sciences, 45.* https://doi.org/10.54097/5gz97548

Tay, J. L., Qu, Y., Lim, L., Puthran, R., Tan, C. L. R., Rajendran, R., Wei, K. C., Xie, H., & Sim, K. (2025). Impact of a virtual reality intervention on stigma, empathy, and attitudes toward patients with psychotic disorders among mental health care professionals: Randomized controlled trial. *JMIR Mental Health*, *12*. https://doi.org/10.2196/66925

Tay, J. L., Xie, H., & Sim, K. (2023). Effectiveness of augmented and virtual reality–based interventions in improving knowledge, attitudes, empathy, and stigma regarding people with mental illnesses: A scoping review. *Journal of Personalized Medicine, 13(1), 112.* https://doi.org/10.3390/jpm13010112

UK Government. (2025, July). *Fit for the future: 10 year health plan for England.* https://assets.publishing.service.gov.uk/media/6888a0996478525675738f3a/fit-for-the-future-10-year-health-plan-for-england-executive-summary.pdf

UK Research and Innovation. (2026, January). *Mindset extended reality (XR) for digital mental health programme*. https://www.ukri.org/what-we-do/browse-our-areas-of-investment-and-support/mindset-extended-reality-xr-for-digital-mental-health-programme/

Wenrui, D., Die, H., Sheng, X., Xiaoyu, L., Jingwen, Z., Qian, C., Jiayuan, L., Zheng, Z., Wenxiu, J., Lijun, M., Xinyi, H., Shengrong, C., Boya, L., & Xiaoming, L. (2019). The efficacy of virtual reality exposure therapy for PTSD symptoms: A systematic review and meta-analysis. *Journal of Affective Disorders*, *257*, 698-709. https://doi.org/10.1016/j.jad.2019.07.086

Zare-Bidaki, M., Ehteshampour, A., Reisaliakbarighomi, M., Mazinani, R., Khodaie Ardakani, M. R., Mirabzadeh, A., Alikhani, R., Noroozi, M., Momeni, F., Samani, A. D., Tavana, M. M., Esmeili, A., & Mousavi, S. B. (2022). Evaluating the effects of experiencing virtual reality simulation of psychosis on mental illness stigma, empathy, and knowledge in medical students. *Frontiers in Psychiatry*, *13*. https://doi.org/10.3389/fpsyt.2022.880331

Zhao, J., Xu, X., Jiang, H., & Ding, Y. (2020). The effectiveness of virtual reality-based technology on anatomy teaching: A meta-analysis of randomized controlled studies. *BMC Medical Education, 20*(127). https://doi.org/10.1186/s12909-020-1994-z

CHAPTER THREE

Empirical Research Study

Written based on guidance for submission to

Psychosis, Taylor & Francis (Appendix D)

Can Virtual Reality Reduce Psychosis Stigma? An Evaluation of a Virtual Reality Simulation on Healthcare Students' Stigma Towards People Living with Psychosis

Stephanie Stubbs[1], Olivia Hannah[1], Adrian Leddy[1], Jordan Tsigarides[1]

[1]Norwich Medical School, University of East Anglia, Norwich, UK.

Word count: 6000

Abstract word count: 194

Author Note

Stephanie Stubbs https://orcid.org/0009-0004-3591-3229

Olivia Hannah https://orcid.org/0009-0004-9620-3909

Adrian Leddy https://orcid.org/0000-0002-7803-9437

Jordan Tsigarides https://orcid.org/0000-0001-9893-8002

Correspondence: Jordan Tsigarides, Norwich Medical School, University of East Anglia, Norwich, UK. Email: j.tsigarides@uea.ac.uk

Abstract

Background: Psychosis remains one of the most stigmatised mental health conditions, contributing to healthcare inequalities and barriers to effective care. Immersive virtual reality (IVR) offers a novel means of integrating contact- and education-based destigmatisation approaches. However, evidence of its effectiveness within healthcare education remains limited and heterogeneous.

Methods: Using a single-arm pre-post design, this study examined how sensitive a 360° video VR simulated psychosis (VRSP) intervention was on improving stigma-related outcomes among UK healthcare students (N = 70). Outcomes included: attitudes, empathy, social distance, and continuum beliefs.

Results: Significant reductions were observed in stigmatising attitudes and desire for social distance, alongside significant increases in empathy and continuum beliefs. The intervention was well tolerated, with low levels of reported cybersickness. Exploratory analyses indicated comparable outcomes across healthcare disciplines, previous contact with people with psychosis, and previous VR training.

Discussion: These findings suggest VRSP is a promising educational tool for reducing multiple components of psychosis-related stigma among healthcare students. However, limited change in certain attribution-linked domains highlights the need for further research to evaluate whether VRSP can effectively shift entrenched causal beliefs and establish longer-term and comparative effectiveness.

Keywords: virtual reality, psychosis, stigma, healthcare education

Introduction

Stigma, defined as an "attribute that is deeply discrediting" (Goffman, 1963, p.3), is commonly conceptualised as comprising of three interrelated components: problems in knowledge (e.g., ignorance), prejudice attitudes, and discriminatory behaviour (Thornicroft et al., 2008). Attribution theory is a commonly referenced framework for understanding stigma, proposing causal beliefs shape peoples' emotional and behavioural responses (Weiner et al., 1988). Mental health conditions are frequently attributed to controllable and unstable causes, eliciting blame, anger, and punishing/avoiding behaviours, whereas physical health conditions evoke pity and helping behaviours (Corrigan et al., 2003; Cronan et al., 2016).

Psychosis remains among the most stigmatised conditions, with discrimination reported across employment, education, and relationships (Crestois et al., 2025; Kinson et al., 2018). Psychosis stigma is also evident in healthcare settings, with the World Health Organization (WHO, 2022) estimating that 71% of people with psychosis do not receive necessary services. This contributes to substantial health inequalities, including poorer health outcomes, reduced treatment adherence, inadequate healthcare delivery, and premature mortality (Kane et al., 2019; Thornicroft et al., 2007). Such disparities may be exacerbated by stigmatising attitudes amongst healthcare professionals (HCPs), with perceptions of dangerousness and desire for avoidance at times comparable or greater than the public (Birtel & Oldfield, 2022; Loch et al., 2013; Reavley et al., 2014). Reducing mental health stigma therefore remains an international (WHO, 2021) and national priority, with initiatives such as the 'Time to Change' campaign (2024).

Educational and contact-based approaches are the most used mental health stigma-reduction strategies, although effects vary, and research remains limited (McCullock & Scrivano, 2023). Within destigmatisation interventions, empathy is a key component (Hecht

et al., 2021), with higher empathy associated with improved therapeutic alliance, treatment effectiveness, clinical competence, and patient satisfaction (Elliott et al., 2011; Ruffalo et al., 2024; Walsh et al., 2019). However, declines in empathy and sympathy during healthcare training, known as ethical erosion, has been observed, and educators recognise the need for more effective training (Chen et al., 2012; Winter et al., 2023).

In parallel, there is a need to integrate continuum beliefs into destigmatisation efforts, since viewing psychotic phenomena as existing on a continuum with everyday experiences reduces 'us versus them' categorical thinking and marginalisation (Peter et al., 2021). Additionally, it is associated with lower perceived dangerousness, unpredictability, and intended social distance, alongside increased pro-social responses (Peter et al., 2021). Most continuum belief interventions rely on text-based vignettes; however, face-to-face contact is considered to enhance personal connections further (Thibodeau, 2020). Peter et al. (2021) therefore suggested integrating more virtual contact interventions through video and digital-based approaches to improve attitudes towards mental health conditions.

Virtual reality (VR) offers a means of integrating education and contact-based destigmatisation interventions, as it delivers immersive life-sized multisensory environments, predominantly through 360° head-mounted displays. In the last two decades, research exploring VR in mental health has notably increased (Valmaggia et al., 2016). Whilst most have focused on patient-based interventions (Rus-Calafell et al., 2017), emerging evidence suggests VR could be effective in enhancing empathy, knowledge, and attitudes towards people with mental health conditions (Formosa et al., 2018).

Drawing on social cognitive, experiential, and situated learning theories (Bandura, 1986; Kolb, 1984; Lave & Wenger, 1991), VR has the potential to be more effective than other teaching methods (e.g., role-play) as it enables users to explore patients' perspectives by stepping into their shoes (Riches et al., 2022). This allows professionals to evaluate from a

sensory perspective rather than relying on pre-exiting beliefs about psychosis (Kalyanaraman et al., 2010). Moreover, VR offers scalable training amid NHS workforce shortages (HM Government, 2024; Kyaw et al., 2019).

Preliminary studies evaluating virtual reality simulated psychosis (VRSP) suggest potential for stigma reduction, with improvements in empathy (Kalyanaraman et al., 2010; Zare-Bidaki et al., 2022), attitudes (Kalyanaraman et al., 2010; Marques et al., 2022; Tay et al., 2025; Zare-Bidaki et al., 2022), knowledge (Marques et al., 2022; Zare-Bidaki et al., 2022), and social distance (Tay et al., 2025). However, findings remain mixed, especially for empathy, which did not significantly increase following VRSP in one study (Tay et al., 2025) or significantly differ from a two-dimensional comparator in another (Marques et al., 2022). Similarly, Kalyanaraman et al. (2010) found desire for social distance to increase when the VRSP intervention was not accompanied with additional information (Kalyanaraman et al., 2010).

It is acknowledged the available studies are methodologically heterogenous, with few reporting feasibility or usability testing prior to evaluating efficacy, limiting conclusions regarding acceptability and intervention quality. This is salient given variability in VR systems, immersion levels, and virtual environments. Additionally, most studies did not assess cognitive, affective, and behavioural stigma-related components, and none explored continuum beliefs. Interventions aimed to increase empathy should align with the lived experience of people with psychosis (Zare-Bidaki et al., 2022), yet patient and public involvement was inconsistently reported, and most relied on computer-generated environments. This may limit ecological validity and can evoke the ‘uncanny valley’ phenomenon, where near-realistic avatars elicit discomfort and avoidance in users (Mori, 1970).

360° video has been considered a better alternative when aiming to elicit emotions, as it captures real environments, enhancing realism and sense of presence, whilst still offering first-person embodiment (Ionescu et al., 2021). However, empirical evaluation remains limited. The present study therefore examined whether a 360° video VRSP could reduce cognitive, affective, and behavioural psychosis-related stigma among UK healthcare students. It was hypothesised that empathy, attitudes, continuum beliefs, and social distance would improve following VRSP, with exploratory analyses examining differences in discipline, prior contact with psychosis, and previous VR training. Targeting students early into their professional development may offer sustained benefits when considering longevity of careers and mitigating declines in ethical erosion.

Method

Design and Ethics

A preliminary feasibility study indicated the VRSP intervention was acceptable among UK healthcare students, with potential positive effects on empathy and stigmatising attitudes (Hannah et al., 2025); however, it did not evaluate efficacy. The present study therefore adopted a single-arm pre-post experimental design to examine the effect of VRSP on four psychosis-related stigma outcomes: empathy, attitudes, social distance, and continuum beliefs. This design was selected to assess preliminary effect sizes and outcome measure sensitivity to change and determine whether progression to randomised controlled trials (RCTs) is warranted. Ethical approval was obtained from the University of East Anglia (UEA) Faculty of Medicine and Health Sciences Research Ethics Subcommittee (ETH2526-0070, Nov 2024; Appendix E).

Participants

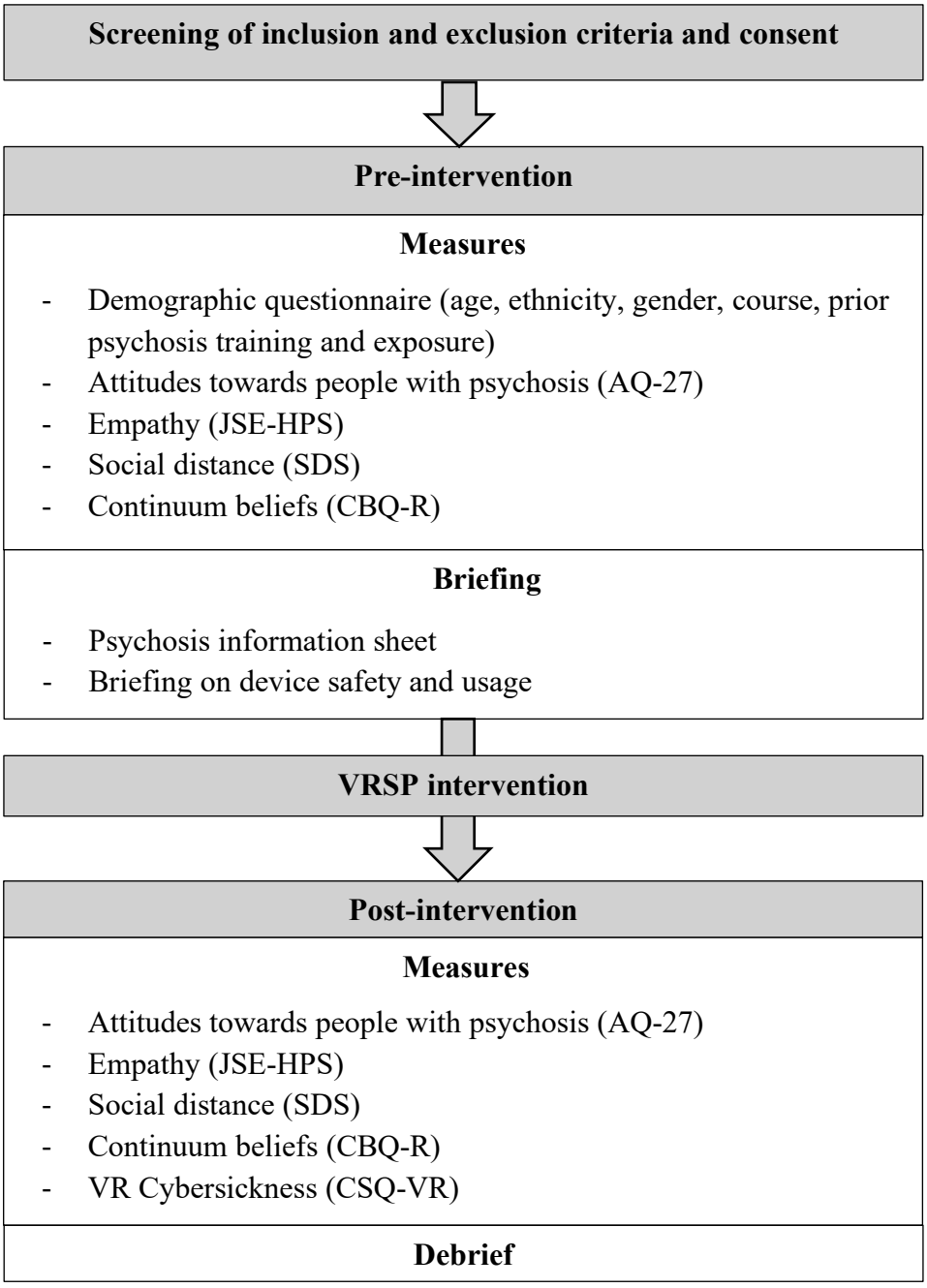
Participants were recruited from the UEA (February-May 2025) using convenience and snowball sampling, through email distributions, posters, and online advertisements. Eligible participants were students enrolled in healthcare courses within the Schools of Medicine, Health Sciences, and Chemistry, Pharmacy and Pharmacology (CPP). Due to prior knowledge, exposure, or medical conditions, students were excluded if they: (1) were enrolled in mental healthcare courses; (2) had previously participated in VRSP research; (3) reported medical conditions impacting VR participation (e.g. vertigo, seizure disorders, hearing or visual impairments); or (4) reported personal or close familial history of psychotic disorders.

Procedure

An overview of the study procedure is presented in Figure 4. Participants accessed an electronic participant information sheet (Appendix F), initial screening questionnaire (Appendix G), and consent form (Appendix H) prior to participation. Eligible participants who provided informed consented were allocated a timeslot to attend the study in person. During their timeslot, they completed pre- and post-intervention questionnaires in English via Microsoft Forms, using a tablet or their phone (Appendix I). Before the VRSP, participants were provided a psychosis information sheet developed using the NHS online overview of psychosis (2023; Appendix J). This was intended to establish baseline knowledge and minimise risk of inadvertently increasing psychosis stigma (Kalyanaraman et al., 2010; Zare-Bidaki et al., 2022). Participants were then briefed on the intervention and device safety and were instructed to remain seated throughout using a height-adjustable rotating chair to look around the 360° environment. After the intervention, participants' wellbeing was assessed before they completed the post-intervention measures. Participants were then debriefed and provided the opportunity to enter a prize draw as compensation (Appendix K).

Figure 4

Study Procedure Flowchart



VRSP Intervention

The VRSP intervention was delivered using a Meta Quest 3 VR system (Meta Platforms Inc., Menlo Park, California, USA) and over-ear headphones to optimise audio quality, minimise external noise, and promote immersion. The 13-minute 360° video VRSP presented a fictional person with psychosis whom participants 'embodied' from a first-person perspective across a series of everyday scenarios (Figure 5). The VRSP simulated commonly reported experiences of psychosis, including auditory and visual hallucinations and delusional ideation. This was developed alongside individuals with lived experience (Hannah et al., 2025).

Figure 5

Example of Two VRSP Scenes



Note. Left image depicts a scene from a social event where the character is experiencing auditory hallucinations whilst trying to communicate with peers. The right image shows a scene where the character is seeing the GP alongside their mother to seek a diagnosis.

Measures

Attributions Questionnaire (AQ-27; Corrigan et al., 2003)

The AQ-27 is a 27-item measure assessing stigmatising attitudes towards people with mental illness, grounded in Weiner et al. (1988) attributional model of public stigma. It explores nine stigma subscales using a 9-point Likert scale, with higher scores indicating

greater stigmatising attitudes. The AQ-27 has been widely used with HCPs and students (Corrigan et al., 2004; Irvine et al., 2012; Law et al., 2009) and has marginal to good internal consistency and test re-test reliability (α = .55-.93; Brown, 2008; Corrigan et al., 2004). This was also perceived in the present sample pre- and post-intervention (α = .79/.77).

Jefferson Scale of Empathy – Health Professions Student Version© (JSE-HPS; Hojat et al., 2001; Appendix L)

The JSE-HPS is a 20-item measure widely used to measure empathy in medical education research (Colliver et al., 2010; Hojat et al., 2018). Items are rated on a 7-point Likert scale, with higher scores reflecting greater empathy. The JSE-HPS has an acceptable internal consistency (α = .78) and test-retest reliability coefficients over a three-month interval (r = .58; Fields et al., 2011). The present sample's Cronbach was marginal to low pre- and post-intervention (α = .66/.56).

Social Distance Scale (SDS; Link et al., 1987)

The SDS is a widely used seven-item measure assessing preferences for social distance from stigmatised populations, including people with mental illness (Angermeyer & Matschinger, 2004). Items are rated on a 4-point Likert scale, with higher scores reflecting greater desire for social distance. For the present study, the vignette character name was replaced with 'someone with psychosis' to ensure relevance while maintaining scale integrity. Similar adaptations have demonstrated good internal consistency (α = .90, Angermeyer & Matschinger, 2004; α = .89, Wiesjahn et al., 2014), alongside the present sample pre- and post-intervention (α = .83/.88). Despite its widespread use in stigma research, published evidence of its test-retest reliability could not be identified.

Continuum Beliefs Questionnaire - Revised (CBQ-R; Schlier et al., 2016)

The nine-item CBQ-R was used to measure continuum beliefs. Items are rated on a 7-point Likert scale, with higher scores indicating stronger continuum beliefs. The revised

version demonstrated improved internal consistency and test re-test reliability (α = .60; Schlier et al., 2016), with the present sample having an even higher internal consistency pre- and post-intervention (α = .69/.76).

Cybersickness in Virtual Reality Questionnaire (CSQ-VR; Kourtesis et al., 2023)

Cybersickness symptoms were assessed using the CSQ-VR, measuring nausea, disorientation, and oculomotor symptoms. Each item was assessed using two items rated on a 7-point Likert scale, with higher scores indicating greater symptom severity. Kourtesis et al. (2023) found the CSQ-VR to have a higher internal consistency than other cybersickness measures (α = .87), and the present sample also demonstrated an acceptable internal consistency (α = .79).

Power Calculation

A priori power analysis was conducted using G*Power (version 3.1.9.7), informed by previous VRSP research (Zare-Bidaki et al., 2022). Assuming a medium effect size (*d* = .50) and alpha level of .05, a minimum of 27 participants were required to achieve 80% power. Recruitment aimed to exceed this threshold by 10% to account for potential attrition (Sakpal, 2010).

Statistical Analysis

Statistical analyses were conducted using IBM SPSS Statistics (version 29.0.2.0). Descriptive statistics were used to summarise demographic variables and cybersickness symptoms. As the 5% trimmed mean were comparable to untrimmed means, no outliers were excluded (Pallant, 2016). Data distribution was assessed using visual inspection of histograms and Shapiro-Wilk tests. For normally distributed outcome variables, mean difference and confidence intervals were reported, and paired-samples t-tests were conducted. For non-normally distributed outcome variables, median difference was reported and

Wilcoxon signed-rank tests were used. To control for Type I error across AQ-27 subscales, a Bonferroni correction was applied, resulting in an adjusted significance threshold of $p < .0056$.

Exploratory analyses were conducted to examine potential baseline and post-intervention differences in stigma-related outcomes according to university school, prior contact with someone with psychosis, and previous VR training. Depending on distributional assumptions, one-way ANOVA, Kruskal-Wallis, and Mann-Whitney U tests were used.

Results

Sample Characteristics

A total of 70 participants were included in the analysis, with no withdrawals or missing data. Participants were enrolled across a range of healthcare courses, with medicine being the most common. Within the school of health science, occupational therapy (n = 11), physiotherapy (n = 7), paramedic science (n = 6), nursing (n = 5), and speech and language therapy (n = 4) were the most common. Most participants reported no prior VR training or contact with people with psychosis (Table 4).

Table 4

Demographic Characteristics

Variable	Level	Sample (N = 70)
Age, mean (SD)	–	23.5 (6.7)
Gender, n (%)	Female	54 (77.1%)
	Male	16 (22.9%)
Ethnicity, n (%)	White / Caucasian	35 (50.0%)
	Asian / Asian British	22 (31.4%)
	Black / Black British / Caribbean / African	7 (10.0%)
	Mixed or multiple ethnic groups	3 (4.3%)
	Other ethnic groups	3 (4.3%)
University School, n (%)	School of Health Science	38 (54.3%)
	School of Medicine	20 (28.6%)
	School of CPP	12 (17.1%)
Previous VR Training, n (%)	No	54 (77.1%)
	Yes	16 (22.9%)
Previous Work or Contact with Psychosis, n (%)	No	54 (77.1%)
	Yes	16 (22.9%)

Note. n = number of participants within the sample

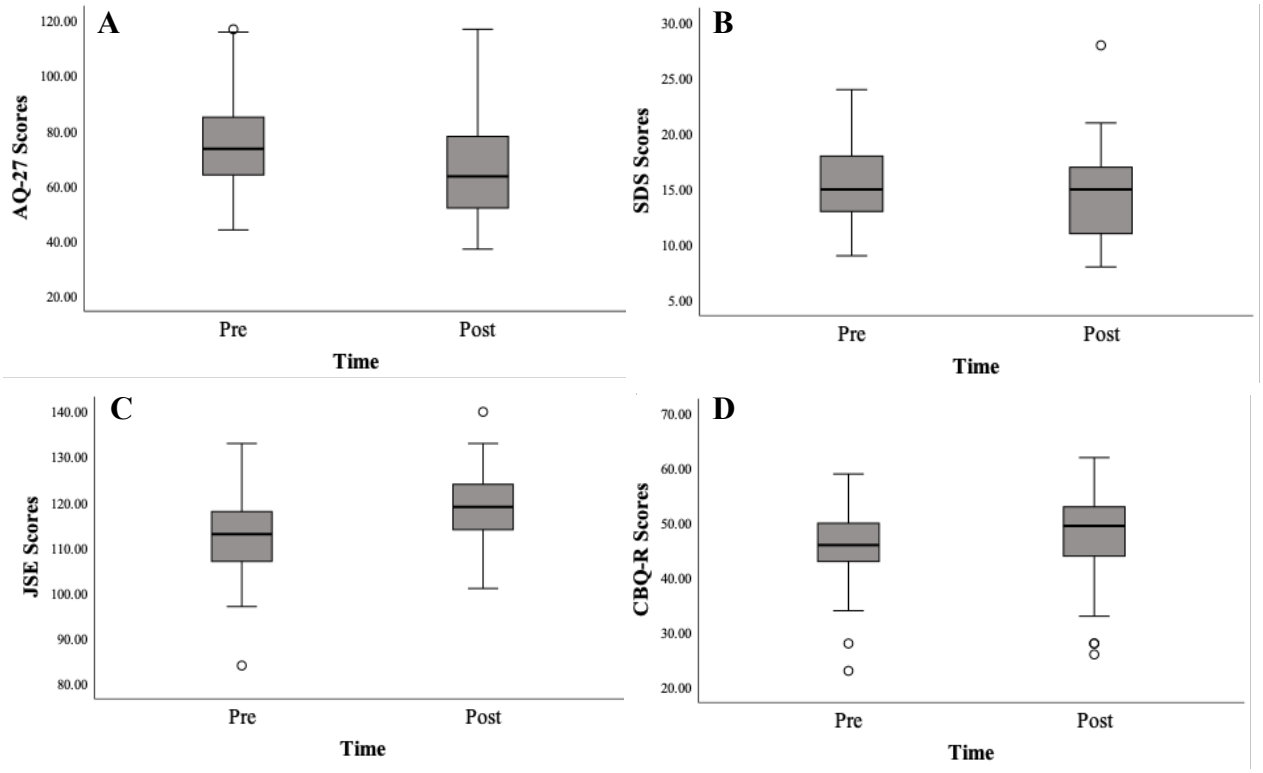
Intervention Effects on Stigma-Related Outcomes

Significant improvements were observed across all four stigma-related outcomes following the VRSP intervention (Figure 6). Stigmatising attitudes decreased significantly

from pre- to post-intervention (mean difference = −10.23, 95% CI [−13.16, −7.30], $t(69)$ = −6.97, p <.001, Cohen's d = 0.83), empathy increased significantly (median difference = 6.0, z = 6.54, p < .001, r = .78), and continuum beliefs showed a small significant increase (mean difference = 1.50, 95% CI [0.21, 2.79], $t(69)$ = 2.32, p = .023, Cohen's d = .28). Although central tendencies in social distance scores remained stable, a significant overall reduction was detected (z = −2.61, p = .009) with a medium effect size (r = .31), suggesting meaningful shifts occurred at individual levels.

Figure 6

Changes in Stigma-Related Outcomes Following the VRSP Intervention



Note. Boxes represent the IQR, with the horizontal line indicating the median. Whiskers extend to values within 1.5 x IQR, and circles denote outliers. Panel A displays stigmatising attitudes, Panel B social distance, Panel C empathy, and Panel D continuum beliefs.

AQ-27 Subscales

Signification reductions were observed for anger, danger, fear, avoidance, segregation, coercion, and unwillingness to help, all with medium-to-large effect sizes. Reduction in blame and pity did not reach the Bonferroni-adjusted significance threshold (Table 5).

Table 5

Changes in AQ-27 Subscale Scores from Pre- to Post-Intervention

Subscale	Median (Pre)	Median (Post)	*Z*	*p*	Effect Size (r)
Anger	5.00	3.00	-3.85	<.001*	0.46
Avoidance	12.50	10.00	-3.41	<.001*	0.41
Blame	7.00	6.00	-1.89	.058	0.23
Coercion	11.00	10.00	-3.71	<.001*	0.44
Danger	7.50	6.00	-3.02	.003*	0.36
Fear	6.00	5.00	-2.79	.005*	0.33
Pity	10.00	9.00	-1.98	.048	0.24
Segregation	5.00	4.00	-3.50	<.001*	0.42
Unwillingness to Help	7.00	5.00	-5.01	<.001*	0.60

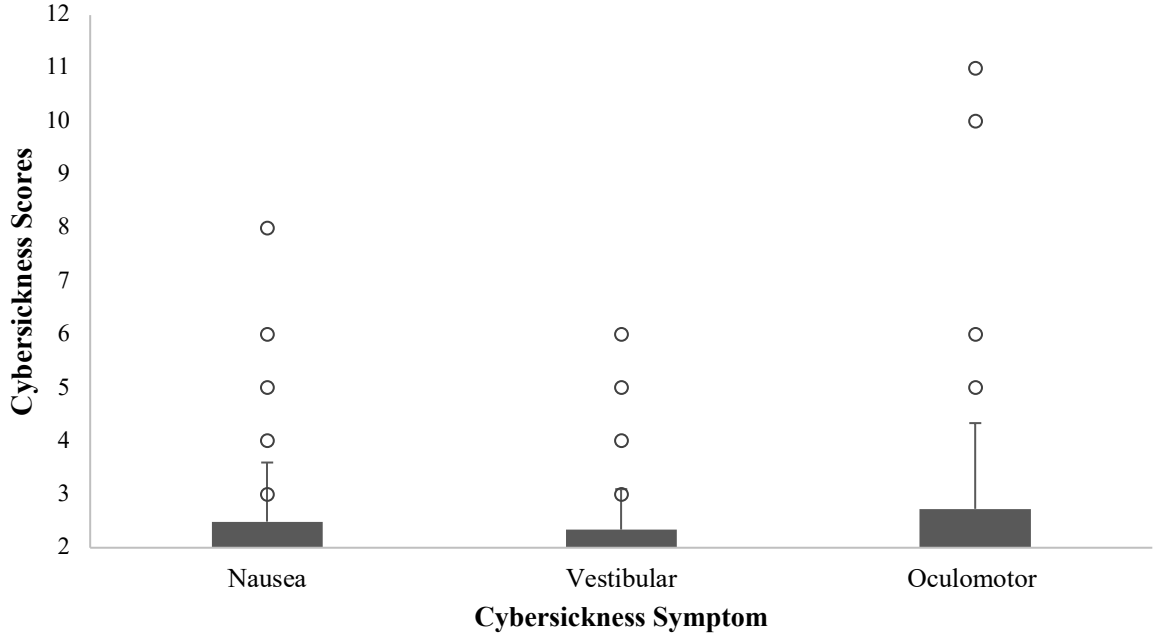
** p <.0056, Bonferroni-corrected threshold.*

Cybersickness

Most participants reported no or minimal cybersickness symptoms across all CSQ-VR subscales (Figure 7). A small number reported more moderate symptoms; however, no participants withdrew or reported persistent symptoms after removing the headset.

Figure 7

Cybersickness Mean Scores Bar Chart



Note. Bars represent the total mean scores, with error bars reflecting the SD. Circles represent outliers. The y-axis is truncated at the minimum possible score of 2 'absent feeling'.

Secondary Outcomes

No baseline differences were observed across outcome measures based on university school or previous VR training (all $p > .05$). Participants who had previous contact with people with psychosis demonstrated higher baseline continuum belief scores than those without prior contact (median difference = 5.50, U = 578.0, z = 2.05, $p = .041$, $r = .24$). No significant differences were observed between any of the groups' post-intervention or change scores (all $p > .05$).

Discussion

Summary and Interpretation of Findings

This study examined whether a 360° video VRSP intervention could reduce psychosis-related stigma among UK healthcare students across cognitive, affective, and behavioural domains. Overall, the VRSP intervention was associated with significant improvements in all stigma-related outcomes, including attitudes, empathy, social distance, and continuum beliefs. These findings extend previous research supporting the utility of immersive VR as a destigmatisation tool within healthcare education (Kalyanaraman et al., 2010; Marques et al., 2022; Tay et al., 2025; Zare-Bidaki et al., 2022), whilst counteracting studies which did not find VRSP to significantly improve empathy or social distance (Kalyanaraman et al., 2010; Marques et al., 2022; Tay et al., 2025).

Further analyses of stigmatising attitudes indicated significant reductions across subscales reflecting anger, fear, dangerousness, avoidance, segregation, coercion, and unwillingness to help. Smaller reductions were observed for blame and pity, which did not survive Bonferroni correction. Consistent with attribution theory (Corrigan et al., 2003; Weiner et al., 1988, Weiner, 1995), VRSP may therefore be more effective at challenging threat-based assumptions around dangerousness and unpredictability, reducing subsequent emotional and behavioural responses, such as fear and avoidance. This is in contrast to beliefs around responsibility and control, which are more closely linked to blame and pity.

Previous literature suggests perspective-taking VR may be more effective at automatically inducing emotional responses, such as compassion and empathy, compared to cognitive responses, as the passive experience requires minimal cognitive effort from participants (Chen & Ibasco, 2023). This could explain why larger effects were seen for empathy and social distance compared to continuum beliefs. Future research could explore

differences in outcomes when compared to more interactive VRSP, which incorporates cognitive or reflective tasks. This may enhance learning, as reflection is considered a key part of experiential learning (Kolb, 1984). In addition, more explicit and sustained education may be required to challenge embedded causal beliefs.

Exploratory Findings

The exploratory analyses highlighted no differences between participants based on university school and previous VR training. This suggests comparable baseline levels of stigma across these groups, supporting the assumption that changes were not due to pre-existing group differences. Contrastingly, participants with prior contact with individuals with psychosis had higher baseline continuum beliefs, consistent with contact theory and links between certain levels of familiarity and reduced stigma (Allport, 1954; Angermeyer et al., 2004; Corrigan & Nieweglowski, 2019). As no differences were observed between the groups post-intervention, it may suggest VRSP was able to simulate the benefits of interpersonal exposure, and thereby be a novel means of increasing continuum beliefs. This may be particularly beneficial for HCPs who have infrequent contact with people with psychosis. However, adequately powered RCTs would be required to confirm potential benefits.

Strengths and Clinical Implications

This study progressed from the feasibility study, providing promising preliminary effect sizes and outcome measure sensitivity. To the authors' knowledge, this is the first in the UK to explore VRSP as an educational tool, expanding on other countries by incorporating multiple components of stigma within a singular study and being the first to investigate continuum beliefs. Successful participant recruitment was another strength, demonstrating broad interest in VRSP across future HCPs. This is encouraging when considering the incorporation of VRSP into healthcare education alongside evidence of

disengagement with common learning approaches, such as e-learning, lectures, and small group case-based learning (Reid et al., 2016; Reji & Harris, 2019; Scarbrough et al., 2020; Wammes et al., 2019).

The findings of this study therefore highlight the need to progress to RCTs, with the successful recruitment showing promise for adequately powered trials and retention in longer-term follow-ups. This will enable evaluation of VRSP effectiveness over time and relative to comparator educational interventions, determining the durability of effects, how VRSP can be integrated into existing curricula, and whether improvements in stigma-related outcomes translate into changes in clinical behaviour and patient care.

Limitations and Future Research

Several limitations warrant consideration. Firstly, the lack of comparators and use of a psychosis information sheet, limits attribution of effect, alongside self-report measures increasing social desirability bias. Whilst the sample was mostly representative of the NHS workforce in terms of gender and ethnicity (NHS England, 2021; HM Government, 2023), participants were recruited from a single UK university, limiting generalisability. There is also a risk of volunteer bias, although attempts were made to mitigate this by simplifying the process, increasing flexibility for participation, having a larger sample, and providing incentives. The exclusion criteria for the study also limits our understanding of how VRSP would impact mental healthcare students and students with personal or family history with psychosis. Future research should aim to recruit healthcare students from across the UK, as well as expanding to other populations, such as those who were excluded, or NHS professionals trained outside of the UK, who may hold different cultural understandings of psychosis and stigma.

Moreover, internal consistency for the JSE-HPS in the sample was lower than previously reported and decreased following the VRSP intervention. As the JSE-HPS is an

established and widely validated measure, items were not removed to increase reliability, thus the effect size for empathy may need to be interpreted with caution. The JSE-HPS captures multiple dimensions of empathy, including professional perspective-taking, compassionate care, and standing in patients' shoes. It is possible the immersive, first-person nature of the VRSP intervention had an influence on specific components of empathy more strongly than others, resulting in more differentiated responding across items and reduced inter-item homogeneity. Additionally, variability in healthcare students' degrees and backgrounds may have contributed to differences in how certain items were interpreted. Future research should explore the relationship between VRSP, healthcare courses, and multiple facets of empathy in greater detail.

Conclusion

In conclusion, this study provides further evidence for the use of VRSP to reduce psychosis-related stigma among healthcare students by improving attitudes, empathy, desire for social distance, and continuum beliefs. The findings support the need for adequately powered RCTs to progress the research further and continue to explore the effectiveness and durability of VRSP as a destigmatisation tool across healthcare populations. Expanding the evidence base will clarify how VRSP can be integrated into educational programmes and progressing to continued professional development in professional training.

Declaration of Interest Statement

The authors report there are no competing interests to declare.

Funding

This research did not receive any specific grant from funding agencies.

References

Allport, G. W. (1954). *The nature of prejudice* (Vol. 2, pp. 59-82). Addison-Wesley.

Angermeyer, M. C., & Matschinger, H. (2004). The stereotype of schizophrenia and its impact on discrimination against people with schizophrenia: Results from a representative survey in Germany. *Schizophrenia Bulletin, 30*(4), 1049–1061. https://doi.org/10.1093/oxfordjournals.schbul.a007120

Angermeyer, M. C., Matschinger, H., & Corrigan, P. W. (2004). Familiarity with mental illness and social distance from people with schizophrenia and major depression: Testing a model using data from a representative population survey. *Schizophrenia research*, *69*(2-3), 175-182. https://doi.org/10.1016/S0920-9964(03)00186-5

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Prentice-Hall, Inc.

Birtel, M. D., & Oldfield, G. (2022). Affective, cognitive, and behavioural mental illness stigma in health care: A comparison between general ward nurses and the general population. *Stigma and Health*, *7*(4), 380-388. http://doi.org/10.1037/sah0000416

Brown, S. A. (2008). Factors and measurements of mental illness stigma: A psychometric examination of the attribution questionnaire. *Psychiatric Rehabilitation Journal, 32*(2), 89-94. https://doi.org/10.2975/32.2.2008.89.94

Chen, D. C., Kirshenbaum, D. S., Yan, J., Kirshenbaum, E., & Aseltine, R. H. (2012). Characterizing changes in student empathy throughout medical school. *Medical Teacher, 34*, 305-311. https://doi.org/10.3109/0142159X.2012.644600

Chen, V. H. H., & Ibasco, G. C. (2023). All it takes is empathy: How virtual reality perspective-taking influences intergroup attitudes and stereotypes. *Frontiers in Psychology, 14*. https://doi.org/10.3389/fpsyg.2023.1265284

Colliver, J., Conlee, M., Verhulst, S. J., & Dorsey, J. K. (2010). Rebuttals to critics of studies of the decline of empathy. *Academic Medicine, 85*(12), 1813-1814. https://doi.org/10.1097/ACM.0b013e3181faa3ed

Corrigan, P. W., & Nieweglowski, K. (2019). How does familiarity impact the stigma of mental illness? *Clinical Psychology Review, 70*, 40-50. https://doi.org/10.1016/j.cpr.2019.02.001

Corrigan, P. W., Markowitz, F. E., Watson, A., Rowan, D., & Kubiak, M. A. (2003). An attribution model of public discrimination towards persons with mental illness. *Journal of Health and Social behaviour, 44*(2), 162-179. https://doi.org/10.2307/1519806

Corrigan, P. W., Watson, A. C., Warpinski, A. C., & Gracia, G. (2004). Stigmatising attitudes about mental illness and allocation of resources to mental health services. *Community Mental Health Journal, 40*(4), 297-307. https://doi.org/10.1023/b:comh.0000035226.19939.76

Crestois, N., Kempton, M. J., & Twumasi, R. (2025). A systematic review and meta-analysis of employer discrimination towards people living with psychosis. *Schizophrenia Research, 278*, 35-46. https://doi.org/10.1016/j.schres.2025.03.018

Cronan, S. B., Key, K. D., & Vaughn, A. A. (2016). Beyond the dichotomy: Modernizing stigma categorization. *Stigma Health, 1*(4), 225-243. https://doi.org/10.1037/sah0000031

Elliott, R., Bohart, A. C., Watson, J. C., & Greenberg, L. S. (2011). Empathy. *Psychotherapy, 48*(1), 43-49. https://doi.org/10.1037/a0022187

Delisle, M., Ward, M. A. R., Pradarelli, J. C., Panda, N., Howard, J. D., & Hannenberg, A. A. (2019). Comparing the learning effectiveness of healthcare simulation in the observer versus active role: Systematic review and meta-analysis. *Simulation in Healthcare, 14*(5), 318-332. https://doi.org/10.1097/SIH.0000000000000377

Fields, S., Mahan, P., Tillman, P., Harris, J., Maxwell, K., & Hojat, M. (2011). Measuring empathy in healthcare profession students using the Jefferson Scale of Physician Empathy: Health provider-student version. *Journal of Interprofessional Care, 25*(4), 287-293. https://doi.org/10.3109/13561820.2011.566648

Formosa, N. J., Morrison, B. W., Hill, G., & Stone, D. (2018). Testing the efficacy of a virtual reality-based simulation in enhancing users' knowledge, attitudes, and empathy relating to psychosis. *Australian Journal of Psychology, 70*(1), 57-65. https://doi.org/10.1111/ajpy.12167

Goffman, E. (1963). *Stigma: Notes on the management of spoiled identity*. Prentice Hall. https://doi.org/10.1093/sf/43.1.127

Hannah, O., Leddy, A., & Tsigarides, T. (2025). *Virtual perspective in psychosis: Investigating embodied virtual reality educational interventions and unpacking the impact of immersion on participant attrition.* [Doctoral dissertation, University of East Anglia]. UEA Digital Repository. https://ueaeprints.uea.ac.uk/id/eprint/100777/1/2025HannahOClinPsyD_Thesis.pdf

Hecht, M., Kloß, A., & Bartsch, A. (2022). Stopping the stigma. How empathy and reflectiveness can help reduce mental health stigma. *Media Psychology*, *25*(3), 367-386. https://doi.org/10.1080/15213269.2021.1963991

HM Government. (2023, April 13). *NHS Workforce*. NHS Digital. https://www.ethnicity-facts-figures.service.gov.uk/workforce-and-business/workforce-diversity/nhs-workforce/latest/#:~:text=in%20June%202022%2C%20over%201.3,doctor%2C%20and%20associate%20specialist%20positions

HM Government. (2024, December 8). *Government to tackle NHS workforce crisis with refreshed plan.* https://www.gov.uk/government/news/government-to-tackle-nhs-workforce-crisis-with-refreshed-plan

Hojat, M., DeSantis, J., Shannon, S. C., Mortensen, L. H., Speicher, M. R., Bragan, L., LaNoue, M., & Calabrese, L. H. (2018). The Jefferson Scale of Empathy: A nationwide study of measurement properties, underlying components, latent variable structure, and national norms in medical students. *Advances in Health Sciences Education: Theory and Practice, 23*(5), 899-920. https://doi.org/10.1007/s10459-018-9839-9

Hojat, M., Mangione, S., Nasca, T. J., Cohen, M. J., Gonnella, J. S., Erdmann, J. B., Veloski, J., & Magee, M. (2001). The Jefferson Scale of Physician Empathy: Development and preliminary psychometric data. *Educational and Psychological Measurement, 61*(2), 349-365. https://doi.org/10.1177/00131640121971158

Hussey, I., Alsalti, T., Bosco, F., Elson, M., & Arslan, R. (2025). An aberrant abundance of Cronbach's alpha values at .70. *Advances in Methods and Practices in Psychological Science, 8*(1). https://doi.org/10.1177/25152459241287123

Ionescu, A., Daele, T. V., Rizzo, A., Blair, C., & Best, P. (2021). 360° videos for immersive mental health interventions: A systematic review. *Journal of Technology in Behavioral Science, 6*, 631-651. https://doi.org/10.1007/s41347-021-00221-7

Irvine, A. B., Billow, M. B., Eberhage, M. G., Seeley, J. R., McMahon, E., & Bourgeois, M. (2012). Mental illness training for licensed staff in long-term care. *Issues in Mental Health Nursing, 33*(3), 181-194. https://doi.org/10.3109%2F01612840.2011.639482

Kalyanaraman, A., Penn, D. L., Ivory, J. D., & Judge, A. (2010). The virtual doppelganger: Effects of a virtual reality simulator on perceptions of schizophrenia. *Journal of Nervous Mental Disorders, 198*, 437-443. https://doi.org/10.1097/NMD.0b013e3181e07d66

Kane, J. C., Elafros, M. A., Murray, S. M., Mitchell, E. M. H., Augustinavicius, J. L., Causevic, S., & Baral, S. D. (2019). A scoping review of health-related stigma outcomes for high-burden diseases in low- and middle-income countries. *BMC Medicine, 17*(17). https://doi.org/10.1186/s12916-019-1250-8

Kinson, R. M., Hon, C., Lee, H., Abdin, E. B., & Verma, S. (2018). Stigma and discrimination in individuals with first episode psychosis; one year after first contact with psychiatric services. *Psychiatry Research, 270,* 298-305. https://doi.org/10.1016/j.psychres.2018.09.044

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice-Hall.

Kourtesis, P., Linnell, J., Amir, R., Argelaguet, F., & MacPherson, S. E. (2023). Cybersickness in Virtual Reality Questionnaire (CSQ-VR): A validation and

comparison against SSQ and VRSQ. *Virtual Worlds, 2*(1), 16–35. https://doi.org/10.3390/virtualworlds2010002

Kyaw, B. M., Saxena, N., Posadzki, P., Vseteckova, J., Nikolaou, C. K., George, P. P., Divakar, U., Masiello, I., Kononowicz, A. A., Zary, N., & Car, L. T. (2019). Virtual reality in health professions education: Systematic review and meta-analysis by the digital health education collaboration. *Journal of Medical Internet Research, 21*(1). https://doi.org/10.2196/12959

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge University Press.

Law, G. U., Rostill-Brookes, H., & Goodman, D. (2009). Public stigma in health and non-healthcare students: Attributions, emotions, and willingness to help with adolescent self-harm. *International Journal of Nursing Studies, 46*, 108-119. https://doi.org/10.1016/j.ijnurstu.2008.08.014

Link, B. G., Cullen, F. T., Frank, J., & Wozniak, J. F. (1987). The social rejection of former mental patients: Understanding why labels matter. *American Journal of Sociology, 92*, 1461-1500. http://doi.org/10.1086/228672

Loch, A. A., Hengartner, M. P., Guarniero, F. B., Lawson, F. L.., Wang, Y-P., Gattaz, W. F., & Rössler, W. (2013). The more information, the more negative stigma towards schizophrenia: Brazilian general population and psychiatrists compared. *Psychiatry Research, 205*(3), 185-191. https://doi.org/10.1016/j.psychres.2012.11.023

Marques, A. J., Veloso, P. G., Araújo, M., de Almeida, R. S., Correia, A., Pereira, J., Queiros, C., Pimenta, R., Pereira, A. S., & Silva, C. F. (2022). Impact of a virtual reality-based

simulation on empathy and attitudes toward schizophrenia. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.814984

McCullock, A. P., & Scrivano, R. M. (2023). The effectiveness of mental illness stigma-reduction interventions: A systematic meta-review of meta-analyses. *Clinical Psychology Review, 100*. https://doi.org/10.1016/j.cpr.2022.102242

Mori, M. (1970). The uncanny valley. *Energy*, *7*(4), 33–35.

NHS England. (2021). *News: NHS celebrates the vital role hundreds of thousands of women have played in the pandemic.* https://www.england.nhs.uk/2021/03/nhs-celebrates-the-vital-role-hundreds-of-thousands-of-women-have-played-in-the-pandemic/

Pallant, J. (2016). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS* (6th ed.). Open University Press, McGraw-Hill Education.

Peter, L., Schindler, S., Sander, C., Schimdt, S., Meuhlan, H., McLaren, T., Tomczyk, S., Speerforck, S., & Schomerus, G. (2021). Continuum beliefs and mental illness stigma: A systematic review and meta-analysis of correlation and intervention studies. *Psychological medicine, 51*(5), 716-726. https://doi.org/10.1017%2FS0033291721000854

Pottle, J. (2019). Virtual reality and the transformation of medical education. *Future Healthcare Journal, 6*(3), 181-185. https://doi.org/10.7861/fhj.2019-0036

Reavley, N. J., Mackinnon, A. J., Morgan, A. J., & Jorm, A. F. (2014). Stigmatising attitudes towards people with mental disorders: A comparison of Australian health professionals with the general community. *The Australian and New Zealand Journal of Psychiatry, 48*(5), 433-441. https://doi.org/10.1177/0004867413500351

Riches, S., Iannelli, H., Reynolds, L., Fisher, H., Cross, S., & Attoe, C. (2022). Virtual reality-based training for mental health staff: A novel approach to increase empathy, compassion, and subjective understanding of service user experience. *Advances in Simulation, 7*(9). https://doi.org/10.1186/s41077-022-00217-0

Ruffalo, M. L., Kottapalli, M., & Anbukkarasu, P. (2024). Empathy in the care of individuals with schizophrenia: A vital element of treatment. *American Journal of Psychotherapy, 77*(1), 30-34. https://doi.org/10.1176/appi.psychotherapy.20230022

Rus-Calafell, M., Garety, P., Sason, E., Craig, T. J. K., & Valmaggia, L. R. (2017). Virtual reality in the assessment and treatment of psychosis: A systematic review of its utility, acceptability and effectiveness. *Psychological Medicine, 48*(3), 362-391. https://doi.org/10.1017/S0033291717001945

Sakpal, T. V. (2010). Sample size estimation in clinical trial. *Perspectives in Clinical research, 1*(2), 67-69. https://pmc.ncbi.nlm.nih.gov/articles/PMC3148614/

Schlier, B., Scheunemann, J., & Lincoln, T. M. (2016). Continuum beliefs about psychotic symptoms are a valid, unidimensional construct: Construction and validation of a revised continuum beliefs questionnaire. *Psychiatry Research, 241***,** 147–153. https://doi.org/10.1016/j.psychres.2016.04.085

Tay, J. L., Qu, Y., Lim, L., Puthran, R., Tan, C. L. R., Rajendran, R., Wei, K. C., Xie, H., & Sim, K. (2025). Impact of a virtual reality intervention on stigma, empathy, and attitudes toward patients with psychotic disorders among mental health care professionals: Randomized controlled trial. *JMIR Mental Health*, *12*. https://doi.org/10.2196/66925

Thibodeau, R. (2020). Continuum belief, categorical belief, and depression stigma: Correlational evidence and outcomes of an online intervention. *Stigma and Health, 5*(4), 404-412. https://doi.org/10.1037/sah0000211

Thornicroft, G., Borhan, E., Kassam, A., & Lewis-Holmes, E. (2008). Reducing stigma and discrimination: Candidate interventions. *International Journal of Mental Health Systems, 2*(3). https://doi.org/10.1186/1752-4458-2-3

Thornicroft, G., Rose, D., & Kassam, A. (2007). Discrimination in health care against people with mental illness. *International Review of Psychiatry*, *19*, 113–122. https://doi.org/10.1080/09540260701278937

Time To Change. (2024). A campaign to change the way people think and act about mental health problems. https://www.time-to-change.org.uk

Valmaggia, L. R., Latif, L, Kempton, M. J., & Calafell, M. R. (2016). Virtual reality in the psychological treatment for mental health problems: A systematic review of recent evidence. *Psychiatry Research,* 189-195. https://doi.org/10.1016/j.psychres.2016.01.015

Walsh, S., O'Neill, A., Hannigan, A., & Harmon, D. (2019). Patient-rated physician empathy and patient satisfaction during pain clinic consultations. *Irish Journal of Medical Science 188*(4), 1379–1384. https://doi.org/10.1007/s11845-019-01999-5

Weiner, B. (1995). *Judgements of responsibility: A foundation for a theory of social conduct*. Guilford Press.

Weiner, B., Perry, R. P., & Magnusson, J. (1988). An attributional analysis of reactions to stigma. *Journal of Personality and Social Psychology, 55*(5), 738-748. https://doi.org/10.1037/0022-3514.55.5.738

Wiesjahn, M., Brabban, A., Jung, E., Gebauer, U. B., & Lincoln, T. M. (2014). Are continuum beliefs about psychotic symptoms associated with stereotypes about schizophrenia? *Psychosis, 6*(1), 50–60. https://doi.org/10.1080/17522439.2012.740068

Winter, R., Ward, A., Norman, R. I., & Howick, J. (2023). A survey of clinical empathy training at UK medical schools. *BMC Medical Education*, *23*(1), 40. https://doi.org/10.1186/s12909-022-03993-5

World Health Organization. (2021). *Comprehensive mental health action plan 2013-2030*. https://iris.who.int/bitstream/handle/10665/345301/9789240031029-eng.pdf?sequence=1

World Health Organization. (2022, June 17). *WHO highlights urgent need to transform mental health and mental health care. https://www.who.int/news/item/17-06-2022-who-highlights-urgent-need-to-transform-mental-health-and-mental-health-care*

Zare-Bidaki, M., Ehteshampour, A., Reisaliakbarighomi, M., Mazinani, R., Khodaie Ardakani, M. R., Mirabzadeh, A., Alikhani, R., Noroozi, M., Momeni, F., Samani, A.D., Mehrabi Tavana, M. M., Esmaeili, A., & Mousavi, S. B. (2022). Evaluating the effects of experiencing virtual reality simulation of psychosis on mental illness stigma, empathy, and knowledge in medical students. *Frontier Psychiatry*, *13*, 1-9. https://doi.org/10.3389/fpsyt.2022.880331

CHAPTER FOUR

Discussion and Critical Evaluation

Discussion and Critical Evaluation

This chapter provides a summary and critical evaluation of the systematic review and empirical research study presented in this thesis. Strengths and limitations of the research portfolio, alongside clinical and theoretical implications and future research directions are also dissected.

Summary of Findings and Theoretical Underpinnings

This thesis aimed to investigate immersive virtual reality (IVR) head-mounted displays (HMDs) as mental health educational tools for healthcare professionals (HCPs) and students. The thesis first synthesised the available literature within the field using a primarily narrative approach with exploratory meta-analyses where appropriate. An empirical study was then conducted to specifically investigate how sensitive an IVR simulated psychosis (VRSP) intervention was on improving stigma-related outcomes among UK healthcare students.

Systematic Review and Meta-Analysis

The systematic review and meta-analysis identified how IVR is starting to be explored in three main areas: diagnostic and consultation skills, patient-perspective simulations, and risk assessment and management. The review overall found IVR to have high acceptability, tolerability and safety, with infrequent but occasional technological limitations, including conversation constraints and limited user agency. Effectiveness outcomes highlighted promising results, but significance varied across studies. At an individual study level, IVR often led to improvements in knowledge, empathy, attitudes, and stigma; however, significance varied, and they did not always outperform comparator conditions. Whilst not statistically significant, a small pooled effect was found between studies, favouring IVR over

comparator conditions across the exploratory stigma, empathy, and attitude meta-analyses, demonstrating potential within an emerging and heterogenous evidence base.

Empirical Research Study

The empirical research study also found IVR to be a promising mental health educational tool. Significant improvements were identified across all four psychosis-related stigma outcomes among healthcare students following the VRSP intervention. Medium-to-large effects were seen for overall stigmatising attitudes, empathy, and social distance, whilst a small effect was seen for continuum beliefs. Low levels of cybersickness were reported, with any symptoms experienced dissipating quickly following the removal of the HMD. The subscale analyses of stigmatising attitudes highlighted significant reductions in more threat-based assumptions, such as dangerousness, and subsequent emotional and behavioural responses, such as fear and avoidance. Smaller decreases were observed for blame and pity, which did not survive Bonferroni correction.

Exploratory analyses highlighted how university school and previous virtual reality (VR) training did not impact baseline, change, or post-scores. Differences were observed for participants who had previous contact with individuals with psychosis, as they had higher baseline continuum beliefs than participants with no prior contact. This is consistent with contact theory and how certain levels of familiarity with people with mental health conditions may help reduce stigma (Allport, 1954; Angermeyer et al., 2004; Corrigan & Nieweglowski, 2019). No differences were observed in their change or post-scores, suggesting VRSP may be able to simulate interpersonal exposure and work as a virtual contact-based destigmatisation tool. In doing so, this could help standardise contact-based exposure within educational contexts.

Combined Discussion

The systematic review and empirical study provided complementary insights into IVR within mental health educational contexts for HCPs and students. Together they highlight key consistencies in that IVR is well tolerated and an acceptable educational tool. However, whilst promising, there was variability in the effectiveness of IVR across the evidence base, as well as some beliefs potentially being less sensitive to change than certain emotional or behavioural responses. When considering the four stages of experiential learning theory (Kolb, 1984), facilitating reflections (reflective observation) after the IVR experience (concrete experience) may support learners to form new ideas and beliefs (abstract conceptualisation). They could then apply this to new situations in the final stage of learning (active experimentation), which could include placements, work, or additional IVR training. Increasing active participation within IVR training may also support learning within the concrete experience and active experimentation stages, as well as reducing limitations around user agency.

Critical Review

Strengths and Contributions

To the author's knowledge, the systematic review and meta-analysis is the first to synthesise research regarding IVR as a mental health education tool among HCPs and students. Such reviews are important given the rapidly expanding utility of IVR within healthcare populations and mental health contexts. Striving for transparency, accuracy, and reduced bias, the review was registered on PROSPERO, and PRISMA guidelines were followed (Page et al., 2021). This was further strived for by having a second reviewer screen and critically appraise 20-27% of the papers, as well as having effective communication between the research team to refine included and excluded studies. To maximise the chance of included studies, a variety of VR terminology was used, on top of additional manual

searches. Furthermore, papers before 2015 were excluded to ensure the synthesis only included modern VR HMD systems, reducing heterogeneity where possible.

Again, to the author's knowledge, the empirical study was the first in the UK to explore VRSP as an educational tool to reduce psychosis-related stigma among healthcare populations. It was able to expand on studies carried out in other countries by incorporating cognitive, affective, and behavioural components of stigma within a singular study, as well as being the first to investigate continuum beliefs. All outcomes were measured using validated instruments previously used within healthcare populations and stigma research, reducing the risk of measurement error, and ensuring they measured their intended constructs. Additionally, the VRSP training package was developed using Patient and Public Involvement (PPI) and was previously shown to be a feasible and acceptable intervention among UK healthcare students (Hannah et al., 2025). These are considerable strengths that are not always seen within IVR literature, as highlighted in the systematic review. However, it is recognised that the study could have benefited from further PPI to informed outcome measures and ensure materials were accessible to healthcare students while accurately reflecting psychosis-related stigma most relevant to those with lived experience.

Moreover, recruitment was successful for the empirical study. This meant the study was adequately powered, which is again not always seen within the field, as demonstrated in the systematic review. An ethical amendment was made to incorporate pharmacy students into the study after the research team were contacted by numerous students asking to participate. Whilst they were not originally included due to sitting outside of the university's medicine and healthcare schools, it demonstrated the interest within the study across multiple healthcare populations. This is very encouraging when considering the implementation of IVR mental health training going forward, as there appears to be a real interest in this

methodology of teaching, which should be embraced. This is especially important seeming as there is evidence of disengagement in other learning approaches commonly used within healthcare education and training, such as lectures, e-learning, and small group case-based learning (Reid et al., 2016; Reji & Harris, 2019; Scarbrough et al., 2020; Wammes et al., 2019). Positively, we were able to honour all students who initially signed up to the study, providing them with the opportunity to experience the VRSP, which students in the feasibility study had reported as finding enjoyable and insightful (Hannah et al., 2025).

Limitations

In addition to the strengths and contributions of this research, several limitations should be acknowledged. Many theoretical outcomes within psychology and psychiatry fields cannot be objectively or directly assessed, and therefore rely on self-report measures (Paola, 2020). This is a limitation seen within both the systematic review and the empirical study, therefore making it difficult to establish behavioural change. Whilst the empirical study recognised stigma as a multifaceted construct, with cognitive, affective, and behavioural components, there is a lack of consistency and standardised approaches to measuring stigma within the literature (Fox et al., 2018). This leads to heterogeneity between studies, making it difficult to compare and assess effective change. Moreover, the lack of extended timepoints across IVR studies within the field, including the empirical study, means the long-term durability of these interventions is unknown, alongside the subsequent impact on patient populations, service quality, and concepts such as ethical erosion.

The findings across both papers were restricted to mostly high-income economies, limiting the generalisability in low- and middle-income counties. It is also recognised that the review incorporated countries from western and eastern contexts, where mental health, education, and cultural constructs may differ, which could increase heterogeneity. However,

given the small evidence base, sensitivity analyses around study demographics were not possible. Study heterogeneity, including design, HMD, IVR content, outcome measures, and comparator groups, alongside the varied study quality and inconsistent reporting of data, led to the meta-analytic findings being exploratory. It also made it difficult to make causal conclusions regarding the effectiveness of IVR mental health educational tools.

Given the novelty of the empirical study and the desire to reach statistical power, a single-arm pre-post experimental design was employed. Whilst this was essential to assess the sensitivity of the VRSP intervention on stigma-related outcomes and to know whether progression to randomised controlled trials (RCTs) was indicated, it has its limitations. Primarily, the lack of comparator conditions in this study, and similar studies within the systematic review, make it difficult to assess whether IVR is more effective than non-immersive or more traditional training approaches. Whilst this is anticipated given the novelty of the research area, the rapid pace of technological development in IVR, whilst positive, presents an ongoing challenge for producing comparable empirical research.

Lastly, previous VRSP research has largely focused on single healthcare cohorts, such as medical or psychology students. The empirical study sought to advance this by recruiting students across multiple healthcare disciplines. Although exploratory subgroup analyses suggested comparable effects across disciplines, it is recognised that these were underpowered and should be interpreted with caution. The exclusion criteria implemented in IVR studies also limit our understanding of how IVR interventions function across different populations. Thus, the impact of IVR mental health education on other relevant groups remains unclear, including students enrolled in mental health courses, HCPs, and HCPs who trained outside of the UK. More broadly, certain populations are routinely excluded from IVR research and training due to health-related concerns (e.g. risk of seizures) and

accessibility barriers (e.g. visual or audio impairments). This further restricts the generalisability of findings, alongside raising questions regarding equity of access in emerging educational technology.

Clinical Implications

This thesis has several important clinical implications for IVR mental health education and training across healthcare professions. Firstly, research highlights the varied potential of IVR as an exposure-based educational tool within a range of mental health contexts, with promising effects for its ability to simulate interpersonal contact in a safe and widely accepted way. This is particularly valuable for disciplines where exposure to mental health populations and settings may otherwise occur later in training or inconsistently across their training and work, limiting their contact with people experiencing mental health difficulties. This has particular relevance within psychology education, where out of the 157 universities offering undergraduate psychology degrees, only 36 offer a placement year (Complete University Guide Limited, 2026). IVR may therefore function as a preparatory education tool, with particular benefits in supporting learners prior to clinical placements or workforce entry.

Another central implication is that IVR can provide controlled, standardised, and reproducible training opportunities and assessments. Role-plays and objective structured clinical examinations (OSCEs) are commonly used within healthcare courses and are increasingly being incorporated into clinical psychology training (Gibbs, 2019; Yap et al., 2021). Whilst they are considered valuable learning experiences, they require significant resources, making it difficult to facilitate to large cohorts, as well as facing challenges around inconsistent feedback and student anxiety (Roberts et al., 2017, 2021; Rogers et al., 2022). As seen in the systematic review, IVR can offer an alternative approach that allows for

assessment skill rehearsal and OSCEs in a more controlled, standardised, and repeatable manner, which may be more accepted by students in comparison to actors or classmates (Graf et al., 2024).

In addition, embodied first-person perspective IVR shows promise as a tool for reducing mental health stigma by increasing empathy and continuum beliefs, whilst reducing stigmatising attitudes and desire for social distance. This is important given the impact stigma can have on employment, education, relationships, and health within stigmatised groups, such as individuals with psychosis (Crestois et al., 2025; Kane et al., 2019; Kinson et al., 2018; WHO, 2022). Moreover, targeting empathy is clinically relevant given the evidence of ethical erosion seen within healthcare professions (Chen et al., 2012; Winter et al., 2023). A decline in empathy has also been observed in Psychologists, leading to compassion fatigue, resulting in a recognition for more continued professional development training and resources to reduce this impact (Stevens & Al-Abbadey, 2024). Integrating IVR into training may therefore support the maintenance of empathy within the workforce, which has the potential to positively influence therapeutic relationships, treatment, clinical competence, and patient satisfaction (Elliott et al., 2011; Ruffalo et al., 2024; Walsh et al., 2019).

Nevertheless, careful consideration is required in the design and implementation of IVR to avoid the risk of inadvertently increasing stigma (Kalyanaraman et al., 2010; Zare-Bidaki et al., 2022). At present, this involves delivering IVR mental health training in conjunction with additional education until adequately powered trials are completed and more robust conclusions can be draw regarding the causal effects. Additionally, structured debriefs and reflections may be required following IVR training to enhance educational benefits while minimising the risk of increased stigma.

Clinical Psychologists are specifically well positioned to guide the ethical and effective integration of IVR into their training programmes by promoting experiential learning through reflective practice and formulation-based understanding post-exposure. Psychologists are also equipped to ensure psychological safety following IVR training, given how the nature of the content has the potential to be hard hitting for learners. However, as highlighted in the systematic review, the field of psychology has been comparatively slower to integrate and evaluate IVR mental health training, when contrasted to other healthcare disciplines, such as nursing or medicine, where VR-based training has already been adopted and embedded within curricula (Jiang et al., 2022; Lie et al., 2023; Philip & Savundranayagam, 2025).

Whilst considerations have been identified regarding the implementation of IVR, such as initial start-up costs and licensing fees (Hiley et al., 2024), they are increasingly mitigated by the growing expansion of IVR infrastructure within healthcare and educational settings. They are further supported by broader UK healthcare priorities, including the NHS 10-year plan and emerging national initiatives regarding digital innovation and extended reality in mental health contexts (NHS England, 2023; UK Government, 2025; UK Research and Innovation, 2026). Moreover, as the development and infrastructure of IVR becomes more accessible, research and training can advance to lower-income countries, allowing further comparisons and global mental health training.

It is also important to consider future developments within IVR. Many of the barriers currently present in IVR education and its incorporation into the field of psychology, such as communication difficulties and reliance on predetermined scripts, may be reduced through advances in artificial intelligence (AI). Recent developments have already demonstrated the

feasibility and acceptability of generative AI-driven virtual patients capable of dynamic interactions with learners, but it is recognised this is still in its infancy (Jiang et al., 2026).

Furthermore, AI may facilitate the generation of increasingly realistic virtual environments and avatars. Combined with advances in display resolution, motion tracking, and spatial audio, future IVR experiences may approach a level of realism that is difficult to distinguish from real-world interactions. While such developments may enhance educational authenticity, they may also raise ethical considerations regarding the potential for psychological harm, particularly when simulations involve distressing content, such as those designed to replicate psychotic symptoms. This is something that should be monitored as IVR technologies continue to evolve, especially because historically the literature has focused on physical adverse effects, such as cybersickness. Given that psychological harm is infrequently reported across studies, clinical psychologists may have an important role in developing theoretical models and risk assessment frameworks to better understand, identify, and mitigate psychological harm associated with increasingly immersive VR technologies.

Directions for Future Research

In order to continue to develop the evidence base, future research should prioritise adequately powered longitudinal RCTs to gain a greater understanding of the effectiveness of IVR mental health education compared to alternative VR or traditional education approaches. In addition to comparators, mediators could be explored, such as presence, embodiment, interaction, realism, and level of perspective-taking. This will provide insight into which mechanisms of IVR enhance mental health learning to produce more effective training packages. Moreover, longitudinal studies will establish the durability and long-term impact of IVR mental health training, establishing how frequently IVR would need to be implemented into healthcare curriculum and training, and whether it translates to clinical behaviour. This

advancement is necessary given the consensus that IVR is an acceptable and safe mental health education tool.

In addition to the IVR systems, clearer transparency and standardised reporting is required within studies, acknowledging the design, content, HMD, and adverse effects. This will support the expansion of the field and allow for easier comparisons between studies. Moreover, in the development of IVR mental health educational training, ethical considerations, such as the psychological safety of learners, should be at the forefront. IVR designs should be trauma-informed, and the content carefully considered alongside patient and public involvement in order to not significantly increase emotional distress and inadvertently increase stigma towards mental health populations.

Lastly, it would be informative to advance the research to other populations, such as those within the NHS or charitable sectors, as well as those who trained outside the UK and members of the general public caring for people with mental health conditions. Whilst the accessibility of IVR has rapidly increased with HMDs, advancements should be made to increase access for populations with visual or hearing impairments, as well as considering the impact on the learning needs of neurodivergent populations.

Conclusion

In conclusion this thesis portfolio demonstrates the promising application of IVR as a mental health education tool for HCPs and students, with particular promise in its application as a virtual contact-based destigmatisation tool. Despite the heterogeneity amongst the research, IVR was consistently reported to be a safe and acceptable educational tool within this field. However, it is recognised that it should be utilised in conjunction with traditional educational approaches whilst the evidence base continues to develop, and more robust conclusions can be drawn regarding its effectiveness. Future research should focus on

adequately powered longitudinal RCTs with multiple comparator conditions to further develop the field and gain an understanding of the effectiveness and long-term educational impact of IVR within mental health contexts. Advancing the evidence base in this way will help determine how and when IVR mental health training should be implemented within educational training, alongside continued professional development.

References

Abbas, J. R., O'Connor, A., Ganapathy, E., Isba, R., Payton, A., McGrath, B., Tolley, N., & Bruce, I. A. (2023). What is virtual reality? A healthcare-focused systematic review of definitions. *Health Policy and Technology*, *12*(2), Article 100741. https://doi.org/10.1016/j.hlpt.2023.100741

Abes, A., Fairchild, N., Lin, S., Wahba, M., Xiao, K., & Fisher, S. S. (2025). The immersive archive: Archival strategies for the Sensorama & Sutherland HMD. *IEEE International Conference on Artificial Intelligence and eXtended and Virtual Reality (AIxVR),* 307-312. https://doi.org/10.1109/AIxVR63409.2025.00059

Acuña-Rodríguez, M., Quintero, K. F. M., Bolaño-Romero, M. P., & Lozada-Martinez, I. D. (2025). Gaps and opportunities in global mental health research: Disparities across geographic regions and income levels. *Psychiatry Investigation, 22*(11), 1227-1229. https://doi.org/10.30773/pi.2025.0235

Allport, G. W. (1954). *The nature of prejudice* (Vol. 2, pp. 59-82). Addison-Wesley.

Angermeyer, M. C., & Matschinger, H. (2004). The stereotype of schizophrenia and its impact on discrimination against people with schizophrenia: Results from a representative survey in Germany. *Schizophrenia Bulletin, 30*(4), 1049–1061. https://doi.org/10.1093/oxfordjournals.schbul.a007120

Angermeyer, M. C., Matschinger, H., & Corrigan, P. W. (2004). Familiarity with mental illness and social distance from people with schizophrenia and major depression: Testing a model using data from a representative population survey. *Schizophrenia research*, *69*(2-3), 175-182. https://doi.org/10.1016/S0920-9964(03)00186-5

Bahadur, A. G., Hargreaves, F., Antinucci, R., Sockalingam, S., & Abdool, P. S. (2024). Virtual reality simulation for suicide risk assessment training: Prevalence of adverse effects. *Academic Psychiatry*, *48*(1), 57-60. https://doi.org/10.1007/s40596-023-01799-1

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Prentice-Hall, Inc.

Bekele, M. K., & Champion, E. (2019). A comparison of immersive realities and interaction methods: Cultural learning in virtual heritage. *Frontiers in Robotics and AI, 6*(91). https://doi.org/10.3389/frobt.2019.00091

Birtel, M. D., & Oldfield, G. (2022). Affective, cognitive, and behavioural mental illness stigma in health care: A comparison between general ward nurses and the general population. *Stigma and Health*, *7*(4), 380-388. http://doi.org/10.1037/sah0000416

Brown, S. A. (2008). Factors and measurements of mental illness stigma: A psychometric examination of the attribution questionnaire. *Psychiatric Rehabilitation Journal, 32*(2), 89-94. https://doi.org/10.2975/32.2.2008.89.94

Casetta, C., Kępińska, A. P., Stilo, S. A., & Murray, R. M. (2024). Causes and outcome of psychosis. In D. Kingdon, P. Rowlands, & G. Stein (Eds.), *Seminars in general adult psychiatry* (pp. 224-240). Cambridge University Press.

Chen, D. C., Kirshenbaum, D. S., Yan, J., Kirshenbaum, E., & Aseltine, R. H. (2012). Characterizing changes in student empathy throughout medical school. *Medical Teacher, 34*, 305-311. https://doi.org/10.3109/0142159X.2012.644600

Chen, V. H. H., & Ibasco, G. C. (2023). All it takes is empathy: How virtual reality perspective-taking influences intergroup attitudes and stereotypes. *Frontiers in Psychology, 14*. https://doi.org/10.3389/fpsyg.2023.1265284

Cieślik, B., Mazurek, J., Rutowski, S., Kiper, P., Turolla, A., & Szczepańska-Gieracha, J. (2020). Virtual reality in psychiatric disorders: A systematic review of reviews. *Complementary Therapies in Medicine, 52*. https://doi.org/10.1016/j.ctim.2020.102480

Clus, D., Larsen, M. E., Lemey, C., & Berrouiguet, S. (2018). The use of virtual reality in patients with eating disorders: Systematic review. *Journal of Medical Internet Research*, *20*(4). https://doi.org/10.2196/jmir.7898

Colliver, J., Conlee, M., Verhulst, S. J., & Dorsey, J. K. (2010). Rebuttals to critics of studies of the decline of empathy. *Academic Medicine, 85*(12), 1813-1814. https://doi.org/10.1097/ACM.0b013e3181faa3ed

Colman, L., Delaruelle, K., Verniest, R., & Bracke, P. (2020). Burdens in mental health recovery: Causal beliefs and their relation to stigma and help seeking recommendations. *International Journal of Social Psychiatry, 67*(8), 992-1004. https://doi.org/10.1177/0020764020973249

Complete University Guide Limited. (2026). *Results for undergraduate psychology courses.* https://www.thecompleteuniversityguide.co.uk/courses/search/undergraduate/psychology

Corrigan, P. W., & Nieweglowski, K. (2019). How does familiarity impact the stigma of mental illness? *Clinical Psychology Review, 70*, 40-50. https://doi.org/10.1016/j.cpr.2019.02.001

Corrigan, P. W., Markowitz, F. E., Watson, A., Rowan, D., & Kubiak, M. A. (2003). An attribution model of public discrimination towards persons with mental illness. *Journal of Health and Social behaviour, 44*(2), 162-179. https://doi.org/10.2307/1519806

Corrigan, P. W., Watson, A. C., Warpinski, A. C., & Gracia, G. (2004). Stigmatising attitudes about mental illness and allocation of resources to mental health services. *Community Mental Health Journal, 40*(4), 297-307. https://doi.org/10.1023/b:comh.0000035226.19939.76

Crestois, N., Kempton, M. J., & Twumasi, R. (2025). A systematic review and meta-analysis of employer discrimination towards people living with psychosis. *Schizophrenia Research, 278*, 35-46. https://doi.org/10.1016/j.schres.2025.03.018

Cronan, S. B., Key, K. D., & Vaughn, A. A. (2016). Beyond the dichotomy: Modernizing stigma categorization. *Stigma Health, 1*(4), 225-243. https://doi.org/10.1037/sah0000031

Cruz-Neira, C., Sandin, D. J., DeFanti, T. A., Kenyon, R. V., & Hart, J. C. (1992). The CAVE: Audio visual experience automatic virtual environment. *Communications of the ACM*, *35*(6), 64-73. https://doi.org/10.1145/129888.129892

Delisle, M., Ward, M. A. R., Pradarelli, J. C., Panda, N., Howard, J. D., & Hannenberg, A. A. (2019). Comparing the learning effectiveness of healthcare simulation in the observer

versus active role: Systematic review and meta-analysis. *Simulation in Healthcare, 14*(5), 318-332. https://doi.org/10.1097/SIH.0000000000000377

Elliott, R., Bohart, A. C., Watson, J. C., & Greenberg, L. S. (2011). Empathy. *Psychotherapy, 48*(1), 43-49. https://doi.org/10.1037/a0022187

Erbaş, A., Akyüz, E., & Ergöl, S. (2024). The effects of virtual reality used in healthcare education on cybersickness and sense of presence: A systematic review. *PRESENCE: Virtual and Augmented Reality*, *33*, 161–178. https://doi.org/10.1162/pres_a_00414

Fabris, C. P., Rathner, J. A., Fong, A. Y., & Sevigny, C. P. (2019). Virtual reality in higher education. *International Journal of Innovation in Science and Mathematics Education, 27*(8), 69-80. https://doi.org/10.30722/IJISME.27.08.006

Felton, W. M., & Jackson, R. E. (2022). Presence: A review. *International Journal of Human-Computer Interaction, 38*(1), 1-18. https://doi.org/10.1080/10447318.2021.1921368

Fields, S., Mahan, P., Tillman, P., Harris, J., Maxwell, K., & Hojat, M. (2011). Measuring empathy in healthcare profession students using the Jefferson Scale of Physician Empathy: health provider-student version. *Journal of Interprofessional Care, 25*(4), 287-293. https://doi.org/10.3109/13561820.2011.566648

Formosa, N. J., Morrison, B. W., Hill, G., & Stone, D. (2018). Testing the efficacy of a virtual reality-based simulation in enhancing users' knowledge, attitudes, and empathy relating to psychosis. *Australian Journal of Psychology, 70*(1), 57-65. https://doi.org/10.1111/ajpy.12167

Fox, A. B., Earnshaw, V. A., Taverna, E. C., & Vogt, D. (2018). Conceptualizing and measuring mental illness stigma: The mental illness stigma framework and critical review of measures. *Stigma Health, 3*(4), 348-376. https://doi.org/10.1037/sah0000104

Fu, R., & Holmer, H. K. (2016). Change score or follow-up score? Choice of mean difference estimates could impact meta-analysis conclusions. *Journal of Clinical Epidemiology*, *76*, 108-117. https://doi.org/10.1016/j.jclinepi.2016.01.034

Gaebel, W., & Zielasek, J. (2015). Focus on psychosis. *Dialogues in Clinical Neuroscience, 17*(1), 9-18. https://doi.org/10.31887/DCNS.2015.17.1/wgaebel

Gerup, J., Soerensen, C. B., & Dieckmann, P. (2020). Augmented reality and mixed reality for healthcare education beyond surgery: An integrative review. *International Journal of Medical Education, 11*, 1-18. https://doi.org/10.5116/ijme.5e01.eb1a

Gibbs, S. I. (2019). The thespian client: The benefits of role-play teaching techniques in psychology. *American Journal of Applied Psychology, 8*(5), 98-104. https://doi.org/10.11648/j.ajap.20190805.12

Goffman, E. (1963). *Stigma: Notes on the management of spoiled identity*. Prentice Hall. https://doi.org/10.1093/sf/43.1.127

Graf, L., Sykownik, P., Gradl-Dietsch, G., & Masuch, M. (2024). Towards believable and educational conversations with virtual patients. *Frontiers in Virtual Reality*, *5.* https://doi.org/10.3389/frvir.2024.1377210

Gutiérrez-Maldonado, J., Ferrer-García, M., Plasanjuanelo, J., Andrés-Pueyo, A., & Talarn-Caparrós, A. (2015). Virtual reality to train diagnostic skills in eating disorders. Comparison of two low cost systems. *Studies in Health Technology and Informatics, 219*, 75-81. https://doi.org/10.3233/978-1-61499-595-1-75

Gwets, k. L. (2008). Computing inter-rater reliability and its variance in the presence of high agreement. *British Journal of Mathematical and Statistical Psychology, 61,* 29-48. https://doi.org/10.1348%2F000711006X126600

Hannah, O., Leddy, A., & Tsigarides, T. (2025). *Virtual perspective in psychosis: Investigating embodied virtual reality educational interventions and unpacking the impact of immersion on participant attrition.* [Doctoral Thesis, University of East Anglia]. UEA Digital Repository. https://ueaeprints.uea.ac.uk/id/eprint/100777/1/2025HannahOClinPsyD_Thesis.pdf

Harris, N., & Bacon, C. E. W. (2019). Developing cognitive skills through active learning: A systematic review of health care professions. *Athletic Training Education Journal*, 135-148. https://doi.org/10.4085/1402135

Hecht, M., Kloß, A., & Bartsch, A. (2022). Stopping the stigma. How empathy and reflectiveness can help reduce mental health stigma. *Media Psychology*, *25*(3), 367-386. https://doi.org/10.1080/15213269.2021.1963991

Heys, S., Downe, S., McKeown, M., & Thomson, G. (2022). The design, delivery and evaluation of 'Human Perspectives VR': An immersive educational programme designed to raise awareness of contributory factors for a traumatic childbirth

experience and PTSD. *PLoS ONE 17*(11). https://doi.org/10.1371/journal.pone.0276263

Hiley, K., Bi-Mohammad, Z., Taylor, L., Burgess-Dawson, R., Patterson, D., Puttick-Whiteman, D., Gay, G., Hiscoe, J., Munsch, C., Richardson, S., Knowles-Lee, M., Beecham, C., Ralph, N., Chatterjee, A., Mathew, R., & Mushtaq, F. (2025). Extended reality–enhanced mental health consultation training: Quantitative evaluation study. *JMIR medical education*, *11*. https://doi.org/10.2196/64619

HM Government. (2023, April 13). *NHS Workforce*. NHS Digital. https://www.ethnicity-facts-figures.service.gov.uk/workforce-and-business/workforce-diversity/nhs-workforce/latest/#:~:text=in%20June%202022%2C%20over%201.3,doctor%2C%20and%20associate%20specialist%20positions

HM Government. (2024, December 8). *Government to tackle NHS workforce crisis with refreshed plan.* https://www.gov.uk/government/news/government-to-tackle-nhs-workforce-crisis-with-refreshed-plan

Hojat, M., DeSantis, J., Shannon, S. C., Mortensen, L. H., Speicher, M. R., Bragan, L., LaNoue, M., & Calabrese, L. H. (2018). The Jefferson Scale of Empathy: A nationwide study of measurement properties, underlying components, latent variable structure, and national norms in medical students. *Advances in Health Sciences Education: Theory and Practice, 23*(5), 899-920. https://doi.org/10.1007/s10459-018-9839-9

Hojat, M., Mangione, S., Nasca, T. J., Cohen, M. J., Gonnella, J. S., Erdmann, J. B., Veloski, J., & Magee, M. (2001). The Jefferson Scale of Physician Empathy: Development and

preliminary psychometric data. *Educational and Psychological Measurement, 61*(2), 349-365. https://doi.org/10.1177/00131640121971158

Hong, Q. N., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M. P., Griffiths, F., Nicolau, B., O'Cathain, A., Rousseau, M. C., Vedel, I., & Pluye, P. (2018). The Mixed Methods Appraisal Tool (MMAT) version 2018 for information professionals and researchers. *Education for Information*, *34*, 1-7. https://doi.org/10.3233/EFI-180221

Hong, Q. N., Pluye, P., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M. P., Griffiths, F., Nicolau, B., O'Cathain, A., Rousseau, M. C., & Vedel, I. (2019). Improving the content validity of the mixed methods appraisal tool: A modified e-Delphi study. *Journal of Clinical Epidemiology*, *111*, 49-59. https://doi.org/10.1016/j.jclinepi.2019.03.008

Hongthong, B., Jantakoon, T., & Trisupakitti, S. (2025). The effectiveness of virtual reality in medical education: A meta-analysis of knowledge, skills, and motivation outcomes. *Higher Education Studies, 15*(4), 101-118. https://doi.org/10.5539/hes.v15n4p101

Hoppe, M., Baumann, A., Tamunjoh, P. C., Machulla, T. K., Woźniak, P. W., & Schmidt, A. (2022). There is no first- or third-person view in virtual reality: Understanding the perspective continuum. *ACM Digital Library, 360,* 1-13. https://doi.org/10.1145/3491102.3517447

Horigome, T., Kurokawa, S., Sawada, K., Kudo, S., Shiga, K., Mimura, M., & Kishimoto, T. (2020). Virtual reality exposure therapy for social anxiety disorder: A systematic

review and meta-analysis. *Psychological Medicine, 50*, 2487–2497. https://doi.org/10.1017/S0033291720003785

Hussey, I., Alsalti, T., Bosco, F., Elson, M., & Arslan, R. (2025). An aberrant abundance of Cronbach's alpha values at .70. *Advances in Methods and Practices in Psychological Science, 8*(1). https://doi.org/10.1177/25152459241287123

Ionescu, A., Daele, T. V., Rizzo, A., Blair, C., & Best, P. (2021). 360° videos for immersive mental health interventions: A systematic review. *Journal of Technology in Behavioral Science, 6*, 631-651. https://doi.org/10.1007/s41347-021-00221-7

Irvine, A. B., Billow, M. B., Eberhage, M. G., Seeley, J. R., McMahon, E., & Bourgeois, M. (2012). Mental illness training for licensed staff in long-term care. *Issues in Mental Health Nursing, 33*(3), 181-194. https://doi.org/10.3109%2F01612840.2011.639482

Javvaji, C. K., Reddy, H., Vagha, J. D., Taksande, A., Kommareddy, A., & Reddy, N. S. (2024). Immersive innovations: Exploring the diverse applications of virtual reality (VR) in healthcare. *Cereus, 16*(3). https://doi.org/10.7759/cureus.56137

Jensen, L., & Konradsen, F. (2018). A review of the use of virtual reality head-mounted displays in education and training. *Education and Information Technology, 23*, 1515-1529. https://doi.org/10.1007/s10639-017-9676-0

Jiang, H., Vimalesvaran, S., Wang, J. K., Lim, K. B., Mogali, S. R., & Car, L. T. (2022). Virtual reality in medical students' education: Scoping review. *JMIR Medical Education, 8*(1). https://doi.org/10.2196/34860

Jiang, J., Zichen, M., Kwok, T. T., & Wong, J. Y. H. (2026). GenAI-supported virtual patients in health care education: Systematic review. *Journal of Medical Internet Research, 28.* https://doi.org/10.2196/82756

Kalyanaraman, A., Penn, D. L., Ivory, J. D., & Judge, A. (2010). The virtual doppelganger: Effects of a virtual reality simulator on perceptions of schizophrenia. *Journal of Nervous Mental Disorders, 198*, 437-443. https://doi.org/10.1097/NMD.0b013e3181e07d66

Kamphuis, C., Barsom, E., Schijven, M., & Christoph, N. (2014). Augmented reality in medical education? *Perspectives on Medical Education, 3*, 300-311. https://doi.org/10.1007/s40037-013-0107-7

Kane, J. C., Elafros, M. A., Murray, S. M., Mitchell, E. M. H., Augustinavicius, J. L., Causevic, S., & Baral, S. D. (2019). A scoping review of health-related stigma outcomes for high-burden diseases in low- and middle-income countries. *BMC Medicine, 17*(17). https://doi.org/10.1186/s12916-019-1250-8

Karami, B., Koushki, R., Arabgol, F., Rahmani, M., & Vahabie, A. H. (2021). Effectiveness of virtual/augmented reality–based therapeutic interventions on individuals with autism spectrum disorder: A comprehensive meta-analysis. *Frontiers in Psychiatry*, *12*. https://doi.org/10.3389/fpsyt.2021.665326

Kim, H. & Kim, E. (2023). Effects of medical education program using virtual reality: A systematic review and meta-analysis. *International Journal of Environmental Research and Public Health, 20*(5), 3895. https://doi.org/10.3390/ijerph20053895

King, D. R. (2013). A brief history of stereoscopy. *WIREs Computational Statistics, 5*(4), 334-340. https://doi.org/10.1002/wics.1264

Kinson, R. M., Hon, C., Lee, H., Abdin, E. B., & Verma, S. (2018). Stigma and discrimination in individuals with first episode psychosis; one year after first contact with psychiatric services. *Psychiatry Research, 270,* 298-305. https://doi.org/10.1016/j.psychres.2018.09.044

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice-Hall.

Kothgassner, O. D., Goreis, A., Kafka, J. X., Van Eickels, R. L., Plener, P. L., & Felnhofer, A. (2019). Virtual reality exposure therapy for posttraumatic stress disorder (PTSD): A meta-analysis. *European Journal of Psychotraumatology*, *10*(1). https://doi-org.uea.idm.oclc.org/10.1080/20008198.2019.1654782

Kourtesis, P., Linnell, J., Amir, R., Argelaguet, F., & MacPherson, S. E. (2023). Cybersickness in Virtual Reality Questionnaire (CSQ-VR): A validation and comparison against SSQ and VRSQ. *Virtual Worlds, 2*(1), 16–35. https://doi.org/10.3390/virtualworlds2010002

Kutcher, S., Wei, Y., & Coniglio, C. (2016). Mental health literacy: Past, present, and future. *Canadian Journal of Psychiatry, 61*(3), 154-158. https://doi.org/10.1177/0706743715616609

Kyaw, B. M., Saxena, N., Posadzki, P., Vseteckova, J., Nikolaou, C. K., George, P. P., Divakar, U., Masiello, I., Kononowicz, A. A., Zary, N., & Car, L. T. (2019). Virtual reality in health professions education: Systematic review and meta-analysis by the

digital health education collaboration. *Journal of Medical Internet Research, 21*(1). https://doi.org/10.2196/12959

Laker, C., Knight-Davidson, P., & McVicar, A. (2025). The use of 360-degree video to reduce anxiety and increase confidence in mental health nursing students: A mixed methods preliminary study. *Nursing Reports*, *15*(5), 157. https://doi.org/10.3390/nursrep15050157

Lampropoulos, G., & Kinshuk. (2024). Virtual reality and gamification in education: A systematic review. *Educational Technology Research and Development*, *72*(3), 1691-1785. https://doi.org/10.1007/s11423-024-10351-3

Lan, Y. L., Chen, W. L., Wang, Y. F., & Chang, Y. (2023). Development and preliminary testing of a virtual reality measurement for assessing intake assessment skills. *International Journal of Psychology*, *58*(3), 237-246. https://doi.org/10.1002/ijop.12898

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*(1), 159. https://doi.org/10.2307/2529310

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge University Press.

Law, G. U., Rostill-Brookes, H., & Goodman, D. (2009). Public stigma in health and non-healthcare students: Attributions, emotions, and willingness to help with adolescent self-harm. *International Journal of Nursing Studies, 46*, 108-119. https://doi.org/10.1016/j.ijnurstu.2008.08.014

Lee, H. (2025). A unified conceptual model of immersive experience in extended reality. *Computers in Human Behavior Reports, 18*. https://doi.org/10.1016/j.chbr.2025.100663

Lem, W. G., Kohyama-Koganeya, A., Saito, T., & Oyama, H. (2022). Effect of a virtual reality contact-based educational intervention on the public stigma of depression: Randomized controlled pilot study. *JMIR Formative Research*, *6*(5). https://doi.org/10.2196/28072

Lie, S. S., Helle, N., Sletteland, N. V., Vikman, M. D., & Bonsaksen, T. (2023). Implementation of virtual reality in health professions education: Scoping review. *JMIR Medical Education, 9,* https://doi.org/10.2196/41589

Lin, H. L., Wang, Y. C., Huang, M. L., Yu, N. W., Tang, I., Hsu, Y. C., & Huang, Y. S. (2024). Can virtual reality technology be used for empathy education in medical students: A randomized case-control study. *BMC Medical Education*, *24*(1), 1254. https://doi.org/10.1186/s12909-024-06009-6

Link, B. G., Cullen, F. T., Frank, J., & Wozniak, J. F. (1987). The social rejection of former mental patients: Understanding why labels matter. *American Journal of Sociology, 92*, 1461-1500. http://doi.org/10.1086/228672

Loch, A. A., Hengartner, M. P., Guarniero, F. B., Lawson, F. L.., Wang, Y-P., Gattaz, W. F., & Rössler, W. (2013). The more information, the more negative stigma towards schizophrenia: Brazilian general population and psychiatrists compared. *Psychiatry Research, 205*(3), 185-191. https://doi.org/10.1016/j.psychres.2012.11.023

Marougkas, A., Troussas, C., Krouska, A., & Sgouropoulou, C. (2023). Virtual reality in education: A review of learning theories, approaches and methodologies for the last decade. *Electronics*, *12*(13), 2832. https://doi.org/10.3390/electronics12132832

Marques, A. J., Veloso, P. G., Araújo, M., de Almeida, R. S., Correia, A., Pereira, J., Queiros, C., Pimenta, R., Pereira, A. S., & Silva, C. F. (2022). Impact of a virtual reality-based simulation on empathy and attitudes toward schizophrenia. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.814984

McCullock, A. P., & Scrivano, R. M. (2023). The effectiveness of mental illness stigma-reduction interventions: A systematic meta-review of meta-analyses. *Clinical Psychology Review, 100*. https://doi.org/10.1016/j.cpr.2022.102242

Mestre, D. R. (2017). CAVE versus head-mounted displays: Ongoing thoughts. *Electronic Imaging, 29*, 31-35. https://doi.org/10.2352/ISSN.2470-1173.2017.3.ERVR-094

Mori, M. (1970). The uncanny valley. *Energy*, *7*(4), 33–35.

Moscoso, C., Nazari, M., & Matusiak, B. S. (2022). Stereoscopic images and virtual reality techniques in daylighting research: A method-comparison study. *Building and Environment, 214*. https://doi.org/10.1016/j.buildenv.2022.108962

Ng, A., Inagaki, M., Antinucci, R., Sockalingam, S., & Abdool, P. S. (2025). Determining the severity and prevalence of cybersickness in virtual reality simulations in psychiatry. *Advances in Simulation*, *10*(1), 32. https://doi.org/10.1186/s41077-025-00358-y

NHS England. (2021). *News: NHS celebrates the vital role hundreds of thousands of women have played in the pandemic.* https://www.england.nhs.uk/2021/03/nhs-celebrates-the-vital-role-hundreds-of-thousands-of-women-have-played-in-the-pandemic/

NHS England. (2023, June). *NHS long term workforce plan.* https://www.england.nhs.uk/long-read/nhs-long-term-workforce-plan-2/#references

NHS. (2023, September 5). *Psychosis overview*. https://www.nhs.uk/mental-health/conditions/psychosis/overview/

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow C D., Shamseer, L., Tezlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ,* 372. https://doi.org/10.1136/bmj.n71

Pallant, J. (2016). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS* (6th ed.). Open University Press, McGraw-Hill Education.

Paola, G. (2020). The importance of using valid and reliable measures in psychology and psychiatry. *EC Psychology and Psychiatry, 9*(4), 24-25. https://www.researchgate.net/publication/340078344_The_Importance_of_Using_Valid_and_Reliable_Measures_in_Psychology_and_Psychiatry

Peter, L., Schindler, S., Sander, C., Schimdt, S., Meuhlan, H., McLaren, T., Tomczyk, S., Speerforck, S., & Schomerus, G. (2021). Continuum beliefs and mental illness stigma: A systematic review and meta-analysis of correlation and intervention studies.

Psychological medicine, 51(5), 716-726. https://doi.org/10.1017%2FS0033291721000854

Philip, G., & Savundranayagam, M. Y. (2025). Applications of virtual reality and its effectiveness in healthcare training: A scoping review. *Health and Technology, 15*, 217-229. https://doi.org/10.1007/s12553-024-00936-6

Phiri, P., Pemberton, L., Liu, Y., Yang, X., Salmon, J., Boulter, I., Sajid, S., Clarke, J., McMillan, A., Shi, J. Q., & Delanerolle, G. (2024). Tree: Reducing the use of restrictive practices on psychiatric wards through virtual reality immersive technology training. *World Journal of Psychiatry*, *14*(10), 1521-1537. https://doi.org/10.5498/wjp.v14.i10.1521

Piaget, J. (1970). *Science of education and the psychology of the child*. Orion Press.

Pina-Thomas, D., Zohn, J. H., & Phillips, L. (2025). A Comparison of virtual reality and traditional audio-recorded hearing voices simulations: Their impact on empathy in health care students. *Nursing Education Perspective*, *46*(2), 116-118. https://doi.org/10.1097/01.nep.0000000000001271

Plotzky, C., Lindwedel, U., Bejan, A., König, P., & Kunze. (2021). Virtual reality in healthcare skills training: The effects of presence on acceptance and increase of knowledge. *i-com Journal of Interactive Media, 20*(1), 73-83. https://doi-org.uea.idm.oclc.org/10.1515/icom-2021-0008

Popay, J., Roberts, H., Snowden, A., Petticrew, M., Arai, L., Rodgers, M., Britten, N., Roen, K., & Duffy, S. (2006). Guidance on the conduct of narrative synthesis in systematic

reviews: A product from the ESRC methods programme. https://doi.org/10.13140/2.1.1018.4643

Pottle, J. (2019). Virtual reality and the transformation of medical education. *Future Healthcare Journal, 6*(3), 181-185. https://doi.org/10.7861/fhj.2019-0036

Praharaj, S. K., Salagre, S., & Sharma, P. S. V. N. (2021). Stigma, empathy and attitude (SEA) educational module for medical students to improve the knowledge and attitude towards persons with mental illness. *Asian Journal of Psychiatry, 65*. https://doi.org/10.1016/j.ajp.2021.102834

Reavley, N. J., Mackinnon, A. J., Morgan, A. J., & Jorm, A. F. (2014). Stigmatising attitudes towards people with mental disorders: A comparison of Australian health professionals with the general community. *The Australian and New Zealand Journal of Psychiatry, 48*(5), 433-441. https://doi.org/10.1177/0004867413500351

Reird, H. J., Thomson, C., & McGlade, K. J. (2016). Content and discontent: A qualitative exploration of obstacles to elearning engagement in medical students. *BMC Medical Education, 16*(188). https://doi.org/10.1186/s12909-016-0710-5

Reji, M., & Harris, D. M. (2019). Understanding medical student disengagement from small group learning activities by comparing faculty and student perceptions. *The FASEB Journal, 33*(1). https://doi.org/10.1096/fasebj.2019.33.1_supplement.766.3

Restout, J., Bernache-Assollant, I., Morizio, C., Boujut, A., Angelini, L., Tchalla, A., & Perrochon, A. (2023). Fully immersive virtual reality using 360° videos to manage well-being in older adults: A scoping review. *Journal of the American Medical Directors Association, 24*(4), 564-572. https://doi.org/10.1016/j.jamda.2022.12.026

Riches, S., Iannelli, H., Reynolds, L., Fisher, H., Cross, S., & Attoe, C. (2022). Virtual reality-based training for mental health staff: A novel approach to increase empathy, compassion, and subjective understanding of service user experience. *Advances in Simulation, 7*(9). https://doi.org/10.1186/s41077-022-00217-0

Riches, S., Pisani, S., Bird, L., Rus-Calafell, M., Garety, P., & Valmaggia, L. (2021). Virtual reality-based assessment and treatment of social functioning impairments in psychosis: A systematic review. *International Review of Psychiatry*, *33*(3), 337–362. https://doi.org/10.1080/09540261.2021.1918648

Rincon, E., Rodriguez-Guidonet, I., Andrade-Pino, P., & Monfort-Vinuesa, C. (2023). Mixed reality in undergraduate mental health education: A systematic review. *Electronics*, *12*(4), 1019. https://doi.org/10.3390/electronics12041019

Roberts, R. M., Chur-Hansen, A., Winefield, H., Patten, S., Ward, H., & Dorstyn, D. (2017). Using OSCEs with simulation to maximise student learning and assess competencies in psychology: A pilot study. *Focus on Health Profession Education: A Multidisciplinary Journal, 18*(2), 61-75. https://search.informit.org/doi/epdf/10.3316/informit.042904490843097

Roberts, R. M., Oxlad, M., Dorstyn, D., & Chur-Hansen, A. (2021). Objective structured clinical examinations with simulated patients in postgraduate psychology training: Student perceptions. *Australian Psychologists, 55*(2). https://doi-org.uea.idm.oclc.org/10.1111/ap.12457

Rogers, S. L., Hollett, R., & Speelman, C. P. (2022). An evaluation of virtual reality role-play experiences for helping-profession courses. *Teaching of Psychology, 49*(1), 78-84. https://doi-org.uea.idm.oclc.org/10.1177/0098628320983231

Rose, T., Nam, C. S., & Chen, K. B. (2018). Immersion of virtual reality for rehabilitation – Review. *Applied Ergonomics, 69*, 153-161. https://doi.org/10.1016/j.apergo.2018.01.009

Ruffalo, M. L., Kottapalli, M., & Anbukkarasu, P. (2024). Empathy in the care of individuals with schizophrenia: A vital element of treatment. *American Journal of Psychotherapy, 77*(1), 30-34. https://doi.org/10.1176/appi.psychotherapy.20230022

Rus-Calafell, M., Garety, P., Sason, E., Craig, T. J. K., & Valmaggia, L. R. (2017). Virtual reality in the assessment and treatment of psychosis: A systematic review of its utility, acceptability and effectiveness. *Psychological Medicine, 48*(3), 362-391. https://doi.org/10.1017/S0033291717001945

Sakpal, T. V. (2010). Sample size estimation in clinical trial. *Perspectives in Clinical research, 1*(2), 67-69. https://pmc.ncbi.nlm.nih.gov/articles/PMC3148614/

Saredakis, D., Szpack, A., Birckhead, B., Keage, H. A., Rizzo, A., & Loetscher, T. (2020). Factors associated with virtual reality sickness in head-mounted displays: A systematic review and meta-analysis. *Frontiers in Human Neuroscience, 14*. https://doi.org/10.3389/fnhum.2020.00096

Savickaite, S., Husselman, T-A., Taylor, R., Millington, E., Hayashibara, E., & Arthur, T. (2022). Applications of virtual reality (VR) in autism research: Current trends and

taxonomy of definitions. *Journal of Enabling Technologies, 16*(2), 147-154. https://doi-org.uea.idm.oclc.org/10.1108/JET-05-2022-0038

Scarbrough, A. W., Brown, S. L., & Alva, C. (2020). Teaching and learning in the large classroom: A mixed-methods approach for undergraduate health management education. *The Journal of Health Administration Education, 37*, 121-130. https://shsu-ir.tdl.org/server/api/core/bitstreams/fb88d262-b1a9-4d4a-b1bc-f5c528cd6d17/content

Schjerlund, J., Hansen, M. R. P., & Jensen, J. G. (2018). Design principles for room-scale virtual reality: A design experiment in three dimensions. *Designing for a Digital and Globalized world, 10844,* 3-17. https://doi.org/10.1007/978-3-319-91800-6_1

Schlier, B., Scheunemann, J., & Lincoln, T. M. (2016). Continuum beliefs about psychotic symptoms are a valid, unidimensional construct: Construction and validation of a revised continuum beliefs questionnaire. *Psychiatry Research, 241***,** 147–153. https://doi.org/10.1016/j.psychres.2016.04.085

Schröder, D., Wrona, K. J., Mueller, F., Heinemann, S., Fischer, F., & Dockweiler, C. (2023). Impact of virtual reality applications in the treatment of anxiety disorders: A systematic review and meta-analysis of randomized-controlled trials. *Journal of Behavior Therapy and Experimental Psychiatry*, *81*, 101893. https://doi-org.uea.idm.oclc.org/10.1016/j.jbtep.2023.101893

Slater, M., & Sanches-Vives, M. V. (2016). Enhancing our lives with immersive virtual reality. *Frontiers in Robotics and AI, 3*(74). https://doi.org/10.3389/frobt.2016.00074

Stevens, K., & Al-Abbadey, M. (2024). Compassion fatigue and global compassion fatigue in practitioner psychologists: A qualitative study. *Current Psychology, 43*, 7259-7274. https://doi.org/10.1007/s12144-023-04908-3

Tan, B. L., Shi, J., Yang, S., Loh, H., Ng, D., Choo, C., & Medalia, A. (2022). The use of virtual reality and augmented reality in psychosocial rehabilitation for adults with neurodevelopmental disorders: A systematic review. *Frontiers in Psychiatry*, *13*, 1055204. https://doi.org/10.3389/fpsyt.2022.1055204

Tao, Q. (2024). Review paper: Implicit and explicit attitude in psychology. *Journal of Education, Humanities, and Social Sciences, 45*. https://doi.org/10.54097/5gz97548

Tay, J. L., Qu, Y., Lim, L., Puthran, R., Tan, C. L. R., Rajendran, R., Wei, K. C., Xie, H., & Sim, K. (2025). Impact of a virtual reality intervention on stigma, empathy, and attitudes toward patients with psychotic disorders among mental health care professionals: Randomized controlled trial. *JMIR Mental Health*, *12*. https://doi.org/10.2196/66925

Tay, J. L., Xie, H., & Sim, K. (2023). Effectiveness of augmented and virtual reality–based interventions in improving knowledge, attitudes, empathy, and stigma regarding people with mental illnesses: A scoping review. *Journal of Personalized Medicine, 13(1), 112*. https://doi.org/10.3390/jpm13010112

Thibodeau, R. (2020). Continuum belief, categorical belief, and depression stigma: Correlational evidence and outcomes of an online intervention. *Stigma and Health, 5*(4), 404-412. https://doi.org/10.1037/sah0000211

Thornicroft, G., Borhan, E., Kassam, A., & Lewis-Holmes, E. (2008). Reducing stigma and discrimination: Candidate interventions. *International Journal of Mental Health Systems, 2*(3). https://doi.org/10.1186/1752-4458-2-3

Thornicroft, G., Rose, D., & Kassam, A. (2007). Discrimination in health care against people with mental illness. *International Review of Psychiatry*, *19*, 113–122. https://doi.org/10.1080/09540260701278937

Time To Change. (2024). A campaign to change the way people think and act about mental health problems. https://www.time-to-change.org.uk

UK Government. (2025, July). *Fit for the future: 10 year health plan for England.* https://assets.publishing.service.gov.uk/media/6888a0996478525675738f3a/fit-for-the-future-10-year-health-plan-for-england-executive-summary.pdf

UK Research and Innovation. (2026, January). *Mindset extended reality (XR) for digital mental health programme*. https://www.ukri.org/what-we-do/browse-our-areas-of-investment-and-support/mindset-extended-reality-xr-for-digital-mental-health-programme/

Valmaggia, L. R., Latif, L, Kempton, M. J., & Calafell, M. R. (2016). Virtual reality in the psychological treatment for mental health problems: A systematic review of recent evidence. *Psychiatry Research,* 189-195. https://doi.org/10.1016/j.psychres.2016.01.015

Vygotsky, L. S. (1978). *Mind in society: Development of higher psychological processes*. Harvard University Press.

Walsh, S., O'Neill, A., Hannigan, A., & Harmon, D. (2019). Patient-rated physician empathy and patient satisfaction during pain clinic consultations. *Irish Journal of Medical Science, 188*(4), 1379–1384. https://doi.org/10.1007/s11845-019-01999-5

Wammes, J. Dd., Ralph, B. C. W., Mills, C., Bosch, N., Duncan, T. L., & Smilek, D. (2019). Disengagement during lectures: Media multitasking and mind wandering in university classrooms. *Computers & Education, 132*, 76-89. https://doi.org/10.1016/j.compedu.2018.12.007

Weiner, B. (1995). *Judgements of responsibility: A foundation for a theory of social conduct*. Guilford Press.

Weiner, B., Perry, R. P., & Magnusson, J. (1988). An attributional analysis of reactions to stigma. *Journal of Personality and Social Psychology, 55*(5), 738-748. https://doi.org/10.1037/0022-3514.55.5.738

Wenrui, D., Die, H., Sheng, X., Xiaoyu, L., Jingwen, Z., Qian, C., Jiayuan, L., Zheng, Z., Wenxiu, J., Lijun, M., Xinyi, H., Shengrong, C., Boya, L., & Xiaoming, L. (2019). The efficacy of virtual reality exposure therapy for PTSD symptoms: A systematic review and meta-analysis. *Journal of Affective Disorders*, *257*, 698-709. https://doi.org/10.1016/j.jad.2019.07.086

Wheatstone, C. (1838). XVII. Contributions to the physiology of vision. – part the first. On some remarkable, and hitherto unobserved, phenomena of binocular vision. *Philosophical Transactions, 128*, 371-394. https://doi.org/10.1098/rstl.1838.0019

Wiesjahn, M., Brabban, A., Jung, E., Gebauer, U. B., & Lincoln, T. M. (2014). Are continuum beliefs about psychotic symptoms associated with stereotypes about

schizophrenia? *Psychosis, 6*(1), 50–60. https://doi.org/10.1080/17522439.2012.740068

Winter, R., Ward, A., Norman, R. I., & Howick, J. (2023). A survey of clinical empathy training at UK medical schools. *BMC Medical Education*, *23*(1), 40. https://doi.org/10.1186/s12909-022-03993-5

Wohlegenannt, I., Simons, A., & Stieglitz, S. (2020). Virtual reality. *Business & Information Systems Engineering, 62*, 455-461. https://doi.org/10.1007/s12599-020-00658-9

World Health Organization. (2021, September 21). *Comprehensive mental health action plan 2013-2030*. https://iris.who.int/bitstream/handle/10665/345301/9789240031029-eng.pdf?sequence=1

World Health Organization. (2022, June 17). *WHO highlights urgent need to transform mental health and mental health care*. https://www.who.int/news/item/17-06-2022-who-highlights-urgent-need-to-transform-mental-health-and-mental-health-care

World Health Organization. (2026). *Health Workforce*. https://www.who.int/health-topics/health-workforce#tab=tab_1

Yap, K., Sheen, J., Nedeljkovic, M., Milne, L., Lawrence, K., & Hay, M. (2021). Assessing clinical competencies using the objective structured clinical examination (OSCE) in psychology training. *Clinical Psychologist, 25*(3), 260-270. https://doi.org/10.1080/13284207.2021.1932452

Zare-Bidaki, M., Ehteshampour, A., Reisaliakbarighomi, M., Mazinani, R., Khodaie Ardakani, M. R., Mirabzadeh, A., Alikhani, R., Noroozi, M., Momeni, F., Samani, A. D., Tavana, M. M., Esmeili, A., & Mousavi, S. B. (2022). Evaluating the effects of

experiencing virtual reality simulation of psychosis on mental illness stigma, empathy, and knowledge in medical students. *Frontiers in Psychiatry*, *13*. https://doi.org/10.3389/fpsyt.2022.880331

Zhao, J., Xu, X., Jiang, H., & Ding, Y. (2020). The effectiveness of virtual reality-based technology on anatomy teaching: A meta-analysis of randomized controlled studies. *BMC Medical Education, 20*(127). https://doi.org/10.1186/s12909-020-1994-z

Appendices

Appendix A

Glossary of Key Extended Reality Terms

Term	Definition
360° Video	Immersive media created using cameras that capture the real-world in all directions.
Augmented Reality (AR)	Technology that overlays computer-generated content (e.g. images or objects) onto the real-world environment, enhancing rather than replacing the physical world.
Embodiment	The experience of adopting a virtual body (avatar) as if it were your own.
Extended Reality (XR)	An umbrella term used to encompass technology that blend or simulate virtual and physical environments, including augmented reality, virtual reality, and mixed reality.
Head-Mounted Displays (HMDs)	A wearable headset with the means to display or project virtual environments. Typically include motion sensors to track users' head, and used alongside headphones, controllers, or haptic gloves to enhance interaction and sensory feedback.
Immersion	The ability to immerse users within the virtual world, ranging from non-immersive (e.g. computer screens) to fully immersive (e.g. head-mounted displays).
Immersive Virtual Reality (IVR)	A form of virtual reality delivered through immersive hardware (e.g. head-mounted displays), isolating users from the physical world.
Interactivity	The degree to which users can interact with the virtual environment, ranging from passive to active interaction.
Mixed Reality (MR)	Technology where physical and virtual elements coexist and interact in real time, enabling a dynamic integration between them both.
Presence	The extent to which an environment, person, or object appears to the users as existing in the same world as them.
Virtual Reality (VR)	A computer-generated or 360° video-based simulated environment that aims to replicate and replace the real physical world.

Appendix B

Systematic Review Journal Guidelines

Author Instructions for International Review of Psychiatry - Taylor & Francis

Structure

Title page; abstract; keywords; introduction, materials and methods, results, discussion; acknowledgements; declaration of interest statement; references; appendices (as appropriate); table(s) with caption(s) on individual pages); figures; figure captions (as a list).

Word limits

No word limit but include word count for your paper. The word limit includes everything (i.e. abstract, tables, references).

Format-Free submission

Authors may submit their paper in any scholarly format or layout. Figures and tables can be placed within the text or submitted as separate documents. References can be in any style or format, so long as a consistent scholarly citation format is applied.

Author details

Include full name and affiliation of all authors on the cover page. Where available, include ORCiDs. One author needs to be identified as the corresponding author, with their email address displayed. Authors' affiliations are the affiliations where the research was conducted.

Abstract

The abstract should be unstructured and up to 200 words, with 3-5 keywords.

Funding details

Supply all details required by your funding and grant-awarding bodies as follows: This work was supported by the [Funding Agency] under Grant [number xxxx].

Disclosure statement

This is to acknowledge any financial or non-financial interest that has arisen from the direct application of your research. If nothing to declare, state this within the article. Suggested wording: *The authors report there are no competing interests to declare.*

Full guidance

https://www-tandfonline-com.uea.idm.oclc.org/action/authorSubmission?show=instructions&journalCode=iirp20

Appendix C

Mixed Methods Appraisal Tool (MMAT)

Category of study designs	Methodological quality criteria	Responses			
		Yes	No	Can't tell	Comments
Screening questions (for all types)	S1. Are there clear research questions?				
	S2. Do the collected data allow to address the research questions?				
	Further appraisal may not be feasible or appropriate when the answer is 'No' or 'Can't tell' to one or both screening questions.				
1. Qualitative	1.1. Is the qualitative approach appropriate to answer the research question?				
	1.2. Are the qualitative data collection methods adequate to address the research question?				
	1.3. Are the findings adequately derived from the data?				
	1.4. Is the interpretation of results sufficiently substantiated by data?				
	1.5. Is there coherence between qualitative data sources, collection, analysis and interpretation?				
2. Quantitative randomized controlled trials	2.1. Is randomization appropriately performed?				
	2.2. Are the groups comparable at baseline?				
	2.3. Are there complete outcome data?				
	2.4. Are outcome assessors blinded to the intervention provided?				
	2.5 Did the participants adhere to the assigned intervention?				
3. Quantitative non-randomized	3.1. Are the participants representative of the target population?				
	3.2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?				
	3.3. Are there complete outcome data?				
	3.4. Are the confounders accounted for in the design and analysis?				
	3.5. During the study period, is the intervention administered (or exposure occurred) as intended?				
4. Quantitative descriptive	4.1. Is the sampling strategy relevant to address the research question?				
	4.2. Is the sample representative of the target population?				
	4.3. Are the measurements appropriate?				
	4.4. Is the risk of nonresponse bias low?				
	4.5. Is the statistical analysis appropriate to answer the research question?				
5. Mixed methods	5.1. Is there an adequate rationale for using a mixed methods design to address the research question?				
	5.2. Are the different components of the study effectively integrated to answer the research question?				
	5.3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?				
	5.4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?				
	5.5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?				

From Hong, Q. N., Pluye, P., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M. P., Griffiths, F., Nicolau, B., O'Cathain, A., Rousseau, M. C., & Vedel, I. (2018). *Mixed Methods Appraisal Tool (MMAT) version 2018 user guide*. Canadian Intellectual Property Office, Industry Canada. http://mixedmethodsappraisaltoolpublic.pbworks.com/w/file/fetch/127916259/MMAT_2018_criteria-manual_2018-08-01_ENG.pdf

Appendix D

Empirical Research Study Journal Guidelines

Author Instructions for Psychosis - Taylor & Francis

Structure

Title page; abstract; keywords; introduction, materials and methods, results, discussion; acknowledgements; declaration of interest statement; references; appendices (as appropriate); table(s) with caption(s) on individual pages); figures; figure captions (as a list).

Word limits

Include word count for your paper. The word limit includes everything (i.e. abstract, tables, references). Maximum word length for a research article is 6000 words.

Format-Free submission

Authors may submit their paper in any scholarly format or layout. Figures and tables can be placed within the text or submitted as separate documents. References can be in any style or format, so long as a consistent scholarly citation format is applied.

Author details

Include full name and affiliation of all authors on the cover page. Where available, include ORCiDs. One author needs to be identified as the corresponding author, with their email address displayed. Authors' affiliations are the affiliations where the research was conducted.

Abstract

Structured abstract (background, methods, results, discussion) of 200 words, with 5-6 keywords.

Funding details

Supply all details required by your funding and grant-awarding bodies as follows: This work was supported by the [Funding Agency] under Grant [number xxxx].

Disclosure statement

This is to acknowledge any financial or non-financial interest that has arisen from the direct application of your research. If nothing to declare, state this within the article. Suggested wording: *The authors report there are no competing interests to declare.*

Full guidance

https://www-tandfonline-

com.uea.idm.oclc.org/action/authorSubmission?show=instructions&journalCode=rpsy20

Appendix E

Ethical Approval

University of East Anglia

Study title: Can Virtual Reality Reduce Psychosis Stigma? An Evaluation of a Virtual Reality Simulation on Healthcare Students' Stigma Towards People Living with Psychosis

Application ID: ETH2526-0070 (significant amendments)

Dear Stephanie,

Your amendment to your study was considered on 18th August 2025 by the FMH S-REC (Faculty of Medicine and Health Sciences Research Ethics Subcommittee).

The decision is: **approved**.

This approval will expire on **14th September 2026**.

Please note that your project is granted ethics approval only for the length of time identified above. Any extension to a project must obtain ethics approval by the FMH S-REC (Faculty of Medicine and Health Sciences Research Ethics Subcommittee) before continuing.

It is a requirement of this ethics approval that you should report any adverse events which occur during your project to the FMH S-REC (Faculty of Medicine and Health Sciences Research Ethics Subcommittee) as soon as possible. An adverse event is one which was not anticipated in the research design, and which could potentially cause risk or harm to the participants or the researcher, or which reveals potential risks in the treatment under evaluation. For research involving animals, it may be the unintended death of an animal after trapping or carrying out a procedure.

Any amendments to your submitted project in terms of design, sample, data collection, focus etc. should be notified to the FMH S-REC (Faculty of Medicine and Health Sciences

Research Ethics Subcommittee) in advance to ensure ethical compliance. If the amendments are substantial a new application may be required.

Please can you send your report once your project is completed to SIRG (student.survey.request@uea.ac.uk).

Approval by the FMH S-REC (Faculty of Medicine and Health Sciences Research Ethics Subcommittee) should not be taken as evidence that your study is compliant with the UK General Data Protection Regulation (UK GDPR) and the Data Protection Act 2018. If you need guidance on how to make your study UK GDPR compliant, please contact the UEA Data Protection Officer (dataprotection@uea.ac.uk).

Please can you send your report once your project is completed to the FMH S-REC (fmh.ethics@uea.ac.uk).

I would like to wish you every success with your project.

On behalf of the FMH S-REC (Faculty of Medicine and Health Sciences Research Ethics Subcommittee)

Yours sincerely,

Dr Paul Linsley

Ethics ETH2526-0070 (Significant amendments): Miss Stephanie Stubbs

Appendix F

Electronic Patient Information Sheet

Stephanie Stubbs
Trainee Clinical Psychologist

Version 3.0, Nov 2024

University of East Anglia
Norwich Research Park
Norwich NR4 7TJ
United Kingdom

Email: s.stubbs@uea.ac.uk
Web: www.uea.ac.uk

Participant Information Sheet
Virtual Reality Simulation of Psychosis in Healthcare Students

Thank you for taking the time to consider taking part in this study. This research is being carried out as part of a Doctorate thesis in Clinical Psychology at the University of East Anglia.

1. What is the purpose of the research?

You are invited to take part in a research study exploring how virtual reality (VR) can be used as an educational tool for healthcare students to provide a sensory experience of what it might be like to live with psychosis and experience symptoms, such as hallucinations.

This participant information sheet tells you about the research study. Knowing what is involved will help you decide if you want to take part. Please read this sheet carefully and ask questions about anything that you do not understand or want to know more about.

2. Why have I been invited?

If you are currently studying in a healthcare course at UEA (e.g., medical, nursing, paramedics) you have specifically been invited to participate because you may work with people with psychosis either now or in the future.

Unfortunately, you cannot partake in this study if:

- You are enrolled on a mental healthcare course (e.g., psychology, mental health nursing)
- You have had significant psychiatry or psychosis training (e.g., at work, research, or uni. This does not include having had lectures or a module on psychiatry or psychosis)
- You or your close relatives (e.g., parents and siblings) have had a history of psychotic disorder
- You have health concerns that would impact your ability to use a virtual reality headset (e.g., vertigo, epilepsy, susceptibility to headaches, head/facial injury, hearing or visual impairments).
- You have previously engaged in VR simulation of psychosis research

3. What will the study involve for me?

- If you agree to take part, you will be asked some questions to ensure you are eligible for the study. You will then be asked to provide your unidentifiable UEA email address and you will be assigned a participant ID number and sent a link to a website where you can choose a date and time to complete the VR intervention in a selected room at UEA.
- During this appointment, you will be informed about how to use the VR simulation. The simulation is a 360-degree video where you will experience a fictional journey of someone with psychosis accessing community services. The simulation will portray audio and visual hallucinations, as well as symptoms of paranoia and delusions. The simulation will last around 12 minutes.

- Before and after the simulation, you will be asked to answer questions about people with psychosis. In total, the session should take around 30-40 minutes, including the VR experience. One researcher will remain with you in case any problems arise. Additionally, you have the right to withdraw at any time during the surveys and/or simulation, as well as being in control of removing the VR headset.
- If you wish, at the end of the study, you can select whether you would like to receive a summary of the research once it has been completed. **You will also have the opportunity to enter a prize draw with the opportunity to win one of three gift vouchers valued at £20.**

4. Do I have to be in the study?
No, this study is completely voluntary, and you do not have to take part. Your decision whether to participate will not affect your current or future relationship with the researchers or anyone else at the University of East Anglia, and it will not affect your progress on your course. You also have the right to withdraw without needing to provide a reason up until the point the data is scored as at this point the data is not identifiable.

5. Are there any risks associated with being in the study?
Whilst most people do not have any risks from using virtual reality headsets, some risks may include disorientation, nausea, blurry vision, mild temporary changes to auditory perception and accepting reality, and psychological distress. If these side effects do occur, they are usually mild and settle quickly after removing the headset. People with increased risk have been excluded from this study for their safety.

Should you experience any discomfort during the simulation, please let a member of the research team know immediately. They will be able to offer additional support.

6. Are there any benefits associated with being in the study?
This study provides healthcare students with a virtual 'first-hand' experience of psychosis symptoms which may help you in the future when working in healthcare settings. These studies are essential to see whether VR is an effective teaching method for students.

7. What will happen to information about me that is collected during the study?
The information collected from this study will be analysed and the findings will be written up and submitted as part of a doctoral thesis in Clinical Psychology (UEA). The information will be stored securely, and your identity will be kept strictly confidential, except as required by law. Any identifiable information, such as your email address will be stored separately and securely, and only accessible to members of the research team. Study findings may be published and be used for other scholarly and educational purposes such as in teaching or conferences, but you will not be identified if you decide to participate in this study. The data will be kept for at least 10 years beyond the last date the data were used. After the 10 years, a member of the research team will securely delete the data.

Your personal data and information will only be used as outlined in this Participant Information Sheet, unless you consent otherwise. Data management will follow the Data Protection Act 2018 (DPA 2018) and UK General Data Protection Regulation (UK GDPR), and the University of East Anglia's Research Data Management Policy.

8. What if I would like further information about the study?
If you have any questions, concerns or would like to know more about the study or the results, please feel free to contact me using the following details:

- *Stephanie Stubbs (Trainee Clinical Psychologist, Primary Researcher)*
  Email: s.stubbs@uea.ac.uk.

Alternatively, please feel free to contact my supervisors:

- *Dr Adrian Leddy (Primary Research Supervisor and Clinical Associate Professor in Clinical Psychology)* Email: a.leddy@uea.ac.uk.

- *Dr Jordan Tsigarides (Secondary Research Supervisor, VR Faculty Lead for Postgraduate Education, Norfolk and Norwich University Hospital, and Doctoral Research Fellow, UEA)*
  Email: j.tsigarides@uea.ac.uk.

If you have any concerns or wish to make a complaint to someone independent from the study, please contact a member of the course:

- *Dr Peter Beazley (Deputy Programme Director for UEA Clinical Psychology Doctorate Programme)*. Email: p.beazley@uea.ac.uk.

9. Who is organising, funding and reviewing this study?

This study is organised and funded by the Doctoral Programme in Clinical Psychology at the UEA. To protect your safety, rights, wellbeing and dignity, all research in the UEA reviewed by a Research Ethics Body. This research was approved by the UEA Faculty of Medicine and Health Sciences Research Ethics Committee on the 8th November 2024 (Application ID: ETH2425-0942).

10. OK, I want to take part – what do I do next?

If you want to take part, please click next to complete the initial screening questionnaire.

Appendix G

Initial Screening Questionnaire

Stephanie Stubbs
Trainee Clinical Psychologist

Version 3.0, Nov 2024

University of East Anglia
Norwich Research Park
Norwich NR4 7TJ
United Kingdom

Email: s.stubbs@uea.ac.uk
Web: www.uea.ac.uk

Initial Screening Questionnaire

Virtual Reality Simulation of Psychosis on Healthcare Students

For participant safety and research protocols, the following exclusion criteria has been developed. In order to be considered for the study, please confirm whether you have:

A history of a psychotic disorder	YES	☐	NO	☐
A close relative with a history of a psychotic disorder	YES	☐	NO	☐
Received significant psychosis training (e.g., work, research, Or uni such as a health degree. This does not include having Had lectures or a module on psychiatry or psychosis)	YES	☐	NO	☐
Current chronic headaches, seizures, vertigo, or other medical conditions that would be affected by flashing lights and/or viewing screens	YES	☐	NO	☐
Current significant hearing or visual impairment that may affect the use of a VR system	YES	☐	NO	☐
Current facial or head injury that may make the use of a VR headset uncomfortable or impractical	YES	☐	NO	☐
Taken part in any other VR simulation of psychosis research	YES	☐	NO	☐

Appendix H

Consent Form

Stephanie Stubbs
Trainee Clinical Psychologist

Version 3.0, Nov 2024

University of East Anglia
Norwich Research Park
Norwich NR4 7TJ
United Kingdom

Email: s.stubbs@uea.ac.uk
Web: www.uea.ac.uk

Virtual Reality Simulation of Psychosis in Healthcare Students
Consent Form

In giving my consent, I state that:

- I understand the purpose of the study, what I will be asked to do, and any risks/benefits involved.
- I have read the Participant Information Sheet, which I may keep, for my records, and have been able to discuss my involvement in the study with the researchers if I wished to do so.
- The researchers have answered any questions that I had about the study and I am happy with the answers.
- I understand that being in this study is completely voluntary and I do not have to take part. My decision whether to be in the study will not affect my relationship with the researchers or anyone else at the University of East Anglia now or in the future.
- I understand that I can withdraw from the research study at any time during the survey and VR simulation. However, following this, I will not be able to withdraw my data.
- I understand that the results of this study will be used in the way described in the information sheet.
- I understand that personal information about me that is collected over the course of this project will be stored securely and will only be used for purposes that I have agreed to. I understand that information about me will only be told to others with my permission, except as required by law.
- I understand my data will be used anonymously for the research project

Having read the information, do you consent to participate in this research project?

I consent ☐
I do not consent ☐

If you agree to take part in this study please provide your unidentifiable UEA email address below. This will allow you to take part in the next stages of the study.

The address should appear in the format: 3 letters 2 numbers 3 letters@uea.ac.uk

For example abc24xya@uea.ac.uk

_____

Appendix I

Empirical Study Measures

This appendix shows the demographic survey developed by the research team, followed by the Attribution Questionnaire, Continuum Beliefs Questionnaire - Revised, Adapted Social Distance Scale, and Cybersickness in Virtual Reality Questionnaire (CSQ-VR). The Social Distance Scale (Link et al., 1987) was originally developed using a vignette featuring 'Jim Johnson', who was hospitalised in a 'mental hospital'. Participants rate their willingness to engage with 'Jim' across different social situations. The adapted version used by the research team replaced 'Jim Johnson' with 'someone with psychosis' to ensure relevance while maintaining the scale integrity. Similar adaptions are made throughout the literature. The Jefferson Empathy Scale for Healthcare Professional Students (JSE-HPS) is not included in the appendices due to copyright laws.

Demographic Survey

The purpose of this survey is to gather demographic and background information from people partaking in this study. This allows us to analyse the data according to subgroups to further understand the outcomes of the study.

This information will be kept strictly confidential and only used for the study, with no dissemination to third parties. It will be stored securely with only the research team having access.

1. Gender identity
   - ☐ Female
   - ☐ Male
   - ☐ Non-binary/Genderqueer
   - ☐ Other:_____
   - ☐ Prefer not to say

2. Age
   _____

3. Race and ethnicity
    - ☐ White / Caucasian
    - ☐ Asian / Asian British
    - ☐ Black / Black British / Caribbean / African
    - ☐ Mixed or multiple ethnic groups
    - ☐ Other ethnic group (please state):_____
    - ☐ Prefer not to say

4. University course and year of study

    _____

5. Have you had any previously experience of using virtual reality simulation training?
    - ☐ Yes
    - ☐ No

    If YES please state (e.g., when? Where? What type of training?)

    _____

6. Have you had any previous contact or experience working with people with lived experience of psychosis?
    - ☐ Yes
    - ☐ No

    If YES please state (e.g., where? Length of work/contact?, job role)

    _____

7. How did you hear about the study?
    - ☐ Word of mouth
    - ☐ Email advert
    - ☐ Social media
    - ☐ In person advert
    - ☐ Other

    If other please specify:

    _____

Attribution Questionnaire (AQ-27)

PLEASE READ THE FOLLOWING STATEMENT ABOUT HARRY:

Harry is a 30-year-old single man with schizophrenia. Sometimes he hears voices and becomes upset. He lives alone in an apartment and works as a clerk at a large law firm. He had been hospitalized six times because of his illness.

NOW ANSWER EACH OF THE FOLLOWING QUESTIONS ABOUT HARRY. CIRCLE THE NUMBER OF THE BEST ANSWER TO EACH QUESTION.

1. I would feel aggravated by Harry.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
not at all								very much

2. I would feel unsafe around Harry.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
no, not at all								yes, very much

3. Harry would terrify me.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
not at all								very much

4. How angry would you feel at Harry?

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
not at all								very much

5. If I were in charge of Harry's treatment, I would require him to take his medication.

1 2 3 4 5 6 7 8 9

not at all very much

6. I think Harry poses a risk to his neighbours unless he is hospitalized.

1 2 3 4 5 6 7 8 9

none at all very much

7. If I were an employer, I would interview Harry for a job.

1 2 3 4 5 6 7 8 9

not likely very likely

8. I would be willing to talk to Harry about his problems.

1 2 3 4 5 6 7 8 9

not at all very much

9. I would feel pity for Harry.

1 2 3 4 5 6 7 8 9

none at all very much

10. I would think that it was Harry's own fault that he is in the present condition.

1 2 3 4 5 6 7 8 9

no, not at all yes, absolutely so

11. How controllable, do you think, is the cause of Harry's present condition?

1 2 3 4 5 6 7 8 9

not at all under completely under

personal control personal control

12. How irritated would you feel by Harry?

1 2 3 4 5 6 7 8 9

not at all very much

13. How dangerous would you feel Harry is?

1 2 3 4 5 6 7 8 9

not at all very much

14. How much do you agree that Harry should be forced into treatment with his doctor even if he does not want to?

1 2 3 4 5 6 7 8 9

not at all very much

15. I think it would be best for Harry's community if he were put away in a psychiatric hospital.

1 2 3 4 5 6 7 8 9

not at all very much

16. I would share a car pool with Harry every day.

1 2 3 4 5 6 7 8 9

not likely very much likely

17. How much do you think an asylum, where Harry can be kept away from his neighbours, is the best place for him?

1 2 3 4 5 6 7 8 9

not at all very much

18. I would feel threatened by Harry.

1	2	3	4	5	6	7	8	9
no, not at all								yes, very much

19. How scared of Harry would you feel?

1	2	3	4	5	6	7	8	9
not at all								very much

20. How likely is it that you would help Harry?

1	2	3	4	5	6	7	8	9
definitely would not help								definitely would help

20. How certain would you feel that you would help Harry?

1	2	3	4	5	6	7	8	9
not at all certain								absolutely certain

22. How much sympathy would you feel for Harry?

1	2	3	4	5	6	7	8	9
none at all								very much

23. How responsible, do you think, is Harry for his present condition?

1	2	3	4	5	6	7	8	9
not at all responsible								very much responsible

24. How frightened of Harry would you feel?

1 2 3 4 5 6 7 8 9

not at all very much

25. If I were in charge of Harry's treatment, I would force him to live in a group home.

1 2 3 4 5 6 7 8 9

not at all very much

26. If I were a landlord, I probably would rent an apartment to Harry.

1 2 3 4 5 6 7 8 9

not likely very likely

27. How much concern would you feel for Harry?

1 2 3 4 5 6 7 8 9

none at all very much

Continuum Beliefs Questionnaire – Revised

9-item version

1. People who have singular hallucinations or delusional thoughts are not necessarily mentally ill
   Fully disagree (1), disagree (2), slightly disagree (3), impartial (4) slightly agree (5), agree (6), fully agree (7)

2. The transition between normal and delusional thinking is fluent.
   Fully disagree (1), disagree (2), slightly disagree (3), impartial (4) slightly agree (5), agree (6), fully agree (7)

3. Hearing voices may have a solacing or protecting function under certain circumstances.
   Fully disagree (1), disagree (2), slightly disagree (3), impartial (4) slightly agree (5), agree (6), fully agree (7)

4. Anyone can experience hallucinations now and again.
   Fully disagree (1), disagree (2), slightly disagree (3), impartial (4) slightly agree (5), agree (6), fully agree (7)

5. Under stress everyone may develop delusional thoughts.
   Fully disagree (1), disagree (2), slightly disagree (3), impartial (4) slightly agree (5), agree (6), fully agree (7)

6. People who hear voices are in definite need of psychiatric treatment.
   Fully disagree (1), disagree (2), slightly disagree (3), impartial (4) slightly agree (5), agree (6), fully agree (7)

7. Somebody, who thinks that he/she is being persecuted, is generally mentally ill.
   Fully disagree (1), disagree (2), slightly disagree (3), impartial (4) slightly agree (5), agree (6), fully agree (7)

8. Only mentally ill people have paranoid thoughts.
   Fully disagree (1), disagree (2), slightly disagree (3), impartial (4) slightly agree (5), agree (6), fully agree (7)

9. Only severely disordered people develop hallucinations.
   Fully disagree (1), disagree (2), slightly disagree (3), impartial (4) slightly agree (5), agree (6), fully agree (7)

Adapted Social Distance Scale (SDS)

1. Would you be willing to sublet a room in your home to someone with psychosis?
   Definitely willing (1), willing (2), unwilling (3), definitely unwilling (4)

2. Would you be willing to work on the same job as someone with psychosis?
   Definitely willing (1), willing (2), unwilling (3), definitely unwilling (4)

3. Would you be willing to have someone with psychosis as a neighbour?
   Definitely willing (1), willing (2), unwilling (3), definitely unwilling (4)

4. Would you be willing to entrust someone with psychosis with child care?
   Definitely willing (1), willing (2), unwilling (3), definitely unwilling (4)

5. Would you be willing to have someone with psychosis marry into your family?
   Definitely willing (1), willing (2), unwilling (3), definitely unwilling (4)

6. Would you be willing to have a common circle of friends with someone with psychosis?
   Definitely willing (1), willing (2), unwilling (3), definitely unwilling (4)

7. Would you be willing to recommend someone with psychosis for a job working for a friend of yours?
   Definitely willing (1), willing (2), unwilling (3), definitely unwilling (4)

Cybersickness in Virtual Reality Questionnaire (CSQ-VR)

A brief tool for evaluating the Virtual Reality Induced Symptoms and Effects (VRISE)

Please, from 1 to 7 choose the response that better corresponds to the presence and intensity of the symptom.

Nausea A: Do you experience nausea (e.g., stomach pain, acid reflux, or tension to vomit)?

Absent feeling (1), very mild feeling (2), mild feeling (3), moderate feeling (4), intense feeling (5), very intense feeling (6), extreme feeling (7)

Nausea B: Do you experience dizziness (e.g., light-headedness or spinning feeling)?

Absent feeling (1), very mild feeling (2), mild feeling (3), moderate feeling (4), intense feeling (5), very intense feeling (6), extreme feeling (7)

Vestibular A: Do you experience disorientation (e.g., spatial confusion or vertigo)?

Absent feeling (1), very mild feeling (2), mild feeling (3), moderate feeling (4), intense feeling (5), very intense feeling (6), extreme feeling (7)

Vestibular B: Do you experience postural instability (i.e., imbalance)?

Absent feeling (1), very mild feeling (2), mild feeling (3), moderate feeling (4), intense feeling (5), very intense feeling (6), extreme feeling (7)

Oculomotor A: Do you experience a visually induced fatigue (e.g., feeling of tiredness of sleepiness)?

Absent feeling (1), very mild feeling (2), mild feeling (3), moderate feeling (4), intense feeling (5), very intense feeling (6), extreme feeling (7)

Oculomotor B: Do you experience a visually induced discomfort (e.g., eyestrain, blurred vision, or headache)?

Absent feeling (1), very mild feeling (2), mild feeling (3), moderate feeling (4), intense feeling (5), very intense feeling (6), extreme feeling (7)

Appendix J

Psychosis Factsheet

Psychosis

"Psychosis is when people lose some contact with reality. This might involve seeing or hearing things that other people cannot see or hear (hallucinations) and believing things that are not actually true (delusions). It may also involve confused (disordered) thinking and speaking." (NHS, 2023)

3 main symptoms of psychosis:

1. **Hallucinations** – where a person sees, hears, feels, smells, or tastes things that do not exist outside their mind but feel very real to the individual (e.g., hearing voices)
2. **Delusions** – holding strong beliefs that others do not hold (e.g., believing there is a conspiracy to harm them)
3. **Disordered thinking and speaking** – quick thoughts and ideas, which can make speech fast and confusing

These symptoms can cause severe distress and a change in behaviour. However, sometimes people can have a positive relationship with their symptoms (e.g., hearing a comforting voice).

There are different types of psychotic disorders (e.g., schizophrenia, bipolar disorder, drug-induced psychosis).

Approximately 1 in 100 people in the UK have a psychotic disorder.

People with psychosis have a higher risk of self-harm and suicide.

Psychosis can be triggered by things, such as trauma, stress, substance misuse, medication side effects, health conditions (e.g., brain tumour, dementia, head injury), childbirth.

Treatment includes medication, talking therapies and social support.

Appendix K

Debrief Form

Stephanie Stubbs
Trainee Clinical Psychologist

Version 4.0, Nov 2024

University of East Anglia
Norwich Research Park
Norwich NR4 7TJ
United Kingdom

Email: s.stubbs@uea.ac.uk
Web: www.uea.ac.uk

Debrief Sheet

Thank you for taking your time to support this research!

What was the aim?
The aim of this study was to explore whether a virtual reality simulation of psychosis could reduce stigma. This is often associated with this population. Stigma was measured using questionnaires around empathy, attitudes towards people with psychosis, and participants' desire for social distance from someone with psychosis. Continuum beliefs were also explored, which is whether someone perceives symptoms of psychosis to be on the same spectrum as everyday experiences.

Why is it important?
Virtual reality (VR) is still a relatively new training method that is starting to be used within healthcare settings for training and treatments. We hope this research will deepen our understanding of how we can support people with psychosis in healthcare settings and broaden training opportunities for healthcare students, so they feel more comfortable working with people with psychosis in the future.

How to withdraw data?
If you would like to withdraw your data, please let the researcher know now. You will not be able to withdraw your data after your leave the study room.

What's next?
We thoroughly appreciate the time you have taken to complete the study. We would like to show our appreciation by giving you the opportunity to enter a prize draw to win one of three gift vouchers, valued at £20.

We also want to give the opportunity for you to receive a copy of the study's findings, following the completion of the study.

Please note your email address will be kept separate from your survey responses. Your data will remain anonymous.

Would you like to receive feedback about the overall results of this study?

YES ☐ NO ☐

Would you like to be entered into the prize draw to win one of three gift vouchers, valued at £20?

YES ☐ NO ☐

If you answered **YES** to either or both of these, please provide your UEA email address in the numbers/letter format rather than your name, e.g., abc24xyz@uea.ac.uk :

Email: _____

If you have experienced any physical side effects as a result of taking part in this study, then we recommend that you contact you GP or call 111 for further medical advice.

If you have experienced any psychological distress from taking part in this study, then we encourage you to consider contacting one of the organisations listed below or reach out to a supportive friend or family member for support. Again, if you experience significant distress, we advise you contact your GP for further advice.

UEA Wellbeing Support Services

Open 9am-5pm, Monday to Friday

Location: The Street, UEA

Web: https://www.uea.ac.uk/uea-life/student-support/wellbeing

The Samaritans
Available 24-hours a day
Call for Free: 116 123
Email: jo@samaritans.org
Letter: Freepost SAMARITANS LETTERS
Web: https://www.samaritans.org/

MIND – Mental Health Charity
Open 9am-6pm, Monday to Friday
Call MIND Infoline: 0300 123 3393
Web: https://www.mind.org.uk

Please do not hesitate to contact the research team if you wish to discuss any aspect of the study further:

- *Stephanie Stubbs (Trainee Clinical Psychologist, Primary Researcher)* Email: s.stubbs@uea.ac.uk.

- *Dr Adrian Leddy (Primary Research Supervisor and Clinical Associate Professor in Clinical Psychology)* Email: a.leddy@uea.ac.uk.

- *Dr Jordan Tsigarides (Secondary Research Supervisor, VR Faculty Lead for Postgraduate Education, Norfolk and Norwich University Hospital, and Doctoral Research Fellow, UEA)* Email: j.tsigarides@uea.ac.uk.

If you have any concerns or wish to make a complaint to someone independent from the study, please contact a member of the course:

- *Dr Peter Beazley (Deputy Programme Director for UEA Clinical Psychology Doctorate Programme).* Email: p.beazley@uea.ac.uk.

Appendix L

Permission to use the JSE-HPS

Dear Stephanie and Dr. Leddy,

Thank you for your notes. With your agreement to all conditions stated in our previous emails, you have our permission to administer the HPS- version of the JSE using your secure online platform for the single not-for-profit study that you described.

Please note that no one except TJU is authorized to provide permission to use the scale. Please do not share the attached files with anyone not involved with this project. I have attached a copy of the scale, the User's Guide and the scoring algorithm. In addition to instructions for administering the JSE, the User Guide gives a detailed account of the creation of the JSE, its evolution and validity studies, etc., written by Dr. Hojat. It also contains an extensive bibliography. If there is any further want to use the JSE in a future project, permission must be requested before starting another project.

Using the JSE online will require you to copy the survey exactly as it appears, and copyright line, into the survey software or website you are using. Then, you would send the secure link to the survey in an email to your participants to complete.

We wish you luck with your research! Please keep us informed of your progress.

Thank you and warm regards,

Jennifer DeSantis
Sr. Research Study Analyst
Asano-Gonnella Center for Research in Medical Education & Health Care
Thomas Jefferson University
1015 Walnut St., Suite 319
Philadelphia, PA 19107